PETITION TO TEMPORARILY MODIFY FRESHWATER FISHERY REGULATIONS ADOPTED UNDER THE CONSERVATION PLAN FOR NATURALLY PRODUCED SPRING CHINOOK SLAMON IN THE ROGUE RIVER
October 19, 2018

PETITIONERS

Curry Sport Fishing Association is a non-profit, public interest organization with about 100 members. The association has been active for over 25 years in issues related to Rogue River fishery resources. An association member served on the advisory committees that helped formulate conservation plans for the spring and fall Chinook salmon advisory committees, Rogue Species Management Units.

Tom Satterthwaite is a retired fishery biologist who worked 32 years for the Oregon Department of Fish and Wildlife, mostly as a fish research project leader and as a fish conservation planner. He was the primary plan author and data analyst during the development of conservation plans for the spring and fall Chinook salmon, Rogue species management units.

The petitioners formally request that the Oregon Fish and Wildlife Commission approve our proposed experimental four year (2019-2022) change to the current freshwater angling regulations for naturally produced spring Chinook salmon (NP CHS) in the Rogue River. Questions or comments relating to this petition should be directed to: Tom Satterthwaite, 541-956-9108, tsbs53@hotmail.com.

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EXECUTIVE SUMMARY

The purpose of this petition is to request an experimental four year (2019-2022) change to the current freshwater angling regulations for naturally produced spring Chinook salmon (NP CHS) in the Rogue River. The petitioners concluded that the resultant data and allied analyses will significantly improve the efficacy of the native fish conservation plan for NP CHS in the Rogue River. The first comprehensive review of the plan is scheduled for 2022 and there are some critical information gaps that should be addressed experimentally as soon as possible.

In December 2017, the commission denied an analogous petition that requested approval of a five year experimental fishery, with the rationale that ODFW would evaluate the merits of such a fishery as part of a 10 year plan review planned for completion in 2018. This review has yet to be

completed. The current petition was submitted because, in the opinion of the petitioners, the window of statistical opportunity will pass unless the experimental fishery begins in 2019. Failure to initiate the experiment will result in continued uncertainty about how to best manage the fishery. Continued uncertainty is disadvantageous because (1) the current conservation plan sunsets in 2022 and (2) abundance has failed to reach desired status despite allied reductions in freshwater harvest rates that began in 2007.

Fishery impacts (harvest and release mortality) were identified in the 2007 conservation plan as one of three primary factors that limit attainment of desired status for NP CHS. However, the conservation plan also clearly stated that major assumptions had to be made in order to generate estimates of freshwater harvest rates. The propriety of these assumptions should be tested as soon as possible. Implementation of the proposed experiment allows for the testing for changes in two key criteria of population status; at minimal cost to ODFW. Statistical sensitivity analyses indicate that the chances of detecting resultant changes (if any) change are good under current population monitoring. The timing of the proposed experiment is advantageous because of the extensive plan review scheduled for 2022.

Implementation of the 2007 conservation plan reduced NP CHS harvest opportunities by two months in most of the Rogue River, along with a complete harvest closure within the most important NP CHS habitat. This proposal calls for a one month temporary restoration of harvest opportunity in that area that remains open to NP CHS harvest. Risk to the NP CHS population is judged to be negligible for four primary reasons: (1) the population salmon is currently viable and sustainable (ODFW 2007), (2) two of three desired status criteria for the NP CHS population have been attained, (3) fishing mortality rates have likely been lower than the 40% design target in the conservation plan, and (4) there is no indication that Rogue NP CHS have increased in abundance relative to other nearby Chinook salmon populations, calling into question the propriety of fishing mortality as a primary limiting factor.

NEW INFORMATION

Recently completed genetic assessments (Thompson et al. 2018) indicated that (1) about 10-20% of the Chinook salmon harvested in the proposed experimental fishery would exhibit a combination of fall and spring Chinook genes and (2) the experimental fishery would not harvest that component of the run which exhibits almost 100% spring Chinook genes (early-run NP CHS).

CONSERVATION PLAN

In 2004, ODFW concluded that a conservation plan was warranted for NP CHS salmon in the Rogue Species Management Unit (SMU) because of the population changes described below. Plan development was guided by ODFW's Native Fish Conservation Policy. Work on the plan began in autumn 2004 and an advisory committee was formed to aid with plan development. The advisory committee met 25 times with ODFW during 2004-06, with a draft plan completed in 2006. In 2007, the Oregon Fish and Wildlife Commission formally adopted the final draft of the conservation plan. ODFW implementation of the conservation plan by began immediately thereafter.

