RECLAMATION

Managing Water in the West

2015 Annual Report

Bureau of Reclamation Report on Monitoring and Implementation Activities Associated with the USFWS 2005 Biological Opinion for Operation and Maintenance of the Bureau of Reclamation Projects in the Snake River Basin above Brownlee Reservoir

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Snake River Area Office
Boise, Idaho

March 2016

U.S. DEPARTMENT OF THE INTERIOR

PROTECTING AMERICA'S GREAT OUTDOORS AND POWERING OUR FUTURE

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

MISSION OF THE BUREAU OF RECLAMATION

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Front cover photograph – North Fork Boise River, Idaho.

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Acronyms and Abbreviations

2005 Opinion	U.S. Fish and Wildlife Service, 2005 Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir
2014 Opinion	U.S. Fish and Wildlife Service, 2014 Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir
2015 Opinion	U.S. Fish and Wildlife Service, 2015 Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir
ARR	Arrowrock Reservoir
BA	Biological Assessment
BACI	before/after, control/impact
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CPUE	catch per unit effort
Deadwood Study	Deadwood Reservoir Operations Flexibility Evaluation
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
IDFG	Idaho Department of Fish and Game
ITS	incidental take statement
O&M	operations and maintenance

Project	Arrowrock Dam Hydroelectric Project
Reclamation	U.S. Bureau of Reclamation
RM	river mile
RPM	Reasonable and Prudent Measure
SOPs	Standard Operating Procedure(s)
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WY	water year

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1. INTRODUCTION

The Bureau of Reclamation (Reclamation) consulted with the U.S. Fish and Wildlife Service (USFWS) pursuant to Section 7 of the Endangered Species Act (ESA) on 12 proposed actions involving the effects of future operations and routine maintenance at 12 Federal projects in the upper Snake River basin on six different listed species known to occur in the area (Reclamation 2004). In March 2005, USFWS completed a non-jeopardy Biological Opinion (2005 Opinion) for Reclamation operations and maintenance (O&M) activities in the Snake River basin above Brownlee Reservoir (USFWS 2005). The 2005 Opinion contained a 30-year incidental take statement (ITS) and corresponding reasonable and prudent measures (RPMs) that outlined nondiscretionary actions to minimize take of species listed under the ESA that may be impacted by Reclamation operations (USFWS 2005). The USFWS determined incidental take by correlating frequencies and magnitudes of streamflow and reservoir conditions at specific facilities with an estimate of population effects during critical seasonal time periods in the Bull Trout's life history. USFWS then described the amount or extent of incidental take at each facility based on operational thresholds.

At the time of the 2005 Opinion, Bull Trout (*Salvelinus confluentus*) were not known to exist in Phillips Reservoir[1] in the Powder River and therefore were not included in the 2005 Opinion or associated documents. In 2011, two Bull Trout were documented in Phillips Reservoir, necessitating Reclamation to consult with USFWS for Bull Trout in this area (Reclamation 2013b). The USFWS completed a non-jeopardy Biological Opinion in June of 2014 (2014 Opinion) for Reclamation O&M activities in the Powder River (USFWS 2014) as a companion document to the 2005 Opinion. The 2014 Opinion contains a 21-year ITS corresponding to the 2005 ITS and RPMs that outline nondiscretionary actions to minimize take of Bull Trout in Phillips Reservoir.

The 2014 Opinion also included consultation on Bull Trout critical habitat for the same area analyzed in the 2005 Opinion. The USFWS concluded that Reclamation's O&M of the upper Snake River projects is not likely to destroy or adversely modify designated critical habitat for Bull Trout.

In addition to Bull Trout, the 2005 Opinion also included consultation on the Snake River physa (Physa [*Haitia*] *natricina*, hereafter physa). Monitoring for physa was reinitiated in 2012, in response to the Minidoka Dam spillway replacement project. Construction was completed during the summer of 2015. Reclamation consulted on project operations following construction of the spillway. The consultation addressed Reclamation's impact to physa located in the Snake River above Brownlee Reservoir, including the Minidoka Dam spillway. Reclamation received a Biological Opinion (2015 Opinion) on May 8, 2015

[1] Phillips Reservoir was referred to as "Phillips Lake" in the 2004 Assessment.

finding that Reclamation's proposed operations are likely to adversely affect physa in the Minidoka Dam spillway. Terms and Conditions and RPMs were provided. The consultation was aligned with ongoing actions associated with the long-term O&M of the current 2005 Opinion (USFWS 2005) and is considered a supplement to the 2005 Opinion.

The ITS has two main components: 1) a monitoring component to ensure the action agency does not exceed the amount or extent of incidental take described in the ITS, and 2) RPMs to minimize the amount or extent of take without altering the basic design, location, scope, duration, or timing of the action. The 2005 Opinion requires Reclamation to provide an annual report to USFWS by December 31 of each year that documents incidental take monitoring efforts and implementation status of all RPMs and Terms and Conditions. At Reclamation's request (letter dated November 13, 2007), USFWS agreed to permanently change the submittal date from December 31 to March 31.

This document is submitted as Reclamation's annual report for Water Year (WY) 2015 (October 1, 2014 to September 30, 2015).

1.1 Bull Trout

Bull Trout are present in five of Reclamation's facilities in the upper Snake River basin. This report covers the four facilities assessed in Reclamation's 2004 Biological Assessment (BA) and 2005 Opinion (Anderson Ranch Dam and Reservoir; Arrowrock Dam and Reservoir; Deadwood Dam and Reservoir, and Agency Valley Dam and Beulah Reservoir), as well as Mason Dam and Phillips Reservoir which was assessed in the 2013 BA and 2014 Opinion (Figure 1).

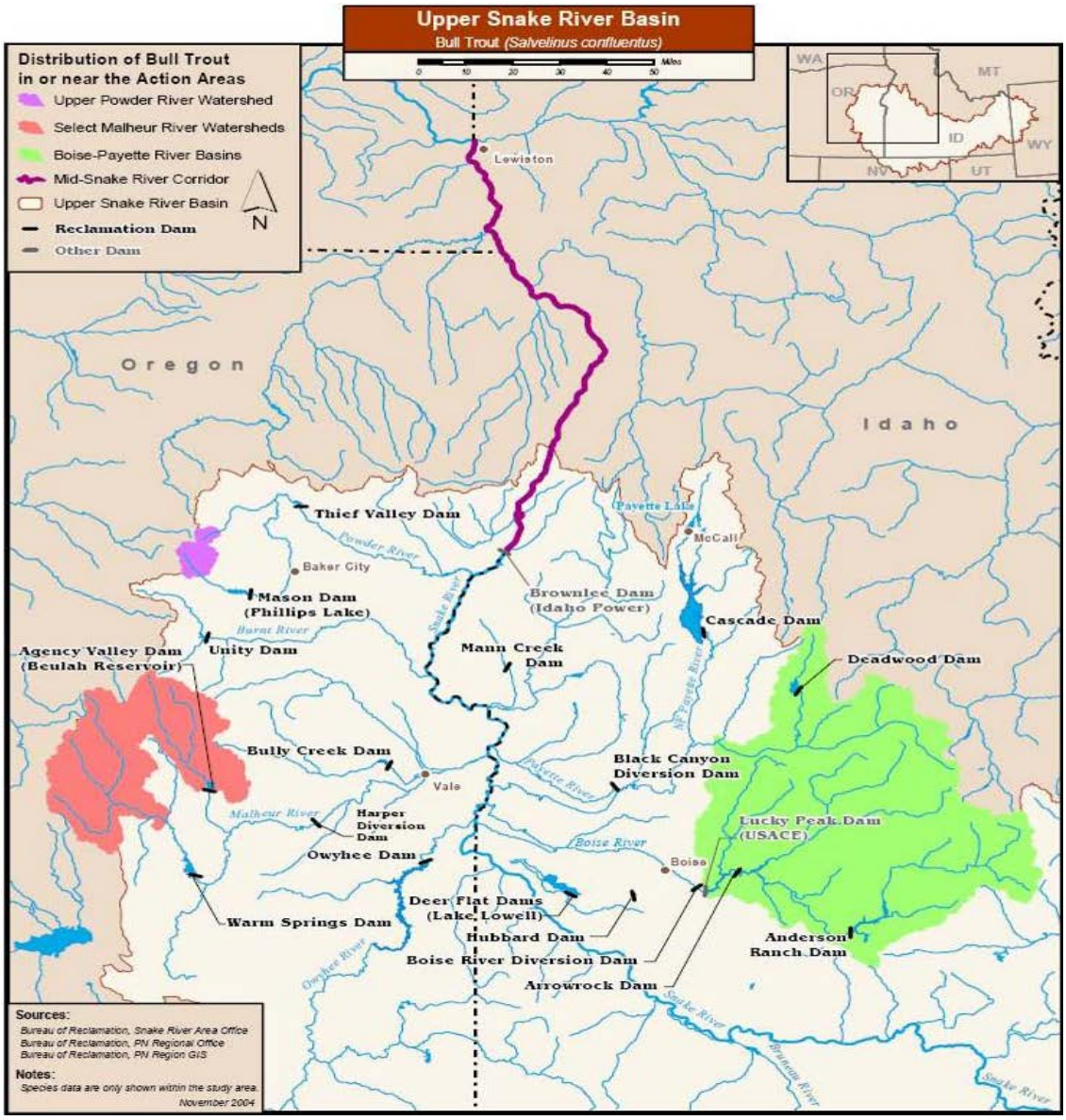

Figure 1. Known distribution of Bull Trout populations (shaded areas on map) associated with Reclamation facilities in the upper Snake River basin (Reclamation 2004).

1.1.1 Bull Trout Monitoring

This report describes operational thresholds, population monitoring, and other relevant Bull Trout work managed by Reclamation and work associated with projects that address specific RPMs. In addition, this report discusses other relevant Bull Trout work that is not managed by Reclamation but is directly relevant to Bull Trout or Bull Trout critical habitat within Reclamation's projects.

The Monitoring and Implementation Plan (Reclamation 2006) identifies how Reclamation will monitor Bull Trout throughout the duration of the 2005 Opinion. Monitoring elements include evaluating operational indicators and tracking population trends. To monitor compliance with the operational thresholds defined in the ITS, operations for WY15 were monitored, evaluated, and summarized using Reclamation's Hydromet system (Reclamation 2015a).[2] Operational thresholds affecting the amount or extent of anticipated take are described in Section 3.

1.2 Snake River Snails

Previous annual reports to the USFWS documented two species of snails in the Snake River basin: Utah valvata and Snake River physa. USFWS determined that Utah valvata did not meet the definition of an endangered or threatened species under the ESA. The Utah valvata was removed from the ESA list, thereby removing all protections, and subsequent monitoring and reporting requirements, provided by the ESA (75 FR 52272). Accordingly, 2010 was the last year Reclamation monitored the Utah valvata.

The physa remains an ESA-listed species; however, the 2005 Opinion did not provide an ITS, monitoring requirements, or Terms and Conditions for physa due to the uncertainty of their presence in the action area. Subsequent to the 2005 Opinion, physa were confirmed in the action area. A supplemental consultation with USFWS to address possible effects to physa from long-term operation of the newly-constructed spillway at Minidoka Dam was completed in 2015 (this supplemental consultation was initiated during construction of the spillway; construction began in 2011 and was completed in spring of 2015). The current take coverage for operations is covered under the *Biological Opinion for the Bureau of Reclamation, Operations and Maintenance above Brownlee Reservoir* (2015 Opinion) issued by USFWS in May of 2015 (USFWS 2015). Information reported in this document is related to the most recent requirements set forth in this 2015 Opinion.

Similar to efforts reported in Reclamation's 2013 and 2014 Annual Reports, the 2015 physa surveys were conducted to gather baseline data that will be used to determine trends of occurrence and abundance within the Minidoka reach (i.e., 10.5-mile reach extending from Minidoka Dam downstream to the I-84 bridge) of the Snake River; determine the effects of a range of spillway flows on physa in the Minidoka Dam spillway; further characterize physa habitats, and meet the reporting requirements of ESA Section 10 (Permit No. TE 056557-5).

[2] See Reclamation's Hydromet website at: http://www.usbr.gov/pn/hydromet/select.html

1.3 Yellow-billed Cuckoo

Reclamation entered into consultation with USFWS in 2015, following the determination to list the western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) in November 2014 (79 FR 67154). A BA for the Yellow-billed Cuckoo in the Snake River basin above Brownlee Reservoir is expected to be finalized with USFWS by the end of Fiscal Year 2016.

2. SUMMARY OF 2015 OPERATIONS

2.1 Idaho

Water supply conditions in early WY15 were near average in much of the Snake River basin above Brownlee Reservoir, with above average carryover. Unfortunately, a shift to much drier and warmer conditions in mid-February resulted in well below average snowpack and water supply conditions. Snowpack on January 1 in the Payette, Boise, and upper Snake River basins was 87, 95, and 123 percent of average, respectively. However, by April 1, snowpack in these three basins had dramatically decreased to 49, 61, and 75 percent, respectively.

Basins south and west of the Boise basin continued the dry pattern of the last couple of years and suffered severe to historic drought conditions due to the lack of reservoir carryover storage from the previous year (which also saw severe drought). Reservoirs were essentially empty by early August in the Owyhee and Malheur basins.

Reservoir carryover storage coming out of the 2014 water year was above average in the upper Snake and Boise projects. November carryover storage from 2014 was 99 percent of average in the Payette, 101 percent of average in the Boise basin, and 111 percent in the upper Snake basin above Milner.

Observed unregulated runoff for the April through July period was well below average, with 45 percent of average for the Payette River at Horseshoe Bend, 53 percent for the Boise River near Boise, and 84 percent for the Snake River at Heise (the seasonal flows at Heise were buoyed by May rain events). There were only minor flood control releases required in the Boise basin in 2015. In the upper Snake, no excess flows passed Milner once irrigation began in late March until flow augmentation began in early June.