The purpose of the Conservation Plan is "to ensure the continued viability of the Rogue Spring Chinook Salmon Species Management Unit (SMU), and to achieve a desired status that will provide significant ecological, economic and cultural benefits for all Oregonians" (ODFW 2007).
It is designed to improve the status of the SMU by managing spring Chinook salmon, and their habitat, so as to attain a quantitative level of desired status. It also describes commitments by the State of Oregon that will conserve the sustainability of this SMU and restore biological attributes necessary to achieve a science-based, socially established, desired status goal.

The conservation plan addresses of myriad of issues related to the current and historical management of NP CHS and their habitat. Included are four primary plan components that directly relate to the purpose of this petition: (1) desired biological status, (2) primary factors responsible for

the disparity between current and desired status, (3) adaptive management, and (4) current status. The first three plan components are discussed below and the fourth component (current status) is discussed later in this document.

Status Criteria
The conservation plan describes a desired status for future condition and performance of the Rogue Spring Chinook Salmon SMU. The desired status statement evolved during protracted discussions with the advisory committees, and represents a science-based product that has a reasonable chance of attainment. Within the desired status statement, there are six elements that relate to abundance, migration timing, age, life history, distribution, persistence, and spawner composition. These elements represent measurable criteria and five (not persistence) were to be monitored annually to determine if and when the desired status goal has been achieved. The population persistence element cannot be monitored annually and only should be assessed during the scheduled five year reviews. All of the other elements were monitored annually during 2007-2010.

In late summer of 2010, Gold Ray Dam (near Central Point) was removed with the allied loss of the fish counting station that had operated continuously since 1942. Three of the status criteria (abundance, migration timing, and life history) were based on NP CHS passage counts and fish size, so these criteria could no longer be monitored. Fortunately, ODFW counted carcasses of spawned Chinook salmon in areas upstream of Gold Ray Dam during 2004-2010. While fall Chinook salmon were included in the total annual counts, there was very good evidence that only spring Chinook salmon spawned in September (ODFW 1991). A subsequent analysis showed that counts of NP CHS that spawned in September averaged 15% (95% confidence interval = ±2%) of the number of counterparts that passed Gold Ray Dam (ODFW 2011). This relationship was to be employed until some better estimation methods can be developed through future analyses or research. However, no analogous methods could be devised to hindcast monitoring metrics for NP CHS age and migration timing (ODFW 2011). As a result, only two status elements (spawner distribution and spawner composition) can now be directly measured; through surveys of spawned carcasses.

Desired status for spawner distribution calls for "Among naturally produced spring Chinook salmon that spawn during September, at least 40% should spawn upstream of the Highway 62 bridge in Shady Cove". This criterion directly addresses the marked negative impact of reservoir construction and operation on the early-migrating, early-spawning component of the NP CHS population (ODFW 1991; ODFW 2000; ODFW 2007).

Desired status for spawner distribution calls for "Hatchery fish should compose no more than 15% of spring Chinook salmon that spawn naturally". This criterion directly addresses the concern related to evidence that natural spawning by hatchery fish can negatively impact the productivity of wild populations (ODFW 2007).

Primary Factors Accounting for Gaps between Current and Desired Status
The conservation plan identified the primary factors that should be addressed in order to achieve desired status, and outlines management strategies designed to minimize the negative affects of primary limiting factors that can be managed. There were disparities between desired status and current status when the conservation plan was formulated (ODFW 2007). Assessments of available data, coupled with the findings from a long-term research project on spring Chinook salmon, indicate there are three primary limiting factors that can, to some degree, be managed. These factors are:
1. operation of William L. Jess Dam (commonly known as Lost Creek Dam).
2. impacts that accrue from operation of ocean and freshwater fisheries.
3. the limited amount of habitat (about 30 miles) available to natural spawners.

Adaptive Management
Fish conservation plans administered by ODFW are linked to an adaptive management framework that will allow plans to evolve over time with the acquisition of new information, including the

assessment of the success of recovery actions implemented. The conservation plan in supporting the Oregon Plan for Salmon and Watersheds, is a "dynamic strategy that will adapt and be modified over time in response to what is learned from monitoring, evaluations, and research" (ODFW 2007). As a result, the conservation plan can be modified if/when additional scientific information becomes available. Development of additional scientific information is the purpose of this petition.

POPULATION STATUS

Historical

Population abundance declined markedly after the construction and operation of William L. Jess Dam (Lost Creek Dam). Passage estimates at Gold Ray Dam (a now removed dam near Central Point with a fish counting station) averaged about 29,000 NP CHS during the 1940s through the 1970s (ODFW 2007). In contrast, during 1997-2006, passage estimates averaged less than 9,000 NP CHS (ODFW 2007). Comparisons to nearby populations of Chinook salmon clearly demonstrated a differential decline in the abundance of NP CHS in the Rogue River (ODFW 2000; ODFW 2007).