Due to the above average carryover storage from the previous year, the upper Snake above Milner reservoir system reached a maximum combined physical storage content of 3,685,336 acre-feet, about 360,000 acre-feet below full capacity of 4,045,695 acre-feet.

The Boise system nearly filled reaching a maximum storage content of 888,831 acre-feet (61,000 acre-feet below its full capacity of 949,700 acre-feet) and would have filled approximately an additional 37,000 acre feet but for early flow augmentation releases. The Payette reservoir system reached a maximum combined storage content of 798,136 acre-feet, 10,000 short of the full storage of 808,500 acre-feet, and would have filled but for early flow augmentation releases.

Insufficient water was available to Reclamation to provide 487,000 acre-feet, the upper limit of flow augmentation to be provided in any given year. However, 427,000 acre-feet was made available for flow augmentation by taking extraordinary measures in accordance with the terms of the Nez Perce Water Rights Settlement, namely by releasing water stored in powerhead space in Anderson Ranch and using additional uncontracted space in Deadwood Reservoir.

The 427,000 acre-feet volume includes 60,000 acre-feet of natural flow rights, a small portion (10,500 acre-feet) of which is considered to occur outside of the April 3 to August 31 migration period.

2.1.1 Boise River Basin Operational Indicators

Specific operations or conditions at Anderson Ranch and Arrowrock dams and reservoirs that are expected to result in the take of Bull Trout in the form of death, harm, sublethal harassment, injury, or displacement were listed by the USFWS's 2005 Opinion. These operations or conditions are summarized as "operational indicators" for each dam in Table 1 and Table 2.

One operational indicator was exceeded during the 2015 reporting period in the Boise River basin. Anderson Ranch Reservoir stored and released water (Table 1; Figure 2 and Figure 3); however, the 2005 Opinion granted Reclamation an exemption for this action for 30 out of 30 years for which the Opinion is valid. Anderson Ranch Dam did not spill over the spillway in 2015.

Discharge from Arrowrock Dam exceeded 695 cubic feet per second (cfs) during the 2015 reporting period (Table 2 and Figure 5); however, the reservoir elevation did not drop below 3,111 feet during the critical season (July through September) or during the period when discharge exceeded 695 cfs. Therefore, no operational indicators were exceeded.

Table 1. Summary of amount or extent of anticipated take of Bull Trout associated with Reclamation's Anderson Ranch Dam and Reservoir facility operations during the 2015 reporting period.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2015 Operations (October 2014 to September 2015)	Quick Reference: Number of times threshold was exceeded
Anderson Ranch Dam and Reservoir	Up to 50 percent of the Middle and North Fork populations are affected by spillway discharges that disrupt timing of migration and spawning and that alter metabolic rates and up to 10 percent of Bull Trout in the reservoir are entrained into the South Fork Boise River	Water is discharged over the spillway	spring	6 of 30 years	Spillway use did not occur during the reporting period	2 of 6 years 2006: 9 days 2014: 3 days
Anderson Ranch Dam and Reservoir	Up to 50 percent of the Middle and North Fork populations are affected by the altered flow and temperature regime that disrupts migration and spawning and that increases metabolic rates	Water is stored and released at Anderson Ranch Dam	Spring through fall	30 of 30 years	Anderson Ranch Reservoir elevations for WY15 are shown in Figure 2.	10 of 30 years Exceeds annually
	Up to 4 percent of Bull Trout in the reservoir experience degraded water quality	Reservoir storage volume falls below 62,000 acre-feet (Figure 3).	Summer	2 of 30 years	Reservoir storage volume was maintained above 62,000 acre-feet (Figure 3).	0 of 2 years

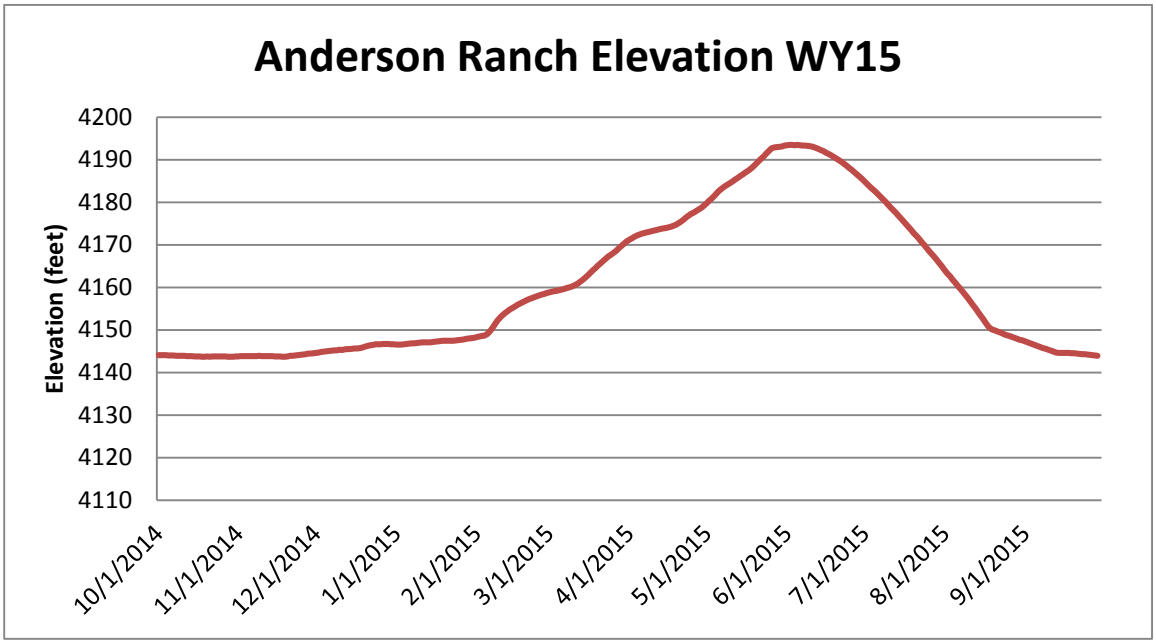

Figure 2. Anderson Ranch Reservoir elevations (feet above sea level) for WY15.

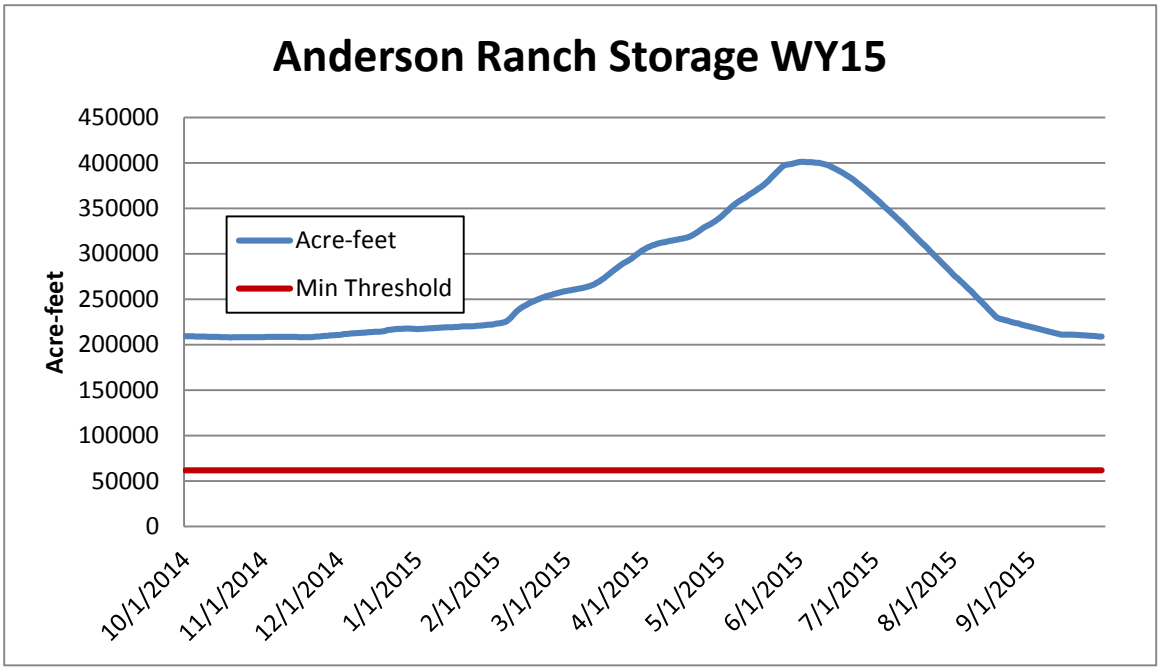

Figure 3. Anderson Ranch Reservoir storage volumes (acre-feet) for WY15. The straight line represents Reclamation's Operational Indicator minimum threshold of 62,000 acre-feet of storage.

Table 2. Summary of amount or extent of anticipated take of Bull Trout associated with Reclamation's Arrowrock Dam and Reservoir facility operations during the 2015 reporting period.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2015 Operations (October 2014 to September 2015)	Quick Reference: Number of times threshold was exceeded
Arrowrock Dam and Reservoir	Up to 50 percent of the Middle and North Fork populations are affected by low reservoir productivity and decreased prey.	Reservoir volume of less than 200,000 acre-feet at the end of June	June 30	3 of 30 years	Reservoir volume dropped below 200,000 acre-feet on June 25, 2015.	3 of 3 years 2007: yes 2013: yes 2015: yes
	Up to 8 percent of Bull Trout in the reservoir are entrained into Lucky Peak Reservoir, as averaged over any consecutive 5-year period.	Water is discharged over the spillway.	March through June	15 of 30 years	Spillway use did not occur during the reporting period.	1 of 15 years 2006: 9 days
Arrowrock Dam and Reservoir	Up to 2 percent of Bull Trout in the reservoir are entrained into Lucky Peak Reservoir	Discharge exceeds 695 cfs while the reservoir water surface elevation is less than 3111 feet	July through September	30 of 30 years	Reservoir Surface elevation did not drop below 3,111 feet during WY15 while discharge exceeded 695 cfs.	10 of 30 years Exceeds annually
	Up to 20 percent of Bull Trout in the reservoir, as averaged over any 5 consecutive years, experience habitat degradation and predation	Mean daily reservoir elevation falls below 3100 feet	September 15 through October 31	18 of 30 years	Reservoir surface elevation did not drop below 3100 feet during the WY 2015 (Figure 4)	0 of 18 years
Arrowrock Dam and Reservoir	Up to 5 percent of Bull Trout in the reservoir are entrained into Lucky Peak Reservoir, as averaged over any consecutive 5-year period	Discharge exceeds 695 cfs while the reservoir water surface elevation is less than 3111 feet (Figure 5)	Winter	20 of 30 years	Reservoir elevations did not drop below 3,111 feet in the winter months of 2015 (Figure 6)	0 of 20 years

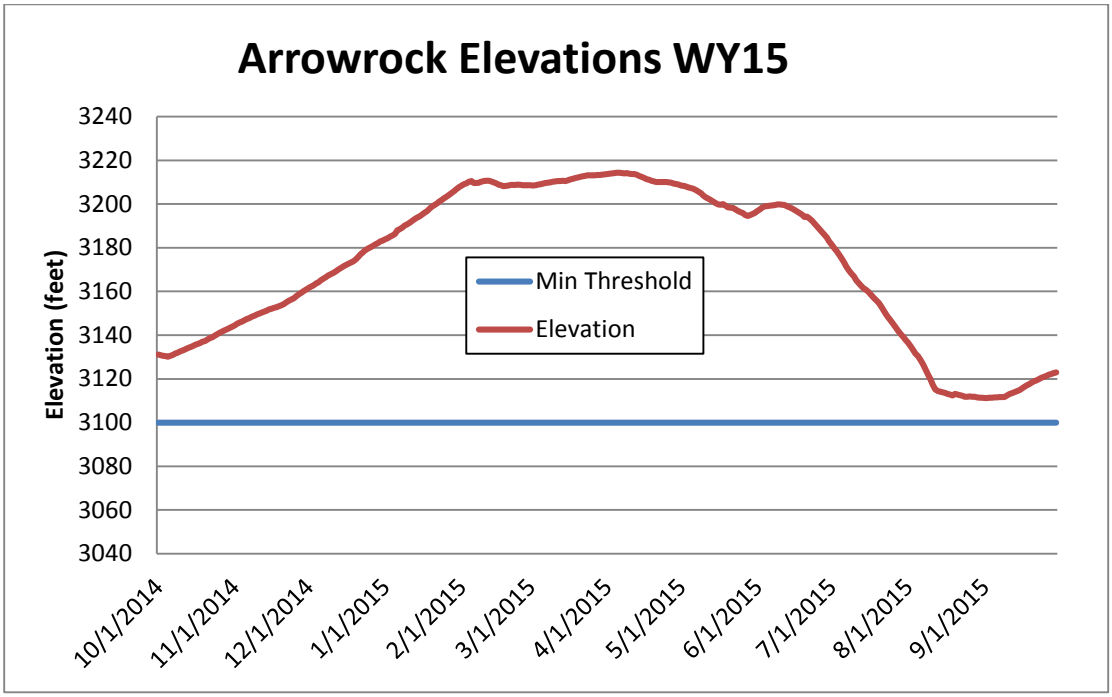

Figure 4. Arrowrock Reservoir surface elevation (feet above sea level) for WY15. The straight line represents Reclamation's Operational Indicator fall minimum threshold at elevation 3,100 feet.

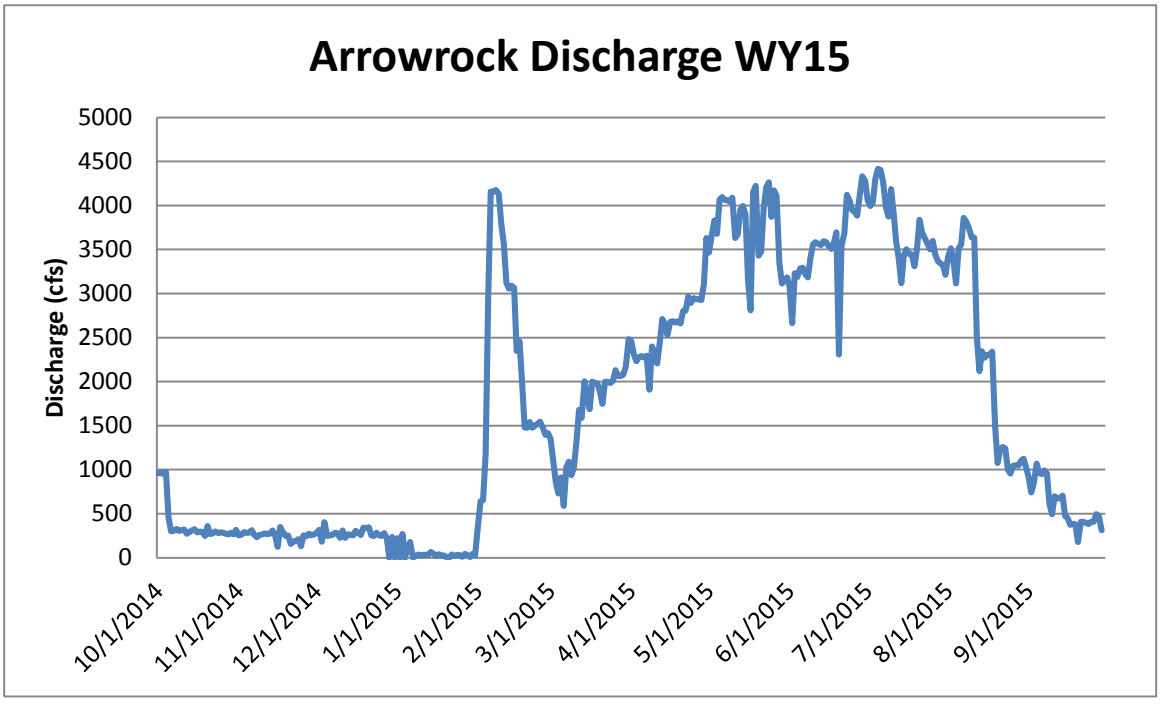

Figure 5. Arrowrock Reservoir discharge in cfs for WY15.

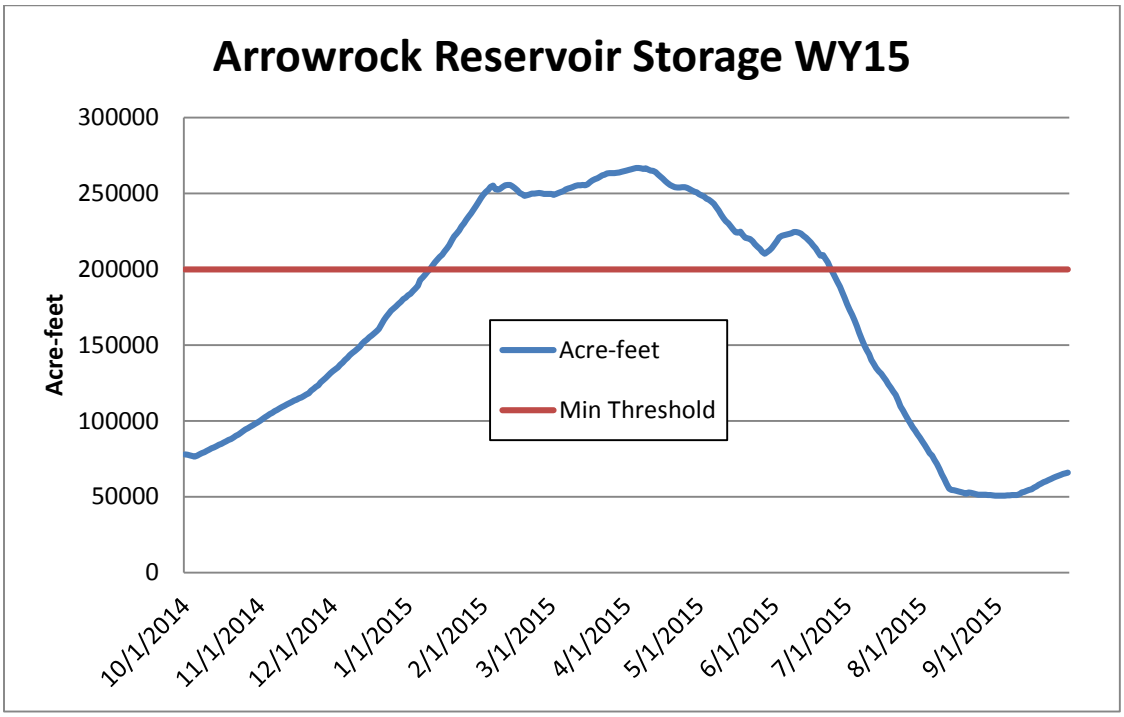

Figure 6. Arrowrock Reservoir storage volume (acre-feet) for WY15. Straight line represents Reclamation's Operational Indicator of reservoir volume of less than 200,000 acre-feet at the end of June.

2.1.2 Payette River Basin Operational Indicators

Specific operations or conditions at Deadwood Dam and Deadwood Reservoir that are expected to result in the take of Bull Trout in the form of death, harm, sublethal harassment, injury, or displacement were listed by the USFWS's 2005 Opinion. These operations or conditions are summarized as "operational indicators" for Deadwood Dam and Reservoir in Table 3.

Three operational indicators were exceeded during the 2015 reporting period in the Payette River basin. Deep water releases occurred throughout the year at Deadwood Dam; however, the 2005 Opinion granted Reclamation an exemption for this action for 30 of 30 years for which the Opinion is valid. Also, Deadwood Reservoir discharged water over the spillway for 50 days during the spring (May 1 through June 19), exceeding two operational indicators (Table 3). The 2005 Opinion granted Reclamation an exemption for this action 11 of the 30 years for which the Opinion is valid. Figure 7 illustrates Deadwood Reservoir storage volume in WY15.

Table 3. Summary of amount or extent of anticipated take of Bull Trout associated with Reclamation's Deadwood Dam and Reservoir facility operations during the 2015 reporting period.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2014 Operations (October 2013 to September 2014)	Quick Reference: Number of times threshold was exceeded
Deadwood Dam and Reservoir	Up to 2 to 4 percent of Bull Trout in Deadwood Reservoir are entrained into the Deadwood River below the dam	Water is discharged over the spillway	Spring	11 of 30 years	Water was discharged over the spillway in WY 2015 during May 1 through June 19.	6 of 11 years 2006: 32 days 2007: 33 days 2008: 33 day 2010: 15 days 2014: 69 days 2015: 50 days
	Up to 2 to 4 percent of Bull Trout in Deadwood Reservoir are affected by degraded water conditions	Reservoir storage volume falls below 50,000 acre-feet	August through October	2 of 30 years	Reservoir storage volumes did not drop below 50,000 acre-feet (Figure 7).	0 of 2 years
Deadwood Dam and Reservoir	All Bull Trout in the Deadwood River downstream from the dam are affected by spillway discharges that disrupt timing of migration and spawning and that alter metabolic rates	Water is discharged over the spillway	May through July	11 of 30 years	Water was discharged over the spillway for 50 days during WY15	6 of 11 years 2006: 32 days 2007: 33 days 2008: 33 day 2010: 15 days 2014: 69 days 2015: 50 days
	All Bull Trout in the Deadwood River downstream from the dam are affected by low winter streamflows and temperatures that affect	Deep water releases at Deadwood Dam and low flows below the dam	Spring-temperature increases and flow decreases; Summer – temperature decreases and flow increases; Fall – temperature	30 of 30 years	All releases are deep water releases except for water discharged over the spillway	10 of 30 years Exceeds annually

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2014 Operations (October 2013 to September 2014)	Quick Reference: Number of times threshold was exceeded
	Bull Trout movement and growth and reproduction of Bull Trout and the prey base		increases and flow reductions; Winter – temperature increases and flow reductions			

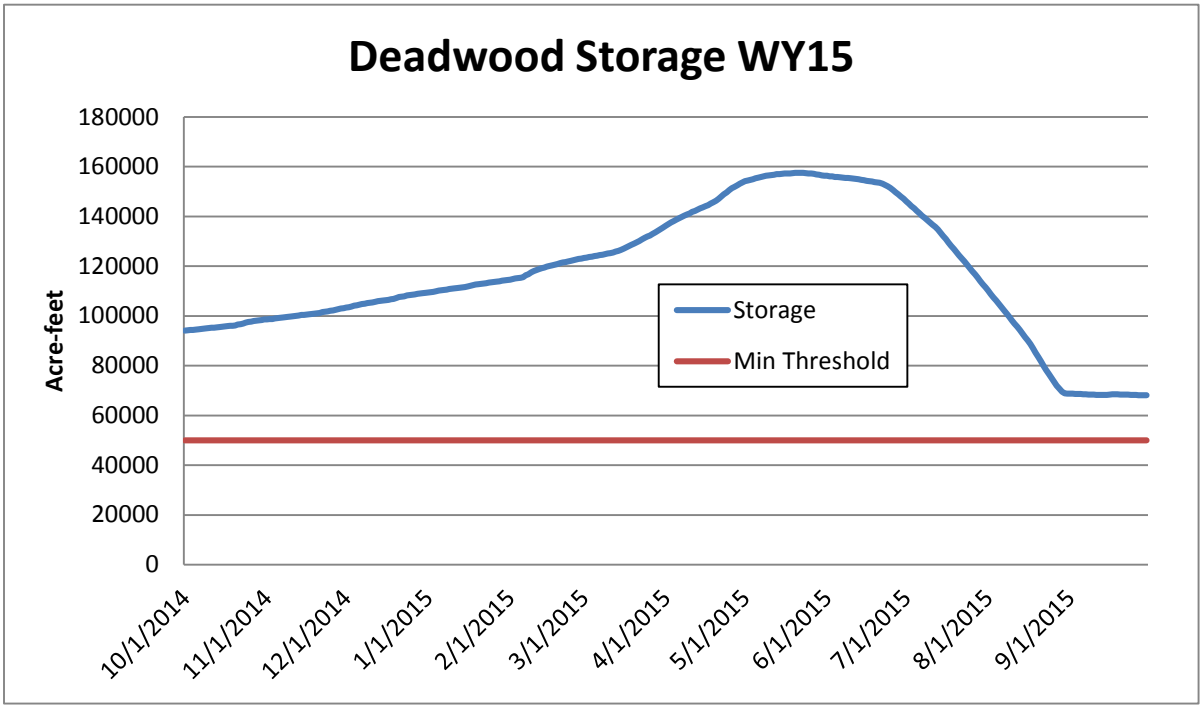

Figure 7. Deadwood Reservoir storage volumes (acre-feet) for WY15. The straight line represents Reclamation's Operational Indicator minimum threshold of 50,000 acre-feet of storage.

2.2 Oregon

Basins south and west of the Boise basin continued the dry pattern of the last couple of years and suffered severe to historic drought conditions due to the lack of reservoir carryover storage from the previous year (which also saw severe drought). Reservoirs were essentially empty by early August in the Owyhee and Malheur River basins.

Carryover storage in Beulah Reservoir for WY15 was very low, at 2,118 acre-feet on October 1, 2014. In the Malheur River basin, WY15 was a below-average water year; this low runoff filled Beulah Reservoir to only 42,599 acre-feet, or about 72 percent of its capacity (59,212 acre-feet) in 2015. Reservoir content dropped below the 2,000 acre-foot conservation pool threshold on July 24, 2015. The reservoir was drafted to its lowest point in WY15 on September 11, 2015, reaching 1,956 acre-feet (3.3 percent of reservoir capacity).

Flow information for WY15 (October 1, 2014 to September 30, 2015) can be found at Reclamation's Hydromet website. Reservoir water operations, including daily average reservoir elevations, contents in acre-feet, storage, and outflow for Reclamation facilities are discussed in detail later in this report.

2.2.1 Malheur River Basin Operational Indicators

Specific operations or conditions at Agency Valley Dam and Beulah Reservoir that are expected to result in the take of Bull Trout in the form of death, harm, sublethal harassment, injury, or displacement were listed by the USFWS's 2005 Opinion. These operations or conditions are summarized as "operational indicators" in Table 4.

One operational indicator was exceeded during the 2015 reporting period in the Malheur River basin. Beulah Reservoir fell below 2,000 acre-feet for 35 days during WY15; however, the 2005 Opinion granted Reclamation an exemption for this action, for 10 out of the 30 years for which the Opinion is valid. Figure 8 illustrates the water storage volume in Beulah Reservoir during WY15.