Changes in the life history characters of NP CHS were also clearly documented. NP CHS now migrate later in freshwater, spawn later, and mature at younger ages (ODFW 2000). Fishery yields simultaneously decreased as a result of later migration and younger maturity (ODFW 2000).

Current

Current status, as portrayed in the conservation plan, is reflected through population metrics obtained during the most recent 10 year period. This discussion follows that format. Data composing the following summaries were obtained from 2007-2017 annual reports listed under the Rogue Spring Chinook Conservation Plan posting on the ODFW website.

Abundance (Status Metric 1): Estimates of NP CHS passage at the site of Gold Ray Dam averaged about 9,000 fish in 2007-2017 and ranged between 3,465 (2007) and 15,320 (2015). In a general sense, returns show an increasing trend during the last 10 years (Figure 1). Based on this result, it is likely that the NP CHS population in the Rogue River remains viable and sustainable; as conveyed in the conservation plan. However, the desired status criterion of at least 15,000 NP CHS (10 year average) has not been attained.

Spawner Distribution (Status Metric 2): During 2007-2017, an average of 60% of the September spawners were found upstream of Shady Cove and ranged between 48% (2015) and 74% (2007). In a general sense, spawning distribution appears to be shifting downstream during the last ten years (Figure 2). However, the desired status criterion of at least 40% upstream of Shady Cove (10 year average) has been attained.

Spawner Distribution (Status Metric 3): During 2007-2017, hatchery fish composed an average of 7% for CHS that spawned naturally and ranged between 1% (2017) and 22% (2007). In a general sense, the relative abundance of hatchery fish dropped sharply during 2007-10 and remained at low levels thereafter (Figure 3). The desired status criterion of no more than 15% hatchery fish among the natural spawners (10 year average) has been attained.

REQUEST FOR EXPERIMENTAL FISHERY

The purpose of this petition is to request an experimental four year (2019-2022) change to the current freshwater angling regulations for NP CHS in the Rogue River. The petitioners believe that the resultant data and allied analyses will significantly aid ODFW by affording opportunities to statistically test for possible subsequent changes to population status indexes.

Requested Regulation Changes

Current relevant angling regulations follow, with the reguested changes embedded as bold italics.
Open for Chinook salmon ***(May 1)*** Jun 1 - Dec 31, upstream to Hog Creek boat ramp

Open for Chinook salmon ***(May 1)*** Jun 1 - Sep 30, from Hog Creek boat ramp upstream to Fishers Ferry boat ramp.
Open for chinook ***(Jun 1)*** Jul 1 - Aug 31 Fishers Ferry Boat Ramp to Dodge Bridge.

Justification for Request
Implementation of the proposed experimental fishery has two primary benefits: (1) development of better information that will lead to an improved conservation plan for NP CHS in the Rogue River and (2) afford anglers additional harvest opportunities. The following discussion addresses two critical questions:
1. Will the resultant data be valuable to ODFW fishery managers?
2. Will the resultant increase in harvest negatively impact the population?

Analytical Value: Restoration of one month of allowable harvest, over the course of four years, will allow for comparisons of metrics under a "pre" versus "post" experimental design. Such comparisons afford fishery managers one way of assessing the effects of a modified factor; in this case angler harvest (Table 1). With a specific month increase in the allowable NP CHS harvest, fishery managers can investigate possible allied changes in the following population and fishery metrics. This matter is discussed in greater detail in **APPENDIX A**.

Table 1. Population and fishery metrics that can be tested for changes after experiment termination in 2022. The Fishers Ferry site is very close to the site of the historical fish counting station at Gold Ray Dam (river mile 125). Dodge Bridge is located at river mile 146.

Metric	Potential to Detect Change[a]
Spawner composition[b]	Good
Spawner distribution[b]	Good
Adult abundance[b]	Marginal
Abundance compared to North Umpqua NP CHS[c]	Good
Abundance compared to Rogue Basin NP CHF[c]	Good
Abundance compared to Klamath Basin CHF[c]	Good
May harvest component, Bay to Fishers Ferry[d]	Good
June harvest component, upstream of Fishers Ferry[d]	Good

[a] *As judged based on a statistical sensitivity analysis.*
[b] *Desired Status Criterion in conservation plan.*
[c] *Co-variation analyses used to evaluate NP CHS abundance in Rogue.*
[d] *Results can be used to estimate impact on total NP CHS harvest.*

Potential Population Impacts: The petitioners concluded that the experimental fishery would have minimal, if any, impact on the productivity and viability of NP CHS in the Rogue River for four primary reasons:
1. The population was judged to be viable and sustainable (ODFW 2007). There is no indication that this conclusion is no longer appropriate because NP CHS abundance increased over the last 10 years (Figure 1).
2. Two of three desired status criteria for the NP CHS population have been attained, which provides some indication that the overall status of the population has improved in the last 10 years.
3. The conservation plan set an average annual target of 40% fishing mortality and regulations for the river fishery were crafted accordingly. Since implementation of the conservation plan in 2007, the actual average harvest rate was likely less than 40% because of (1) conservation closures to NP CHS harvest in 2007-2009 and (2)) the recent removal of three small dams (Gold Ray, Gold Hill Diversion, and Savage Rapids) reduced NP CHS harvest immediately below those migration choke points. The reduced NP CHS harvest that resulted from removal of those dams was not forecasted,

or accounted for, within the conservation plan. Consequently, the proposed increase in freshwater harvest is at least partially offset by the reduction in harvest that resulted from removal of the dams.
4. Perhaps most importantly, there is no indication that the abundance of NP CHS in the Rogue has increased relative to other populations of Chinook salmon in nearby areas since implementation of the conservation plan in 2007 (*see* **NP CHS Abundance as Compared to Other Populations** in **APPENDIX A**). The conservation plan identified fishing mortality as a primary limiting factor and harvest constraints on NP CHS were imposed immediately thereafter. As there is no indication of a relative increase in population abundance, the validity of the conclusion that fishing mortality as a primary limiting factor now appears to be questionable; and thus should be examined experimentally.

TIME FRAME

The commission should make a decision on this petition so that, if the petition is approved, the experimental fishery would be effective for the 2019 fishery year for spring Chinook salmon in the Rogue River.

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ODFW (Oregon Department of Fish and Wildlife). 1991. Effects of Lost Creek Dam on the distribution and time of Chinook salmon spawning in the Rogue River upstream of Gold Ray Dam. Oregon Department of Fish and Wildlife, Fish Research Project DACW 57-77-C-0033, Special Report, Portland.

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Thompson, T., and 11 co-authors. 2018. Anthropogenic habitat alteration leads to rapid loss of adaptive variation and restoration potential in wild salmon populations. Pre-print review draft (www.biorxiv.org/content/biorxiv/early/2018/07/06/310714.full.pdf), Department of Animal Sciences, University of California, Davis, California.

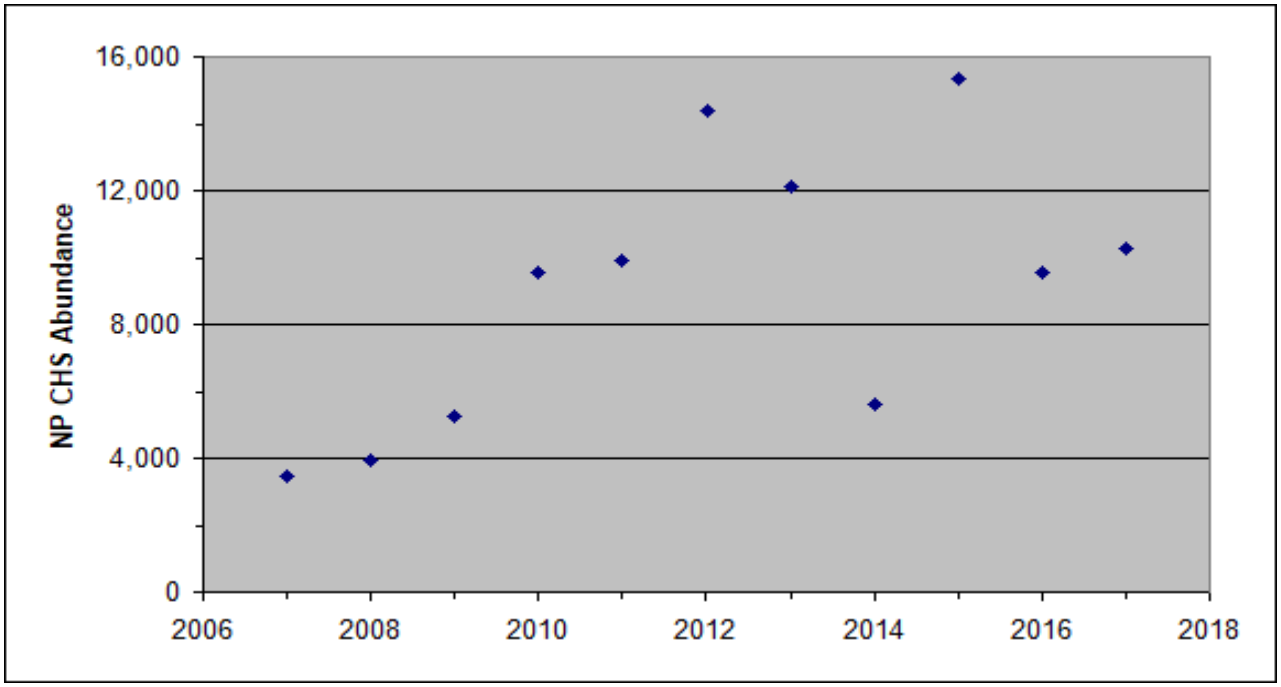

Figure 1. Estimated number of adult NP CHS that passed the fish counting station at Gold Ray Dam, 2007-2017. The counting station was removed in 2010. Counts of spawned carcasses were used to hindcast passage counts during 2011-2017, as described by ODFW (2011).