Table 4. Summary of amount or extent of anticipated take of Bull Trout associated with Reclamation's Beulah Dam and Reservoir facility operations during the 2015 reporting period.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2013 Operations (October 2012 to September 2013)	Quick Reference: Number of times threshold was exceeded
Beulah Dam	Up to 10 percent of Bull Trout in Beulah Reservoir are entrained into the North Fork Malheur River below the dam	Water is discharged over the spillway	May through June	3 of 30 years	Spillway was not used in WY15	2 of 3 years 2006: yes 2011: yes
	All Bull Trout returning to Beulah Reservoir to over-winter are affected by a reduced prey base	Reservoir storage falls below 2,000 acre-feet	August through October	10 of 30 years	Reservoir storage volume fell below 2,000 acre-feet for 35 days in this reporting period (Figure 8).	6 of 10 years 2007: 60 days 2008: 34 days 2009: 53 day 2010: 28 days 2013: 45 days 2014: 56 days 2015: 35 days

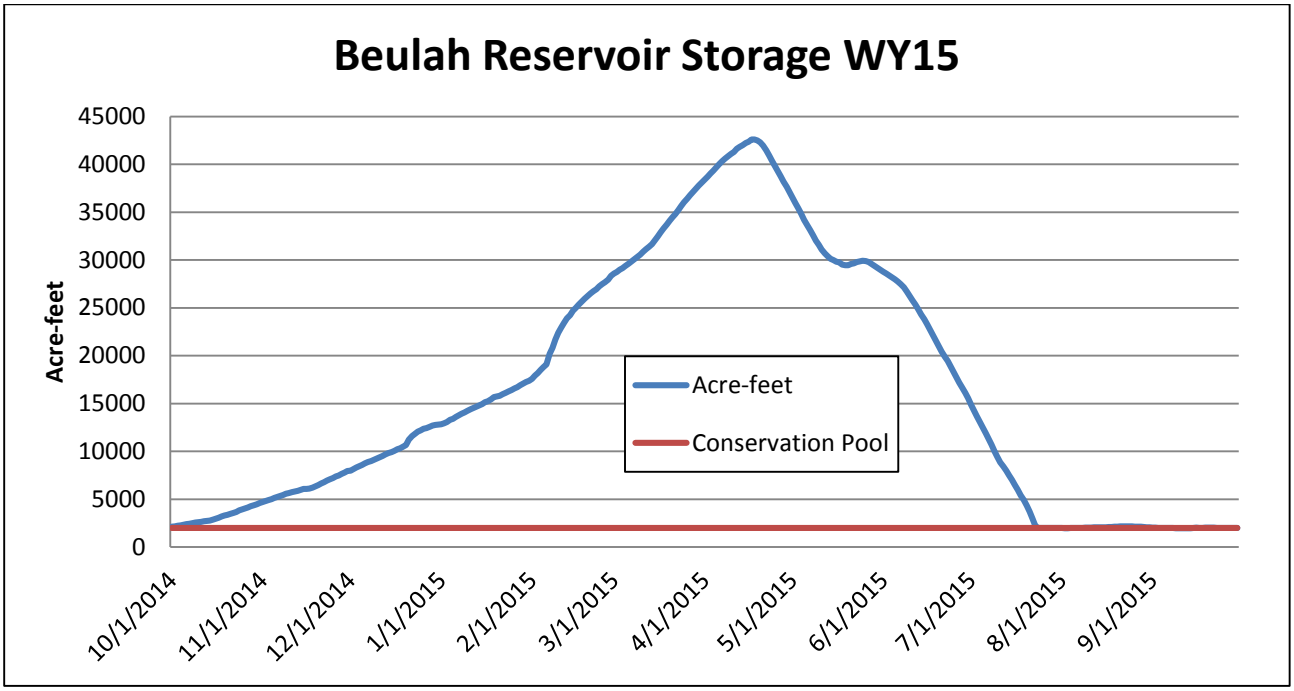

Figure 8. Beulah Reservoir storage volumes (acre-feet) for WY15. The straight line represents Reclamation's Operational Indicator minimum threshold of 2,000 acre-feet of storage.

2.2.2 Powder River Basin Water Year Summary

Bull Trout were discovered in Phillips Reservoir in 2011 necessitating Reclamation to consult with USFWS for Bull Trout in this area (Reclamation 2013b). The USFWS completed the non-jeopardy 2014 Opinion in June of 2014 for Reclamation O&M activities in the Powder River (USFWS 2014) as a companion document to the 2005 Opinion. The 2014 Opinion contains a 21-year ITS and corresponding RPMs that outline nondiscretionary actions for Bull Trout in the Phillips Reservoir. Anticipated take and operational indicators as included in Reclamation's proposed monitoring plan are shown in Table 5. Specific operations or conditions at Mason Dam and Phillips Reservoir that are expected to result in the take of Bull Trout in the form of death, harm, sublethal harassment, injury, or displacement have not yet been defined by USFWS. Reclamation will finalize a monitoring plan with USFWS for Phillips Reservoir in WY16. A summary of operations for WY15 are included in this report. Figure 9 and Figure 10 illustrate the water storage volume in acre-feet and reservoir elevation, respectively, in Phillips Reservoir during WY15.

Table 5. Summary of amount or extent of anticipated take of Bull Trout associated with Phillips Reservoir Operations during the 2015 reporting period, as included in proposed monitoring plan under review by USFWS.

Facility	Anticipated Take	Operational Indicators	Critical Season	Percent of expected occurrence*
Mason Dam/Phillips Reservoir	Up to 12 Bull Trout from resident headwater populations may be displaced during high flow events and be present in the reservoir	Powder River natural flows exceeding 856 cfs	Spring through summer	27 percent (6 of 21 years)
	Up to 12 Bull Trout from resident headwater populations may be displaced during high flow events and be present in the reservoir	Mean daily reservoir elevation falls below 4,048 feet above sea level	Spring through summer	100 percent (21 of 21 years)
* The Percent of Expected Occurrence column reflects content in Reclamation's proposed plan; actual exemptions and their frequencies have not yet been finalized by USFWS.				

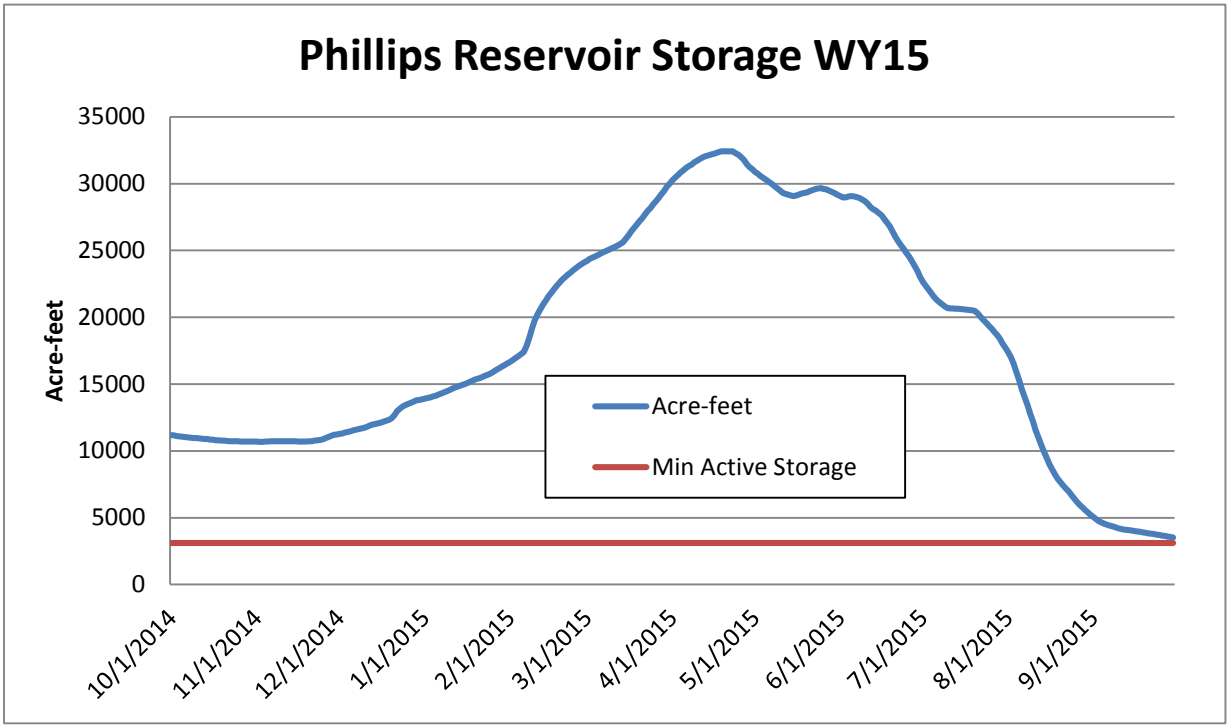

Figure 9. Phillips Reservoir storage volumes (acre-feet) for WY15. Minimum storage occurs when pool elevation reaches 4,009 feet above sea level or 3,100 acre-feet, corresponding to the point of inactive storage.

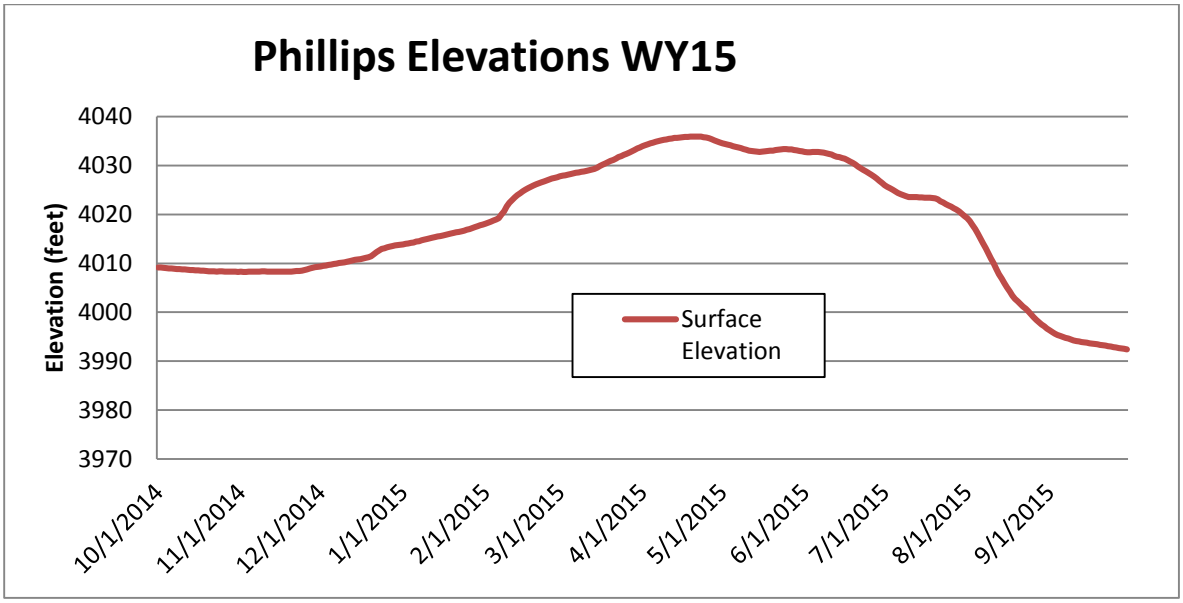

Figure 10. Phillips Reservoir surface elevation (feet above sea level) for WY15.

3. BULL TROUT

This chapter describes the Bull Trout ITS and RPMs, including monitoring efforts during WY15. The ITS includes four RPMs and their associated Terms and Conditions to minimize incidental take of Bull Trout related to O&M at Reclamation's facilities in the identified action areas where Bull Trout are present. Data collected to address these efforts may be used to satisfy the Terms and Conditions and/or monitoring requirements. For example, data collected during a fish sampling activity may be used to help monitor population trends. In 2015, Reclamation was involved with RPM activities and/or monitoring at Deadwood, Arrowrock, Anderson Ranch, Beulah, and Phillips reservoirs.

3.1 Boise River Basin

For the purpose of this report, the Boise River basin study area includes the Arrowrock Reservoir; Anderson Ranch Reservoir; the South Fork Boise River below Anderson Ranch Dam; and portions of the Middle and North Fork Boise rivers; Lucky Peak Reservoir; and Grouse and Cottonwood creeks tributaries to Arrowrock Reservoir (Figure 11).

The 2005 Opinion identified five Terms and Conditions for minimizing the effect and/or amount of take associated with the operation of Arrowrock Dam and two Terms and Conditions for Anderson Ranch Dam. Each of the Terms and Conditions addresses a different aspect of the effects of operations on Bull Trout or Bull Trout critical habitat. Most data collection efforts described in the following sections will be used to assess Terms

and Conditions for both Arrowrock and Anderson Ranch reservoirs because the influences of both facilities overlap.

A review of 2015 Arrowrock Hydroelectric Project operations performed by the Boise Project Board of Control and fish stocking performed by the Idaho Department of Fish and Game (IDFG) is also included in this report.

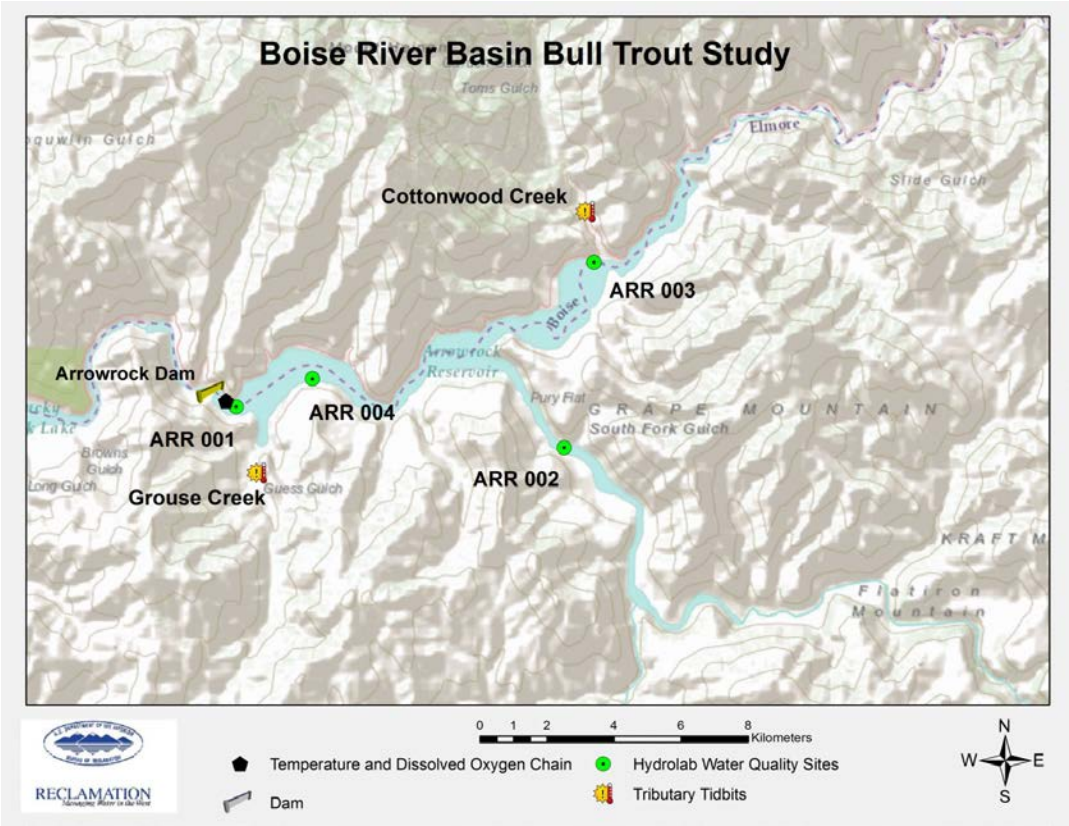

Figure 11. Limnologic and hydrologic sampling locations in Arrowrock Reservoir (ARR), Idaho 2014. Locations for Onset® TidbiT temperature loggers, a temperature and dissolved oxygen chain, and water profile stations are shown.