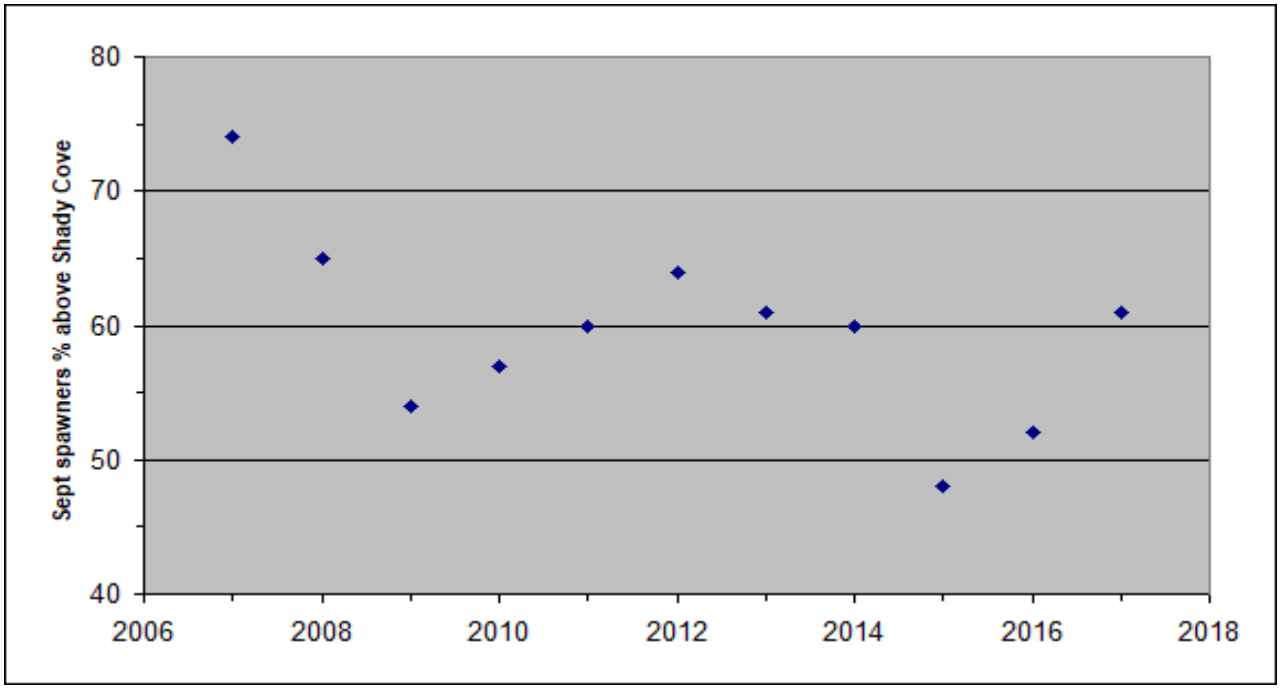

Figure 2. Spawning distribution of NP CHS in the Rogue River based on carcass counts, 2007-2017. Only those fish estimated to have spawned in September are included the plot because later spawners would have included some fall Chinook salmon. ODFW (2000) describes this situation in greater detail.

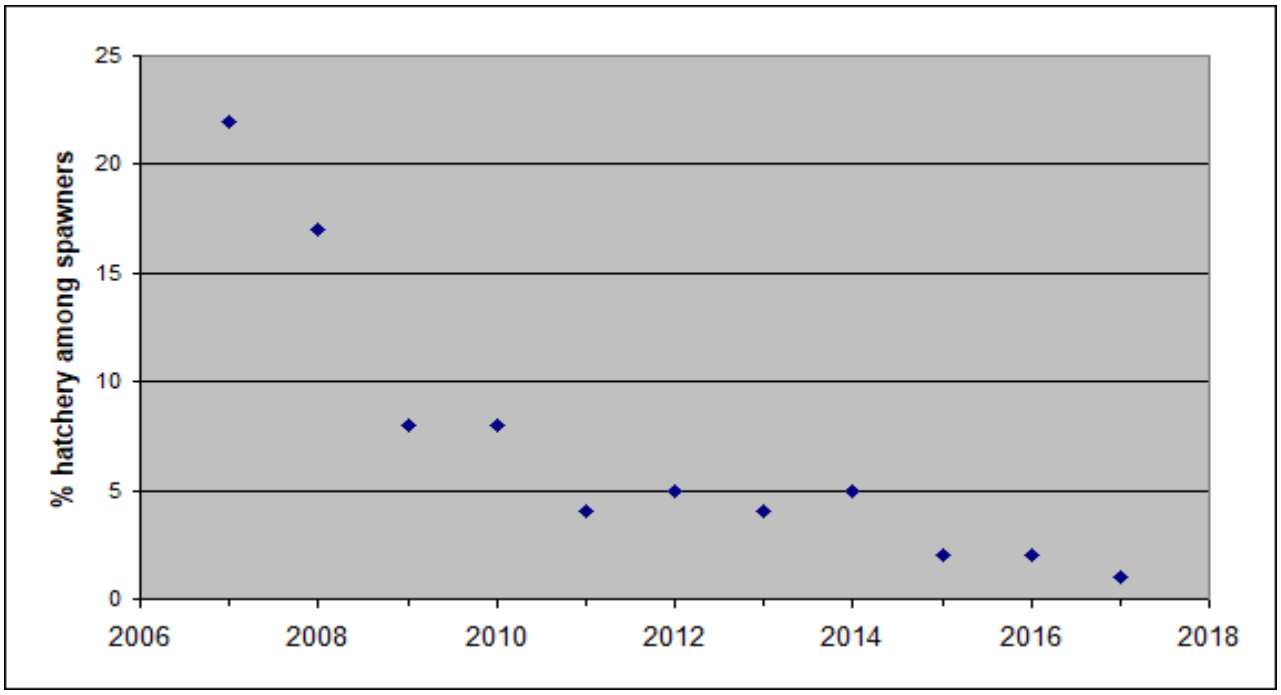

Figure 3. Percentage of hatchery fish among Chinook salmon carcasses recovered during surveys in areas upstream of the site of Gold Ray Dam, 2007-2017. Data includes CHS and CHF, which can not be differentiated at time of carcass recovery.

APPENDIX A
Analytical Benefits of Experiment Results

Desired Status Metrics

The heart of the NP CHS conservation plan is status metrics, which are measurable. These metrics allow fishery managers to gage population status. There are currently three population status metrics. Statistical sensitivity analyses indicated that there are good chances of detecting any changes in two of the three status metrics after implementation of the experimental fishery. This information will improve future quantitative assessments of harvest options when the conservation plan is revised after completion of the first comprehensive review (scheduled for 2022).

There appears to be a good chance that a change in spawner composition (Status Metric 3) could be detected by ongoing monitoring scheduled for 2019-2022. Spawner composition averaged 3.3% hatchery fish during 2011-2017. A sensitivity analysis indicated that results from 2019-2022 monitoring could detect a change, if average spawner composition increases to more than 4.3% hatchery fish. Regardless of whether there is a significant change, fishery managers would better understand how a one month change in harvest opportunity generally affects a key metric of NP CHS population status.

Similarly, there appears to be a good chance that a change in the distribution of September spawners (Status Metric 2) could be detected by ongoing monitoring scheduled for 2019-2022. September spawner distribution (known CHS) averaged 57.9% upstream of Shady Cover during 2010-2017. A sensitivity analysis indicated that results from 2019-2022 monitoring could detect a change, if average spawner composition upstream of Shady Cover decreases to less than 54.0%. Regardless of whether there is a significant change, fishery managers would better understand how a one month change in harvest opportunity generally affects a key metric of NP CHS population status.

In contrast, there appears to be a marginal chance that a change in NP CHS abundance (Status Metric 1) could be detected by ongoing monitoring scheduled for 2019-2022. Passage estimates at the Gold Ray Dam site averaged 9,597 NP CHS during 2008-2017. A sensitivity analysis indicated that results from 2019-2022 monitoring could detect a change if the average number of NP CHS decreases to less than 7,501 fish. While such a change is possible, variations in ocean survival rates of juvenile NP CHS have a markedly greater impact on the abundance of NP CHS as compared to variations in freshwater harvest (ODFW 2000; ODFW 2007). Instead, it is more effective to compare Rogue NP CHS abundance to other Chinook salmon populations in the ecoregion, because the populations co-vary (ODFW 2000; ODFW 2007).

NP CHS Abundance as Compared to Other Populations

There are three nearby groups of Chinook salmon that co-vary with the NP CHS population in the Rogue River: (1) the NP CHS population in the North Umpqua River, (2) collective NP CHF populations in the Rogue River, and (3) collective CHF (fall Chinook salmon) populations in the Klamath River basin of northern California. Abundance estimates for the nearby populations were compared to the abundance estimates for Rogue NP CHS for the period of 1995-2017. Data for North Umpqua CHS and Rogue River Basin CHF were obtained from the ODFW website. Data for Klamath River Basin CHF were reported by PFMC (2018) and included fish of hatchery origin. Comparisons with CHF populations were offset by one year because CHF mature at younger ages as compared to NP CHS in the Rogue River (ODFW 2007; ODFW 2013; PFMC 2018). Proportional data was arcsin transformed before analysis.