3.1.1 South Fork Boise River Data Collection and Arrowrock Reservoir Data Collection

Streamflow and water temperatures were monitored on the South Fork Boise River and selected tributaries (Figure 12). In 2014, Reclamation continued funding the U.S. Geological Survey (USGS) to maintain flow/temperature stream gages at Neal Bridge (USGS gage No. 13192200) on the South Fork Boise River for the purpose of monitoring flow below Anderson Ranch Dam.

Reclamation is currently designing a study plan to develop a water quality model for Anderson Ranch Reservoir to better understand use of the reservoir by Bull Trout and means of take. It is anticipated that reporting of this model will be completed in WY17.

Reclamation is finalizing a water quality model for Arrowrock Reservoir, using data collected in WY12 through WY15. Data collection in Arrowrock Reservoir focusing on water quality monitoring, such as collection of reservoir profiles and water quality sampling, will continue at intervals as needed for model completion and the development of long-term monitoring needs. Future data collection needs will be determined by Reclamation's Regional Water Quality Laboratory.

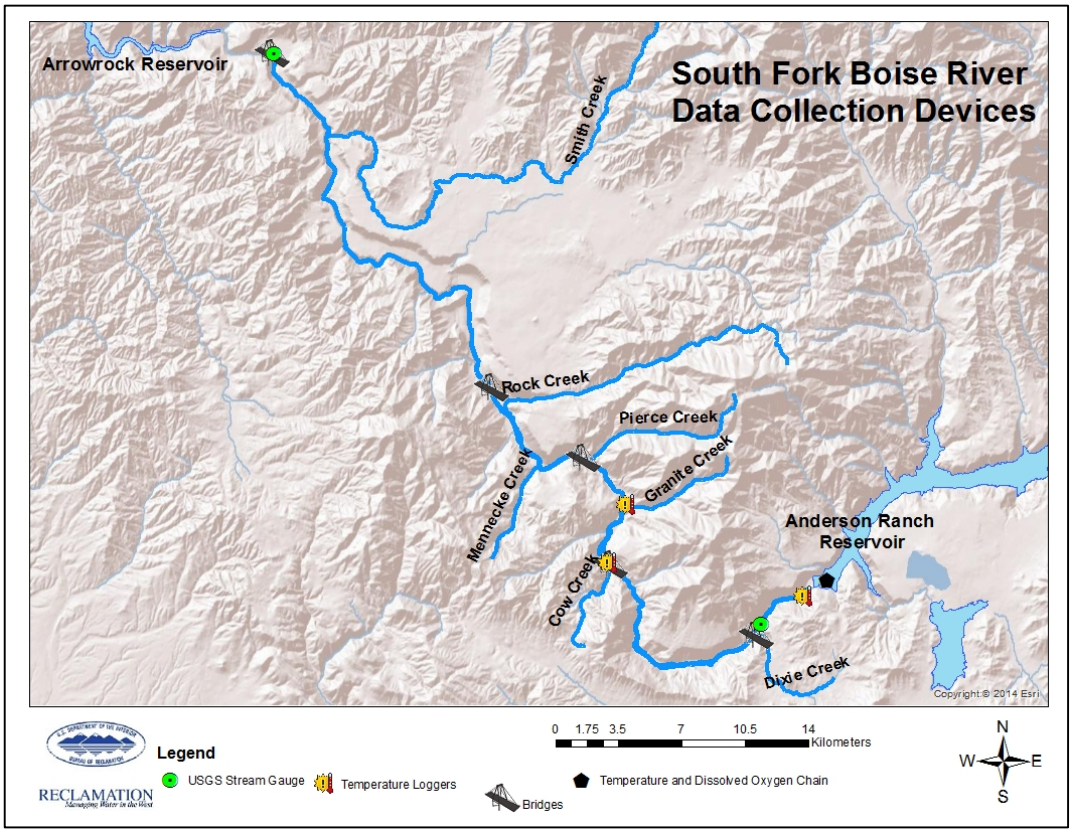

Figure 12. South Fork Boise River basin study area. Locations of Onset® TidbiTs temperature loggers, a temperature and dissolved oxygen chain, pressure transducers and USGS gages, one of which also house a telemetry receiver (Neal Bridge) are shown.

3.1.2 Fish Sampling

Fish sampling to address Terms and Condition 1.c (entrainment) is integrated into trap-and-haul efforts to move potentially displaced (entrained) Bull Trout from Lucky Peak Reservoir back upstream into Arrowrock Reservoir. Trap-and-haul efforts are scheduled to

occur in even-numbered years, and as necessitated by spillway usage. The spillway at Arrowrock Dam was not operated during the reporting period, and so in 2015 Reclamation did not perform any trap-and-haul efforts.

3.1.3 Radio Telemetry

The use of radio transmitters and archival temperature tag technology was used in a study designed to address the Terms and Conditions outlined in the 2005 Opinion. Data collection for that study concluded in WY14, and data are being analyzed for inclusion a future report. No further telemetry tracking occurred during 2015, or is currently planned for Arrowrock Reservoir or the Boise River in the future.

3.1.4 Hydrology and Water Chemistry

Hydrology and water chemistry data were collected in Arrowrock Reservoir and select tributaries during the reporting period. These data are being used to assess Term and Condition 1.b and, coupled with Bull Trout migration behavior, to assess Term and Condition 2.b. Reservoir vertical profiles were collected in February of 2015 at locations shown in Figure 11. Seven water quality parameters were measured, including water temperature, dissolved oxygen concentration, pH, conductivity, turbidity, florescence (chlorophyll), and barometric pressure. Sampling of hydrology and water quality parameters will continue in WY16.

Onset® TidbiTs temperature thermographs were deployed in Grouse Creek and Cottonwood Creek (Figure 11) on May 12, 2011, and data has been retrieved from them yearly. Manual downloads of hourly data from these TidbiTs were performed twice in WY15. Continued water temperature data collection in Grouse and Cottonwood creeks occurred through the 2015 field season.

Two semi-permanent water quality monitoring stations were installed on Arrowrock and Anderson Ranch reservoirs to monitor water quality conditions prior to, during and after thermal stratification. This data is being used to address Terms and Conditions. The Arrowrock station has been in operation since 2012; and was redeployed on March 2, 2015, approximately 200 yards upstream of the dam in the deepest portion of the reservoir. On March 3, 2015, the Anderson Ranch station was deployed approximately 500 yards upstream of the dam in the deepest portion of the reservoir (Figure 12). Onset® TidbiT temperature thermographs were attached to a rope at 1-meter intervals from 1- to 25-meter depths for both stations. Three Minidot temperature/dissolved oxygen sensors were attached at 4 meters, 8 meters, and 20 meters to measure dissolved oxygen above, within, and below the anticipated annual thermocline for both stations. Full vertical profiles were collected on November 5 (Arrowrock station) and November 12 (Anderson Ranch station)

to confirm that a breakdown of stratification and a complete seasonal mixing of the reservoirs had occurred. At that time, the stations were removed for winter storage. Data collection from the Arrowrock station for development of the water quality model was completed in 2015. The Anderson Ranch station will be redeployed in the spring of 2016 when conditions allow.

3.1.5 Trap-and-Haul Efforts

Trap-and-haul efforts to relocate potentially displaced (entrained) Bull Trout in Lucky Peak Reservoir back into Arrowrock Reservoir, are scheduled to occur in even-numbered years, and as necessitated by spillway usage. Trap-and-haul efforts were not conducted during 2015. The spillway at Arrowrock Dam was not operated during the reporting period.

Observed Trends in Lucky Peak Trap-and-Haul Efforts

Trap-and-haul efforts did not occur in 2015; trends for the Lucky Peak Trap-and-haul efforts will be updated and reported in the 2016 annual report. Historic trends in biannual data are shown in Figure 13.

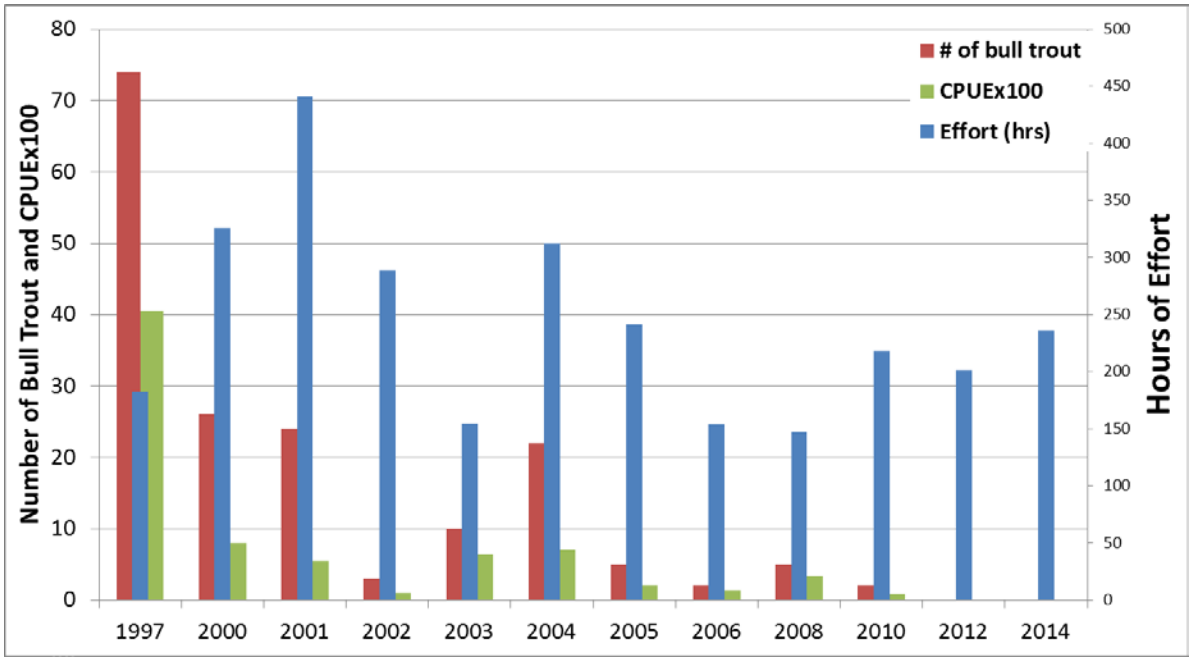

Figure 13. Trap-and-haul trends for historic data, 1997-2014. No Bull Trout were sampled in 2012 or 2014.

3.1.6 Other Activities

Arrowrock Dam Hydroelectric Project – Boise Project Board of Control

Arrowrock Dam Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) licensee No.4656-020, started operations in 2010. Among the requirements of the FERC license, the licensee (Boise Project Board of Control) is obligated to perform the following for 5 years:

1. Monitor water temperature and dissolved oxygen in the project stilling basin.

   The last year of the 5-year requirement of this monitoring was in 2015. During that time, minimum readings for dissolved oxygen occurred during the week of August 10 and averaged 6.66 percent while maximum water temperatures occurred during the week of August 17 and averaged 17.77ºC (Boise Project Board of Control 2016a). Future monitoring recommendations will be prepared by the Boise Board of Control and presented to FERC after review of the Arrowrock Hydro Team.

2. Conduct a fish salvage effort in the project tailrace if a complete shutdown occurs for more than 48 hours when the Lucky Peak Reservoir pool elevation is below 3022 feet.

   Conditions did not occur during the 2015 reporting period that required a fish salvage effort to occur (Boise Project Board of Control 2016b).

3. Meet with the Arrowrock Hydro Team (IDFG, Reclamation, U.S. Army Corps of Engineers [Corps], and USFWS) annually to report operations of the project.

   The 2015 annual meeting occurred March 22, 2016 at the Boise Project Board of Control office, Boise, Idaho. Annual meetings are expected to continue.

Fish Stocking within Reclamation Projects – Boise River Basin IDFG

IDFG annually stocks fish in the Boise River basin for recreational angling. Stocking practices are determined solely by IDFG, and stocking is not performed to meet Reclamation objectives. Table 6 is a summary of fish stocking[3] for all fish types that occurred at Arrowrock and Anderson Ranch reservoirs, and in the South Fork Boise River in 2015.

[3] Comprehensive stocking data for the state is provided by IDFG and is available at http://fishandgame.idaho.gov/public/fish/stocking/speciesByDate.cfm?region=3

Table 6. Fish stocking by IDFG in 2015 in the Boise River basin for all fish types.

Date Stocked	Species Type	Size	Number Stocked
Anderson Ranch Reservoir			
6/4/2015	Fall Chinook	Fingerling (3-6 in.)	5,536
Arrowrock Reservoir			
10/28/2015	Triploid Troutlodge Kamloop	Catchable (6 in. +)	5,254
10/8/2015	Triploid Troutlodge Kamloop	Catchable (6 in. +)	8,134
5/13/2015	Early Spawner Kokanee	Fingerling (3-6 in.)	101,198
South Fork Boise River			
5/15/2015	Hayspur Rainbow Triploid	Catchable (6+ in.)	944
6/19/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	980
6/22/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	975
6/22/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	490
7/10/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	1429
7/13/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	446
7/20/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	500
7/28/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	1987
8/3/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	479
8/21/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	1819
8/26/2015	Triploid Troutlodge Kamloop	Catchable (6+ in.)	1888

3.2 Payette River Basin – Deadwood River System

The 2005 Opinion identified five Terms and Conditions for minimizing the effects to Bull Trout and the amount of take associated with the operation of Deadwood Dam and Reservoir. Each term and condition addresses a different aspect of the effects of operations on Bull Trout and makes assumptions regarding the reservoir operation effects on Bull Trout. Examining the system as a whole allows Reclamation to understand the systemic impacts of individual operational changes. Consequently, Reclamation has been engaged in the multi-year Deadwood Reservoir Operations Flexibility Evaluation (Deadwood Study) to

address the Terms and Conditions jointly and evaluate operational flexibility to minimize biological impacts system-wide.

Evaluating flexibility of the operations and the effects of Deadwood Dam on aquatic fauna requires an understanding of the potential overall ecosystem response to an operational change over time. Using modeling of physical and biological parameters measured over the course of this project allows for an ecosystem analysis of the Terms and Conditions for Deadwood Reservoir operations and its influence on Bull Trout populations. These efforts involved collaboration between multiple agencies and include annual activities not detailed in this report. The results of the Deadwood Study will be provided in the report scheduled for completion in 2016.

3.2.1 Data Collection in the Reservoir and Tributaries above the Dam

Physical, hydrologic, and water quality data were collected in the Deadwood River, Deadwood Reservoir, and selected tributaries as outlined in the Study Proposal (Reclamation 2008).

Hydrology and Water Chemistry

Collection of water temperature data using thermographs continued in 2015 in four tributaries to the reservoir: Deadwood River, Trail Creek, Beaver Creek, and Wildbuck Creek (Figure 14). Onset® TidbiTs recorded hourly water temperature data that were manually downloaded a minimum of one time per year. Temperature data is stored at Reclamation's Snake River Area Office and is being used for biological and hydrologic modeling (Reclamation 2013a).

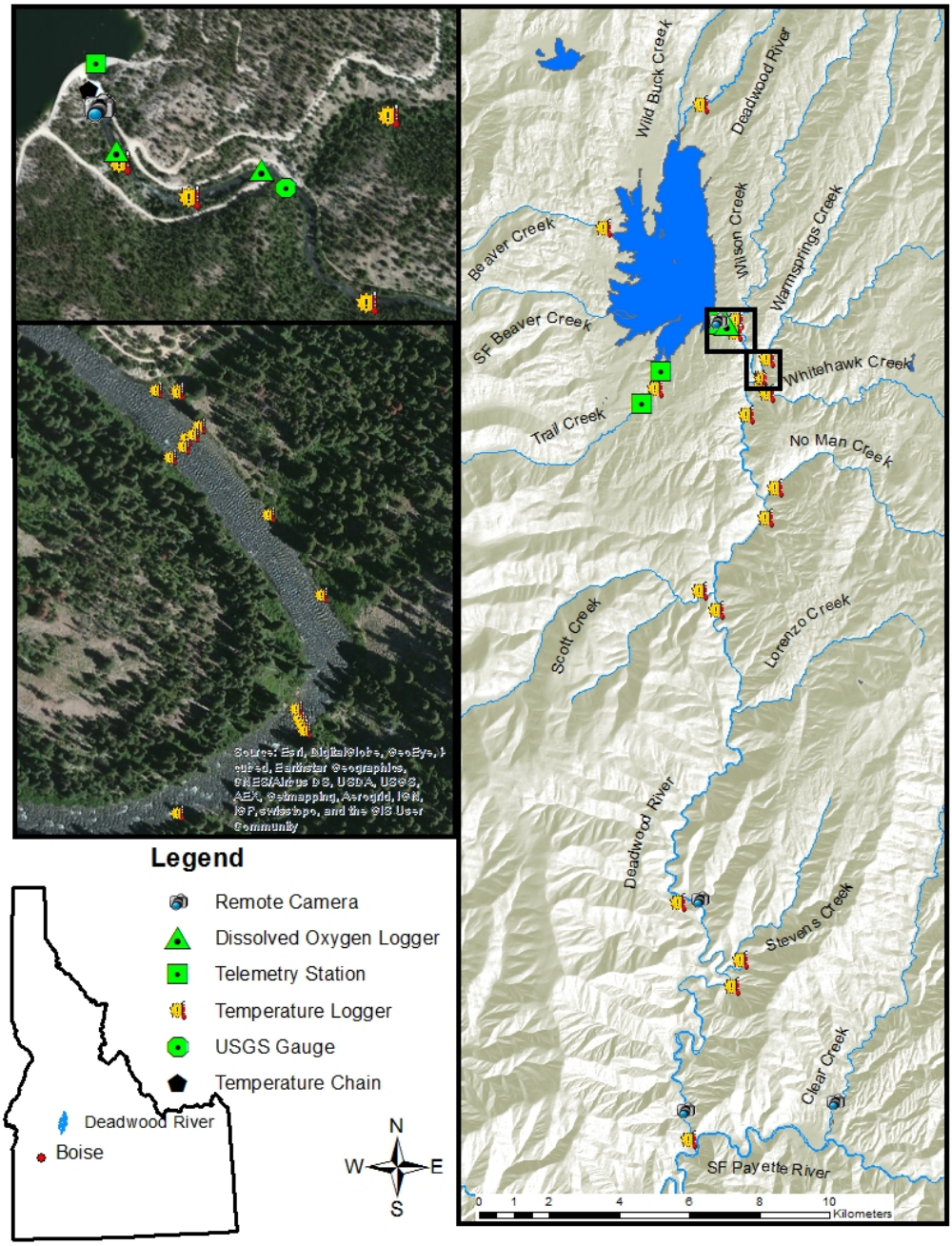

Figure 14. Limnologic and hydrologic sampling locations in the Deadwood study area, Idaho 2015. Equipment used to record data varied between locations and included Onset® TidbiT temperature loggers (individual loggers and a chain set up to collect data at different depths within the stilling basin), miniDO2T dissolved oxygen loggers, Bushnell® game cameras, and a USGS gage.

Other Activities

IDFG operated Kokanee weirs on Trail Creek and the mainstem Deadwood River during the fall spawning period to limit escapement and collect gametes for brood stock. In 2015, the Trail Creek and mainstem weirs were operated from August 6 to September 15. IDFG handled 13 Bull Trout that were captured at the mainstem weir and 11 at Trail Creek.

In 2015, IDFG also stocked 6,100 fingerling fall Chinook salmon (3 to 6 inches) and 10,462 fingerling triploid Hayspur Rainbow Trout into Deadwood Reservoir as a measure to control Kokanee and provide a sport fishery (Table 7).

Table 7. Fish stocking by IDFG in 2015 in Deadwood Reservoir for all fish types.

Date Stocked	Species Type	Size	Number Stocked
Deadwood Reservoir			
6/22/2015	Fall Chinook	Fingerling (3-6 in.)	6,100
6/22/2015	Hayspur Rainbow Triploid	Fingerling (3-6 in.)	10,462

3.2.2 Data Collection in the Deadwood River Downstream of Deadwood Dam

Since 2007, 63 Bull Trout have been captured in the stilling basin below the dam and 197 Bull Trout have been captured in tributaries to the river below the dam. During the 2015 reporting period, no Bull Trout sampling occurred but tracking of previously radio-tagged fishes did occur.

Fish Sampling Below Deadwood Dam

No fish sampling occurred below Deadwood Dam in WY15.

Radio Telemetry

Six telemetry data collection efforts occurred between February 17 and September 30, collecting data from three previously-placed radio tags (one Bull Trout and two Rainbow Trout) that remained active and detectable into the 2015 reporting period; however, it is unclear at the time this report was prepared whether the data from these tags represented movements of live fish or had been expelled. These data, along with data from previous years, will be analyzed and summarized in the Deadwood Flexibility Study Report.

Hydrology and Water Chemistry

Onset® TidbiT temperature loggers continued monitoring water temperatures downstream of Deadwood Dam at multiple locations in the mainstem Deadwood River and in seven tributaries to the Deadwood River: Wilson, Warmsprings, Whitehawk, No-Man, Scott, Lorenzo, and Stevens creeks (Figure 14). The loggers recorded water temperature hourly throughout the year and were manually downloaded.

Temperature data collected by the network of loggers deployed in the Deadwood River near Warmsprings Creek, a geothermally-influenced creek, were downloaded during the 2015 field season. The goal of this data collection effort was to characterize the thermal signature of Warmsprings Creek, determine whether it provides a thermal refuge for Bull Trout, and evaluate how different operational scenarios may affect the warm water entering the Deadwood River from Warmsprings Creek.

All temperature, water quality, and dissolved oxygen datasets are stored in Reclamation's Snake River Area Office and are being used for the biological and hydrologic modeling. Results will be available in the final Study.

3.3 Malheur River Basin – Beulah Reservoir and the North Fork Malheur River

The 2005 Opinion identifies four Terms and Conditions for minimizing the effect and amount of take associated with the operation of Agency Valley Dam and Beulah Reservoir. Each of the Terms and Conditions addresses a different aspect of the effects of operations on Bull Trout. Reclamation is working with USFWS to finalize recommendations for a conservation pool in Beulah Reservoir that would maintain a prey base for Bull Trout that overwinter in the reservoir (Terms and Conditions 4.a and 4.c).

In 2010, USFWS approved a time extension to allow Reclamation to collect additional data at Beulah Reservoir and its tributaries. A 4-year study was initiated in 2010 to extend fish, invertebrate, zooplankton, and water quality sampling to lower drawdown levels and to complete bioenergetics modeling. Prey base and Bull Trout studies (Term and Condition 4.a) were conducted during the first 3 years. During the last year, data collected during this study was combined with previous sampling efforts to conduct bioenergetics modeling and to develop a defensible conservation pool recommendation for Beulah Reservoir and the efficacy of prey supplementation (Term and Condition 4.b).

During the 2015 reporting period, no additional data were collected for this study. The final reports for this work were completed in June 2015 under two covers and include results of the prey base (Reclamation 2015b) and bioenergetics modeling, and population

sustainability (Reclamation 2015c). Results from these efforts will be used to develop the conservation pool recommendations expected to be completed in Fiscal Year 2016. Reclamation will strive to maintain the reservoir pool elevation at or above 2,000 acre-feet until conservation pool recommendations are presented to USFWS.

3.3.1 Temporary Water Lease

In 2015, Reclamation entered into a 2-year temporary water lease with the Vale Irrigation District to maintain reservoir pool elevation at or above 2,000 acre-feet until conservation pool recommendations are presented to the USFWS. (The 2015-2016 water lease extended the minimum study pool that occurred during the studies while the report is being completed.) The pool elevation at Beulah Reservoir fell below 2,000 acre-feet for a total of 35 days during WY15 (Figure 8). A minimum pool elevation of 1,956 acre-feet (3285.29 feet) was reached on September 11, 2015, and carryover was 1,980 acre-feet on September 30, 2015.

During WY15, Standard Operating Procedures (SOPs) were followed to assure the maintenance of a 2,000 acre-feet conservation pool. SOPs involve monitoring water gages above and below the reservoir and using these data to determine adjustments in outflow to maintain or adjust pool elevations. Hot and dry weather conditions led to increased biofouling of equipment between scheduled calibration maintenance. The cause for these errors was discovered and steps were taken to eliminate similar issues in the future.

3.3.2 Trap-and-haul Efforts

Trap-and-haul efforts were not conducted in WY15 because the spillway was not used to release water from the reservoir (Term and Condition 4.d).

3.3.3 Other Activities – Redd Counts

Reclamation participates as a partnering agency in annual survey counts or Bull Trout redds in the North Fork Malheur River basin, to satisfy coordination and basin monitoring requirements set forth in the 2005 Opinion. Carryover storage in Beulah Reservoir has been shown to affect the Bull Trout prey base (Rose and Mesa 2009); however, a direct link between carryover pool elevations and Bull Trout redd counts remains speculative. Figure 15 shows the number of redds observed in the North Fork Malheur River basin and the carryover of reservoir storage in Beulah Reservoir, from previous reporting years to the present. Redd counts were not conducted in the Malheur basin in 2015, because of fire activity constraints and resulting air quality and safety concerns.

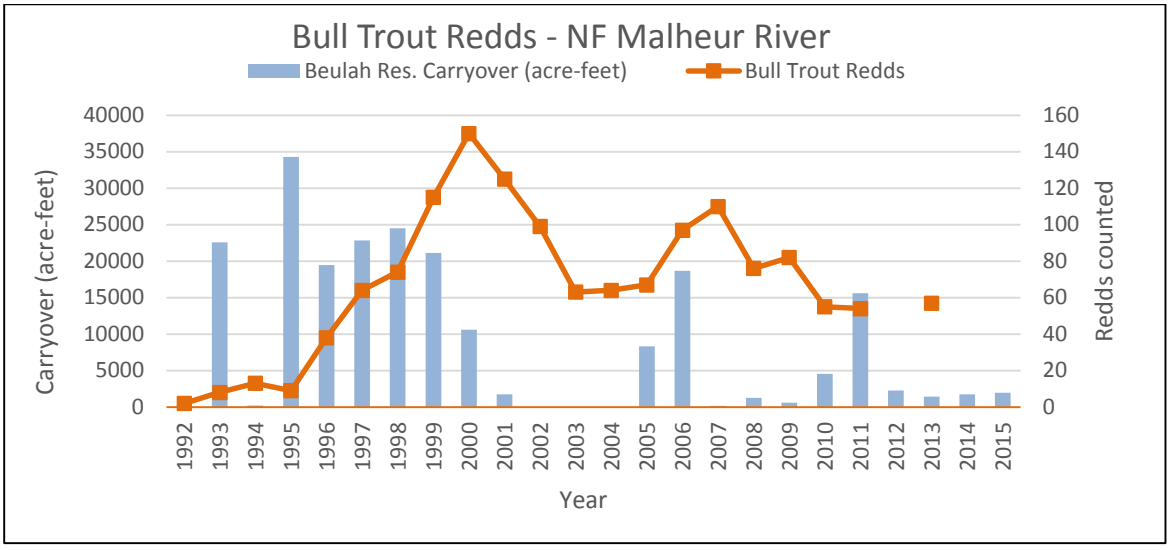

Figure 15. Data on Bull Trout redd trends observed in the North Fork Malheur River watershed (North Fork Malheur River), and carryover storage in Beulah Reservoir, 1992-2015. The number of redds observed after 2007 has been adjusted by one, to reflect reduced size of area surveyed. No data exists for 2012, 2014, and 2015.