First, passage estimates of NP CHS at the Gold Ray Dam site on the Rogue River were positively related ($P = 0.003$) to passage estimates of NP CHS at Winchester Dam on the North Umpqua River (Appendix Figure A-1). A plot of regression residuals failed to suggest that NP CHS abundance in the Rogue River increased after implementation of the conservation plan (Appendix Figure A-2).

However, regression residuals for 2007-2011 appeared lower than regression residuals for 2012-2017; but the difference in means was not significant ($P = 0.093$ for a one-tailed t-test assuming equal variances). Consequently, all of the 1995-2017 data was included in a sensitivity analysis.

There appears to be a good chance that a change in the relative abundance of Rogue NP CHS could be detected by ongoing monitoring scheduled for 2019-2022. The Rogue component averaged 62.6% of the combined populations (Rogue NP CHS, North Umpqua NP CHS) during 1995-2017. A sensitivity analysis indicated that results from 2019-2022 monitoring could detect a change, if the Rogue component decreases to an average of less than 59.2% of the combined populations. Regardless of whether there is a significant change, fishery managers would better understand how a one month change in harvest opportunity generally affects NP CHS abundance in the Rogue River. Improvements to this knowledge base should be very important because of the fundamental assumptions related to estimates of harvest impact embedded in the population assessments of the Rogue NP CHS conservation plan (ODFW 2007).

Second, passage estimates of NP CHS at the Gold Ray Dam site on the Rogue River were positively related ($P = 0.024$) to passage estimates of NP CHF at Huntley Park near the mouth of the Rogue River (Appendix Figure A-3). A plot of regression residuals failed to suggest that NP CHS abundance increased after implementation of the conservation plan (Appendix Figure A-4). However, regression residuals for 2007-2011 appeared lower than regression residuals for 2012-2017; but the difference in means was not significant ($P = 0.068$ for a one-tailed t-test assuming equal variances). Consequently, all of the 1996-2017 data was included in a sensitivity analysis.

There appears to be a good chance that a change in the relative abundance of Rogue NP CHS could be detected by ongoing monitoring scheduled for 2019-2022. The NP CHS component averaged 12.2% of the combined populations (Rogue NP CHS, Rogue NP CHF) during 1996-2017 (CHS return years). A sensitivity analysis indicated that results from 2019-2022 monitoring could detect a change, if the Rogue component decreases to an average of less than 9.9% of the combined populations. Regardless of whether there is a significant change, fishery managers would better understand how a one month change in harvest opportunity generally affects NP CHS abundance in the Rogue River. Improvements to this knowledge base should be very important because of the fundamental assumptions related to estimates of harvest impact embedded in the population assessments of the Rogue NP CHS conservation plan (ODFW 2007).

Finally, passage estimates of NP CHS at the Gold Ray Dam site on the Rogue River were positively related ($P = 0.037$) to freshwater return estimates CHF one year earlier in the Klamath River (Appendix Figure A-5). A plot of regression residuals failed to suggest that NP CHS abundance increased after implementation of the conservation plan (Appendix Figure A-6). However, regression residuals for 2007-2011 appeared lower than regression residuals for 2012-2017; but the difference in means was not significant ($P = 0.162$ for a one-tailed t-test assuming equal variances). Consequently, all of the 1996-2017 data was included in a sensitivity analysis.

There appears to be a good chance that a change in the relative abundance of Rogue NP CHS could be detected by ongoing monitoring scheduled for 2019-2022. The NP CHS component averaged 6.6% of the combined populations (Rogue NP CHS, Klamath CHF) during 1996-2017 (CHS return years). A sensitivity analysis indicated that results from 2019-2022 monitoring could detect a change, if the Rogue component decreases to an average of less than 5.4% of the combined populations. Regardless of whether there is a significant change, fishery managers would better understand how a one month change in harvest opportunity generally affects NP CHS abundance in the Rogue River. Improvements to this knowledge base should be very important because of the fundamental assumptions related to estimates of harvest impact embedded in the population assessments of the Rogue NP CHS conservation plan (ODFW 2007).

Estimation of NP CHS Freshwater Harvest

During conservation plan development, numerous assumptions had to be made in relation to the impacts of the freshwater fisheries (*see* pages 56-58 in ODFW 2007). One primary problem is that the harvest of wild and hatchery fish are not separately estimated from salmon-steelhead cards submitted by anglers. However, because only hatchery fish may be retained at times in different areas, it is possible to evaluate changes in temporal harvest regulations by looking for changes in the harvest timing. Such information will improve future quantitative assessments of harvest options when the conservation plan is revised after completion of the first comprehensive review (scheduled for 2022).