3.4 Phillips Reservoir Bull Trout Sampling Plan

3.4.1 Bull Trout Monitoring

In accordance with the 5-year monitoring plan currently undergoing review by the USFWS and expected to be finalized in 2016, Reclamation began conducting monitoring of the Powder River gage (PRHO; inflow into the reservoir) to record the frequency of events that are expected to lead to Bull Trout migration into/through the reservoir, and recording the frequency of drawdown that seasonally affects access through the Deer Creek varial zone, through continued monitoring of pool elevation (PHL- FB; reservoir water surface elevation). In the 2015 reporting period, inflow measured at PRHO did not exceed 856 cfs, the operational indicator threshold proposed in the current draft monitoring plan.

Reclamation conducted 218.2 hours of fish sampling efforts at Phillips Reservoir between April 21 and April 28, 2015 in an ongoing effort to better determine Bull Trout use of Phillips Reservoir and assess fish community composition. Sampling took place at locations throughout the reservoir's inlet arm near the mouths of the mainstem Powder River and Deer Creek, and included 194.7 hours of sampling via fyke net, 17 hours of sampling via gill net, and 6.5 hours of sampling via hook and line methods. Fish species sampled included Rainbow Trout (*Oncorhynchus mykiss*), Largescale Sucker (*Catostomus macrocheilus*), Bridgelip Sucker (*Catostomus columbianus*), Smallmouth Bass (*Micropterus dolomieu*), Redside Shiner (*Richardsonius balteatus*), Northern Pikeminnow

(*Ptychocheilus oregonensis*), Yellow Perch (*Perca flavescens*), and juvenile crappie and suckers that were not identified to the species level (*Pomoxis* and *Catostomus spp*), respectively (Table 8). No Bull Trout were detected.

Data resulting from this sampling effort are summarized in Table 8, and were included in full in the 2015 report for sampling permit "OR STP#19414: Phillips Reservoir Bull Trout Monitoring," submitted to the National Marine Fisheries Service online system for Authorizations and Permits for Protected Species on August 6, 2015.

Table 8. Phillips Reservoir fish sampling data from 2015 effort, including total catch for each species (SPP) by sampling method and catch per unit effort (CPUE) by sampling method.

Species	Gill Net	Fyke (trap) Net	Hook and Line	Total by SPP
Largescale sucker	45	15	0	60
Yellow Perch	5	45	0	50
Sucker (juvenile, species unknown)	0	38	0	38
Northern Pikeminnow	2	16	0	18
Bridgelip Sucker	8	2	0	10
Redside Shiner	0	6	0	6
Smallmouth Bass	1	1	1	3
Rainbow Trout	1	2	1	3
Crappie	0	3	0	3
Total by Sampling Method	**61**	**128**	**2**	
CPUE by Sampling Method	**3.59**	**0.66**	**0.31**	

3.4.2 Other Activities

A scoping investigation was performed in the varial zone of Deer Creek to help define options for addressing the Conservation Recommendation for Phillips Reservoir in the 2014 Opinion. A technical memorandum was completed in November 2014 (Reclamation 2014), results from this work will be used to develop new information on Bull Trout critical habitat in this area. Reclamation is also looking into incorporating environmental DNA sampling to supplement Bull Trout monitoring activities in the 2016 field season.

4. SNAKE RIVER PHYSA

4.1 Introduction and Background

The 2005 Opinion found that the proposed operations of Minidoka Dam may adversely affect physa in the Minidoka reach of the Snake River; however, insufficient information existed to adequately predict impacts. One of Reclamation's proposed actions in the 2004 BA (Reclamation 2004) was to conduct presence/absence surveys of physa to characterize the environmental variables and physical habitats where physa are found. During surveys conducted from 2006 through 2008, over 274 live physa specimens were found between Minidoka Dam downstream to above Milner Pool (Figure 16; Gates and Kerans 2010). Live physa were found in low densities, primarily among pebble and gravel substrates in the main channel (thalweg) of the Snake River from below Minidoka Dam downstream to above the Milner Pool. Physa were also found in the spillway area of Minidoka Dam, though sample sizes were too small to characterize habitat use and spatial distribution.

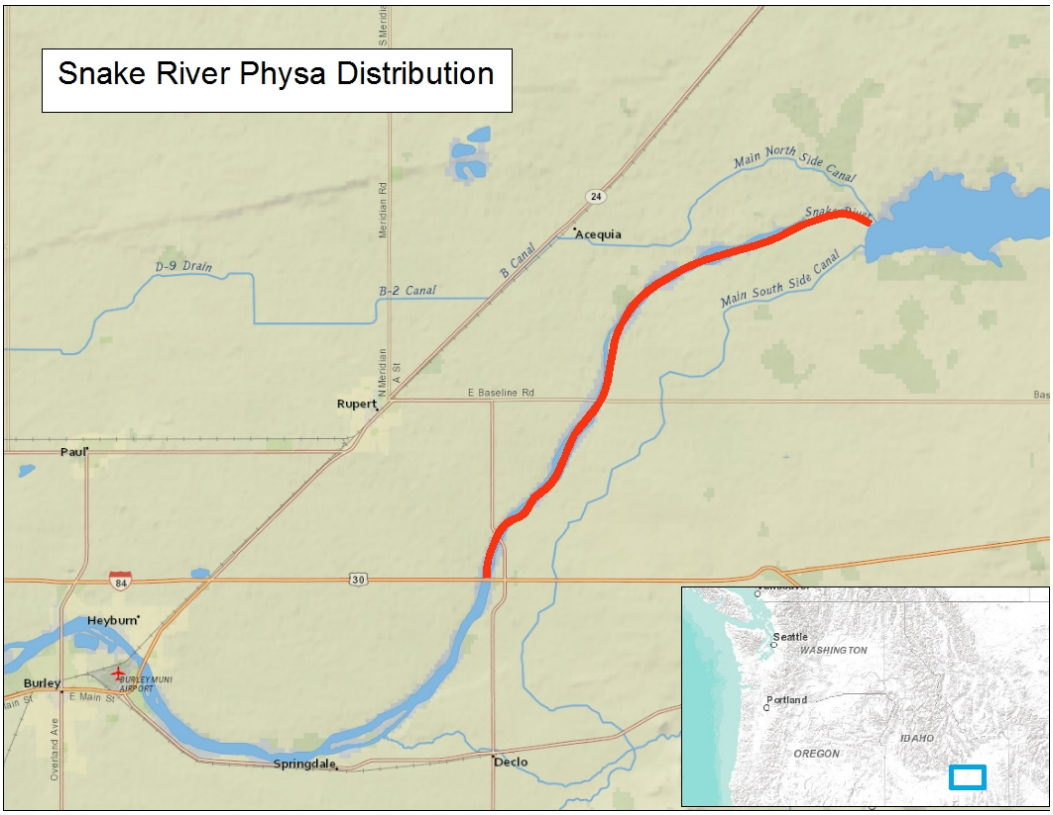

Figure 16. Red line represents the known distribution of Snake River physa (*Physa natricina*) in the Snake River above Milner Dam.

Physa surveys were not conducted from 2009 through 2011; however, during this time, data and specimens were being analyzed and a completion report was prepared for physa identification, habitat characteristics, and distribution (Gates and Kerans 2010). Survey efforts were reinitiated in 2012 in response to the Minidoka Dam spillway replacement project. Construction was completed during the summer of 2015. Post-construction operations may include the diversion of more water, when available, through the Inman Powerplant located at Minidoka Dam. In consultation with USFWS and a multiagency technical team (Technical Team), Reclamation designed a multi-year proposal to reduce minimum spillway flow (Table 9) and monitor physa to determine what, if any, effects reduced flow has on physa occurrence and abundance in the spillway. Due to the complexity of Reclamation's proposed action, Table 9 only identifies minimum spillway and powerplant flows and does not fully represent the proposed post-construction operations comprehensively. Water rights, provisions of spaceholder contracts, commitments to implement the existing biological opinions, and Total Maximum Daily Loads (TMDL) did not change as a result of the spillway replacement project.

Reclamation consulted on project operations following construction of the spillway. The consultation addressed Reclamation's impacts to physa located in the Snake River above Brownlee Reservoir, including the Minidoka Dam spillway. Reclamation received the 2015 Opinion on May 8, 2015 finding that Reclamation's proposed operations are likely to adversely affect physa in the Minidoka Dam spillway. Terms and Conditions and RPMs were provided. The consultation was aligned with ongoing actions associated with the long-term O&M of the current 2005 Opinion (USFWS 2005) and is considered a supplement to the 2005 Opinion. The primary purpose of Table 9 is to illustrate the proposed spillway flow reduction schedule identified in the 2015 Opinion.

The decision was made by Reclamation, in consultation with the Technical Team, to operate Minidoka Dam spillway consistent with previous, preconstruction operations, the first year following completion (2015) of the spillway to assess possible changes in flow patterns associated with the new structure. This was done to allow Reclamation and the Technical Team to discern differences in flow patterns attributed to the new structure as opposed to changes in release rates. Spillway flows from 2014 that were identified in the 2015 Opinion (included in Table 9) were therefore implemented in 2015 as well. Spillway flows for 2015 identified in the 2015 Opinion (also included in Table 9) will be implemented in 2016. It should be noted flows will be evaluated annually by Reclamation and the Technical Team and adjusted as necessary to support evaluation objectives.

Table 9. Current and proposed minimum spillway and powerplant flows at the Minidoka Dam.

	Spillway Flow (cfs)						Powerplant Flow (cfs)					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Nov.	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Dec.	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Jan.	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Feb.	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Mar.	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Apr.	<1,300	<1,300	<1,300	<1,300	<1,000	<500	<5,035	<5,035	<5,035	<5,035	<5,335	<5,835
Apr.	1,300	1,300	1,300	1,300	1,000	500	<8,850*	<8,850	<8,850	<8,850	<8,850	<8,850
May	1,300	1,300	1,300	1,300	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
June	1,300	1,300	1,300	1,300	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
July	1,900	1,900	1,900	1,500	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Aug.	1,900	1,900	1,900	1,500	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Sep.	1,300	1,300	1,300	1,300	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Sep.	<1,300	<1,300	<1,300	<1,300	<1,000	<500	<5,035	<5,035	<5,035	<5,035	<5,335	<5,835
Oct.	<1,300	<1,300	<1,300	<1,300	<1,000	<500	400	400	400	425	425	425

*Irrigation season powerplant flows are highly variable within and among years and are dependent upon several factors. Accurate monthly flows cannot be precisely expressed in a single table. The maximum powerplant capacity at Minidoka Dam is 8,850 cfs.

The objectives of the Minidoka reach physa surveys in 2015 were to gather data that will be used to determine trends of occurrence and abundance within the Minidoka reach; determine the effects of reduced spillway flows on physa in the Minidoka Dam spillway; further characterize physa habitats, and meet the reporting requirements of ESA Section 10, Permit No. TE 056557-5. Data collected in 2015 through 2018 will be compared to data from previous years to determine impacts to physa and their habitat in the Minidoka reach (Figure 16).

4.2 Survey Area

The survey area is located in south-central Idaho and includes the Snake River from Minidoka Dam downstream to the upper end of Milner Pool (Figure 16, river mile [RM] 675 to RM 663). The Minidoka Dam pool elevation ranges from 4,236 feet to 4,245 feet, however, elevations are generally held at 4,245 to maximize power production. The pool elevation is reduced near the end of irrigation (September) season during low-water years to

avoid reducing American Falls Reservoir below 100,000 acre-feet. Minidoka Dam is operated by Reclamation and managed primarily for water storage and hydroelectric generation. Powerplant and spillway discharges from Minidoka Dam bifurcate flow between the original wetted channel of the Snake River and a series of bedrock outcrops not originally wetted. Flows through Minidoka Dam consist of regulated discharge through the Reclamation and Inman powerplants as well as controlled discharge through the spillway structure. Flows from Minidoka Dam downstream to Milner Dam are almost entirely an artifact of controlled releases at Minidoka Dam, as there are no major tributaries or irrigation returns in the Snake River along this reach.

4.3 Methods

4.3.1 Sample Locations

A before/after, control/impact (BACI) study design was implemented to examine changes in the occurrence and abundance of physa at the Minidoka Dam spillway before, during, and after planned reductions in spillway flow. Analyzing physa occurrence and abundance within the spillway in comparison to a downstream location where changes in flow are not expected to occur seeks to provide the ability to detect changes in physa occurrence and abundance due to spillway management, as opposed to changes in physa occurrence that may be simultaneously occurring throughout the study area. Two long-term survey sites were selected at locations where physa were collected during previous surveys (Gates and Kerans 2010).

The downstream site (Control) near the demolished Jackson Bridge (RM 669) is in the original Snake River channel and consists primarily of gravel substrate within a wide, shallow, braided channel. The bankfull width of the Snake River along the Jackson Bridge site is over 400 meters wide, with maximum depths of approximately 4 meters. As a result, approximately 30 percent of the river channel is exposed during non-irrigation season flows. Flows outside of irrigation season at the Jackson Bridge site typically consist of a minimum of 425 cfs through the powerplants. This regulated winter flow is approximately 1.2 meters lower than average August bankfull width flows.

The upstream site (Impact) is located at the Minidoka Dam spillway pool (RM 674.5). The spillway pool, wetted as a result of spillway releases since Minidoka Dam was constructed in 1906, is characterized by braided flows over primarily bedrock and sand substrate. Live physa were discovered in a portion of the spillway area in 2005. It is unknown whether physa colonized the spillway from upstream or downstream, how long they have persisted in the spillway area, or whether they are ephemeral in this nonnative habitat.

Three randomly-selected transects and one permanent reference transect were derived by dividing the shoreline length of each site into 1-meter-wide cross sections perpendicular to the channel. Each transect was divided into 1-square-meter segments, and 20 segments were randomly selected along each transect as potential sampling plots. The Jackson Bridge sampling plots were selected by sampling the first 10 plots occupied from south to north at depths equal to or greater than 1.2 meters deep since previous surveys found virtually no physa in the seasonally-dewatered channel (Gates and Kerans 2010). Spillway sampling sites were selected by sampling the first 10 plots occupied along each transect that were at least 1 meter deep, from north to south.

4.3.2 Snail Collection

Each station was sampled using a venturi suction dredge operated by a SCUBA diver. A 0.25-square-meter plot was excavated to approximately 2.5 centimeters deep at stations where the primary substrate consisted of unconsolidated material such as mud, sand, and gravel. At stations having consolidated substrates such as cobble, boulder, and bedrock, timed samples were suction dredged for a timed duration of 60 seconds. Timed samples were collected for variable-sized areas and hence, suitable only for presence/absence analysis. Each sample was transported through flexible tubing and collected in a 1,000-micrometer sieve on board the boat or buoy station from which dive operations were conducted. Samples were immediately transferred to plastic trays and examined by trained samplers from Reclamation and USFWS under the direction of John Keebaugh from the Orma J. Smith Museum of Natural History. Live physa were enumerated for each plot and returned in proximity to the location from which they were collected.

4.3.3 Habitat Measurements

Physical water quality measurements were made at each sampling plot. Water depth (meters), temperature (°C), and dissolved oxygen (milligrams per liter [mg/L]) were measured at each plot using a Hydrolab® Sonde DS5 meter and Surveyor® handheld monitor. Current velocity (meters per second [m/s]) was measured approximately 10 centimeters above the substrate at each plot using a SonTek® Argonaut ADV current meter operated by USGS staff. Acoustic Doppler Current Profiles (ADCP) were also collected by USGS staff at each transect using a TRDI® Rio Grande ADCP operating at 12 kHz. Dominant and subdominant substrate types were classified by particle size as modified from Overton et al. (1997) (Table 10). Estimates of dominant and secondary substrate composition were made by direct observation of each sampling plot by a SCUBA diver and from inspection of the sieved contents of each sampling plot by snail collection samplers on board the dive vessel.

Table 10. Substrate classifications used to characterize suction dredge plots surveyed in 2015.

Substrate Type	Size Class (mm)
Bedrock	Solid rock
Boulder	>256
Cobble	64-256
Pebble	16-64
Gravel	2-16
Sand	0.1-2
Silt	<0.1

4.4 Results and Discussion

No live physa were found in the Minidoka Dam spillway in 2012 and 2014; therefore, the decision was made by the Technical Team to relocate transects from the Jackson Bridge site to the Minidoka Dam spillway site to increase effort in the spillway for the purpose of detecting live physa from within the spillway area. Twenty plots were sampled at the Jackson Bridge site and sixty plots were sampled at the spillway pool site in 2015. At the Jackson Bridge site (Control site), 3 plots (15 percent) contained live physa, with the collection of 1 live physa in each of three plots (Figure 17). No live physa were found among the 60 samples collected at the spillway pool site (Impact site; Figure 18). Two additional timed searches (6 minutes total search time) were conducted in the spillway area with no physa being encountered. Similar to previous studies, physa were broadly distributed in low densities in the permanently wetted channel of the Snake River at the Jackson Bridge site.

Snake River physa shells were enumerated in 2015 to serve as a possible surrogate to live snail locations. Although snail shells in general are prone to drifting in fluvial environments, analysis of previous Reclamation data has shown concentrations of shells serve as indicators of species presence within the general vicinity of the search site. Physa shells were found in 90 percent (n=18) of the Jackson Bridge samples, however, no physa shells were found in the Minidoka Dam spillway in 2015.

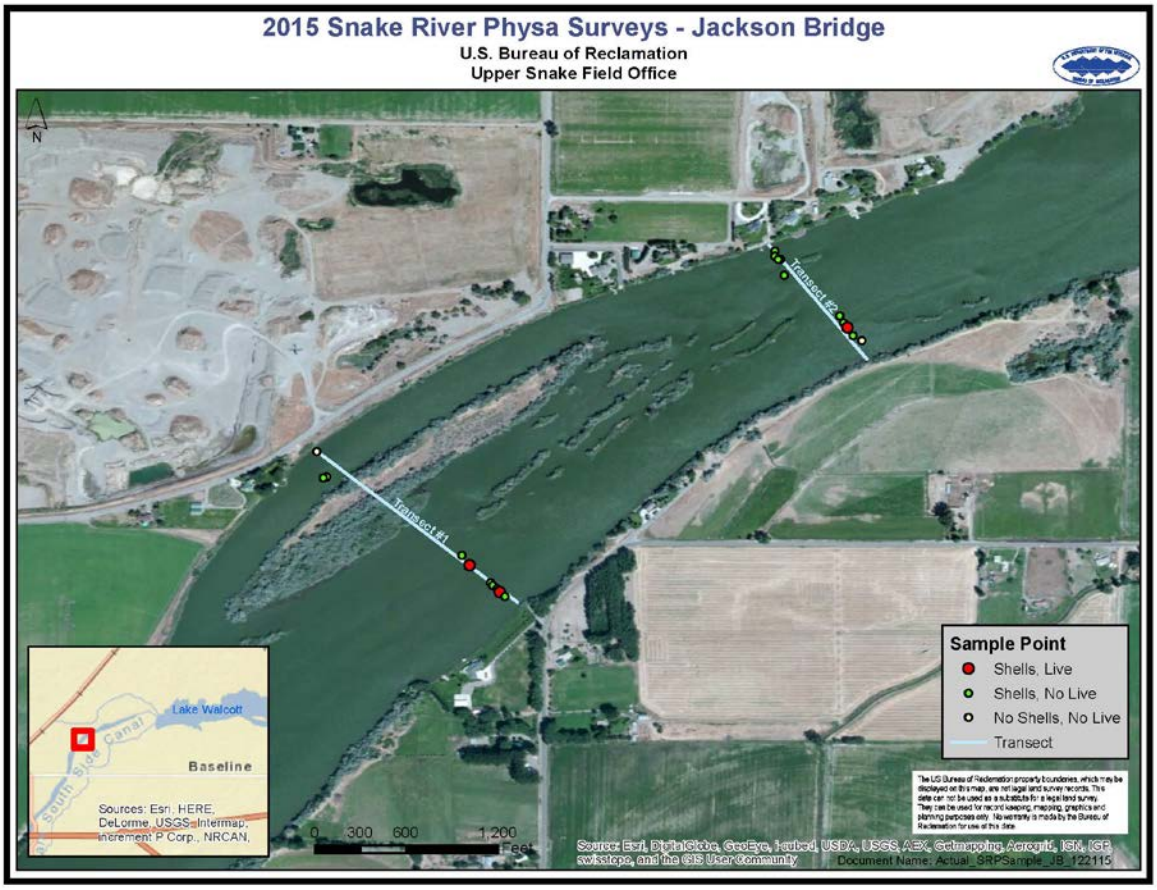

Figure 17. Distribution of Snake River physa at the Jackson Bridge monitoring site in 2015.

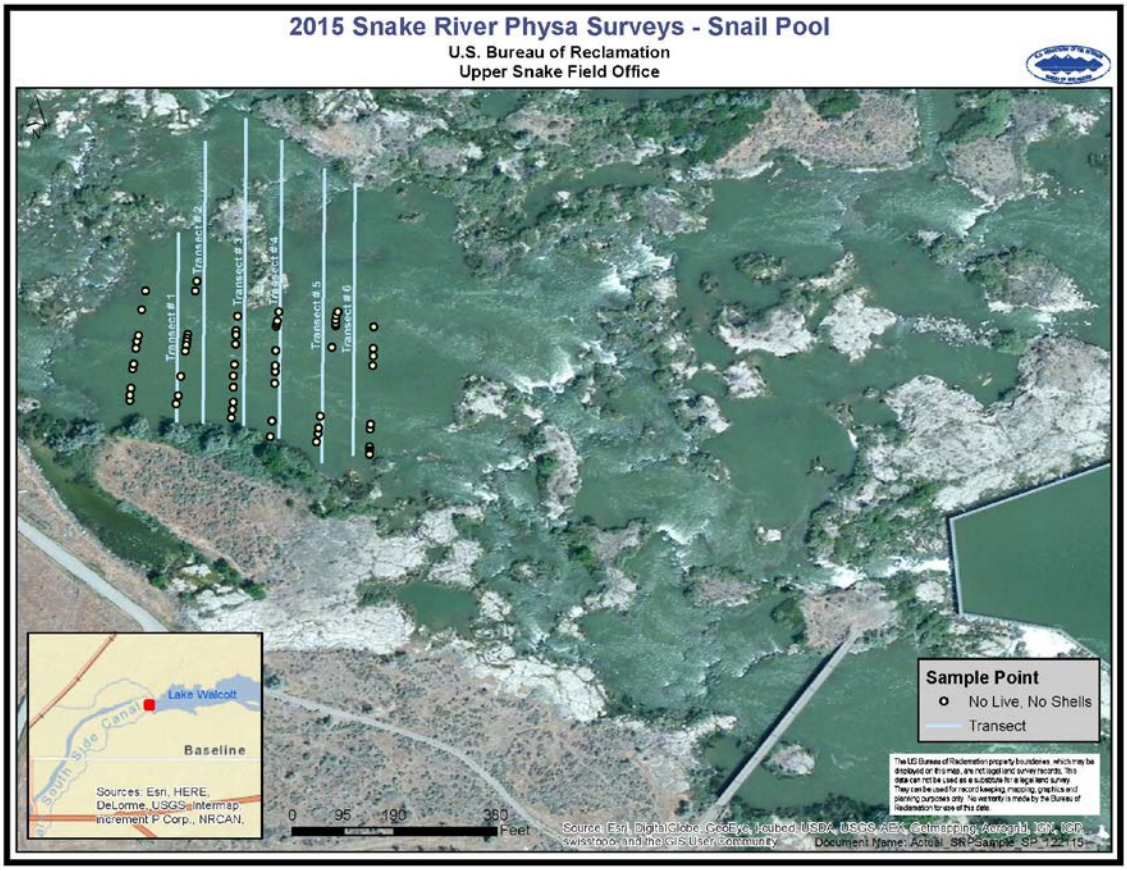

Figure 18. Distribution of Snake River physa at the Minidoka Dam spillway pool monitoring site in 2015.

A total of 3 live Snake River physa were collected during field surveys in 2015. All three live Snake River physa were returned to their respective collection location in apparently good condition. No specimens were preserved and vouchered. Typically, voucher specimens collected in sampling efforts are placed in the designated depository listed in USFWS ESA Section 10 Permit No. TE056557-5.

A total of 8 timed sample plots were conducted at the spillway site in 2006. Of these plots, physa occurrence was 50 percent and ranged in abundance from 1 to 15 per plot. In 2007, 17 timed sample plots were conducted at the spillway pool, resulting in 1 plot containing 1 live physa. Physa were not detected in the spillway pool during 2012; in 2013, 2 live physa were collected from the spillway pool; no live Snake River physa were detected in 2014 and 2015. In response to the scarcity of physa detected at the spillway pool, Reclamation and the Minidoka Dam Spillway Replacement Technical Team modified the sampling methodology for the 2015 field season by removing two transects from the Jackson Bridge site and adding them to the spillway pool. This allowed a greater proportion of the spillway pool to be sampled. The two new transects were specifically located so as to intercept

previous known locations of live Snake River physa. The Jackson Bridge site consisted of the reference transect and one random transect. Continued monitoring for physical and environmental parameters will provide the basis for assessing the effects of reduced spillway flow on the suitability of the spillway pool waters for physa occurrence. Due to the scarcity of the species within the spillway, it is likely water velocity will have to be used to assess possible physa distribution.

Mean physical parameters observed at the two survey sites are identified in Table 11, separated by positive and negative occurrences for live Snake River physa. Range and mean physical parameters are displayed in Table 12.

Table 11. Mean physical parameters observed at Jackson Bridge plots with (+) and without (-) physa and spillway pool plots for 2015.

Parameter	Jackson Bridge Physa (+) n=3	Jackson Bridge Physa (-) n=17	Spillway Pool Physa (+) n=0	Spillway Pool Physa (-) n=60
Flow (m/s)	0.34	0.29	n/a	0.15
Temp (°C)	21.4	21.4	n/a	20.5
Turbidity (NTU)	28.3	30.0	n/a	35.0
Depth (m)	1.89	1.55	n/a	n/a

Table 12. Range and mean of physical habitat parameters measured during the 2015 physa survey. The mean (x̄) is given in parenthesis.

Site	Current Velocity (m/s)	Temperature (°C)	Turbidity (NTU)	Depth (meters)
Jackson Bridge	0.16-0.53 (0.30)	20.4-22 (21.4)	16.0-48.5 (29.2)	1.1–2.3 (1.6)
Spillway Pool	0.01-0.44 (0.15)	19.9-21.0 (20.5)	23.1-46.0 (35.3)	n/a

It should be noted, in 2014 slightly shallower depths were surveyed in the Jackson reach (2014 mean depth 1.59 m), relative to previous years (ex., 2012 mean depth = 1.8 meter), in an attempt to characterize habitat use by Snake River physa near the annual fluctuation zone. In 2015, mean depth was closer to 2012 mean depths. The fluctuation zone is that portion of the Snake River in the Minidoka reach that becomes dewatered as a result of annual reductions in river flow following irrigation season water deliveries. The Minidoka reach of the Snake River fluctuates approximately 1.2 meters annually as a result of operations, with the minimum elevations occurring November through March. Consistent with previous year's work, live Snake River physa are found within the permanently wetted footprint of the river; however, occurrence and density appear to decrease at the margin of that zone.

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