The petition calls for the resumption of NP CHS harvest opportunity in May for the river mouth to Fisher's Ferry. There appears to be a good chance that a change in the May component of harvest could be detected from the 2019-2022 salmon-steelhead cards. During 2011-2016, an average of 13.4% of the total river CHS harvest came from this area in May. Data from earlier years was not used because of conservation closures designed to protect wild fish. A sensitivity analysis indicated that results from 2019-2022 harvest monitoring could detect a change, if the May component increases to more than 13.8% of the total CHS harvest. Regardless of whether there is a significant change, fishery managers could then estimate how a one month change in harvest opportunity would generally affect total harvest.

The petition also calls for the resumption of NP CHS harvest opportunity in June between Fisher's Ferry and Dodge Bridge. There also appears to be a good chance that a change in the June component of harvest could be detected from the 2019-2022 salmon-steelhead cards. During 2011-2016, an average of 17.4% of the total river CHS harvest came from this area in June. Data from earlier years was not used because of conservation closures designed to protect wild fish. A sensitivity analysis indicated that results from 2019-2022 harvest monitoring could detect a change, if the June component increases to more than 18.6% of the total CHS harvest. Regardless of whether there is a significant change, fishery managers could then estimate how a one month change in harvest opportunity would generally affect total harvest.

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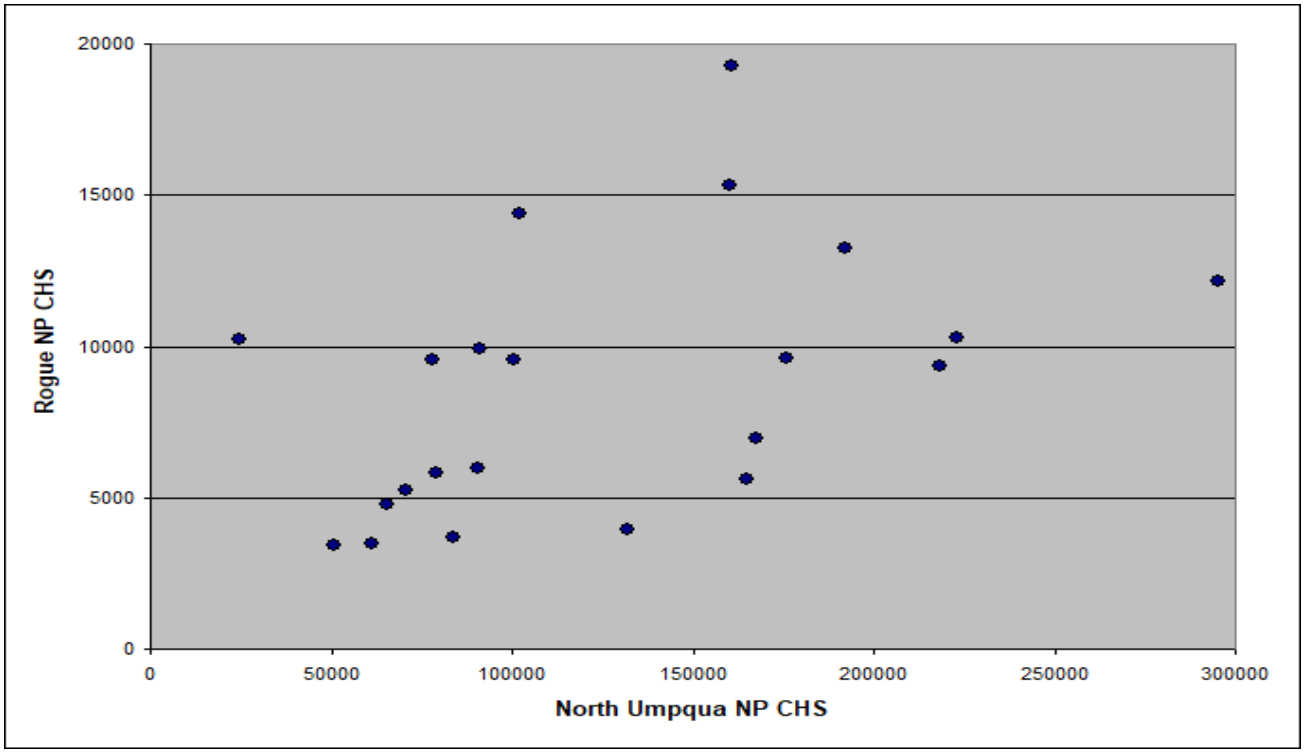
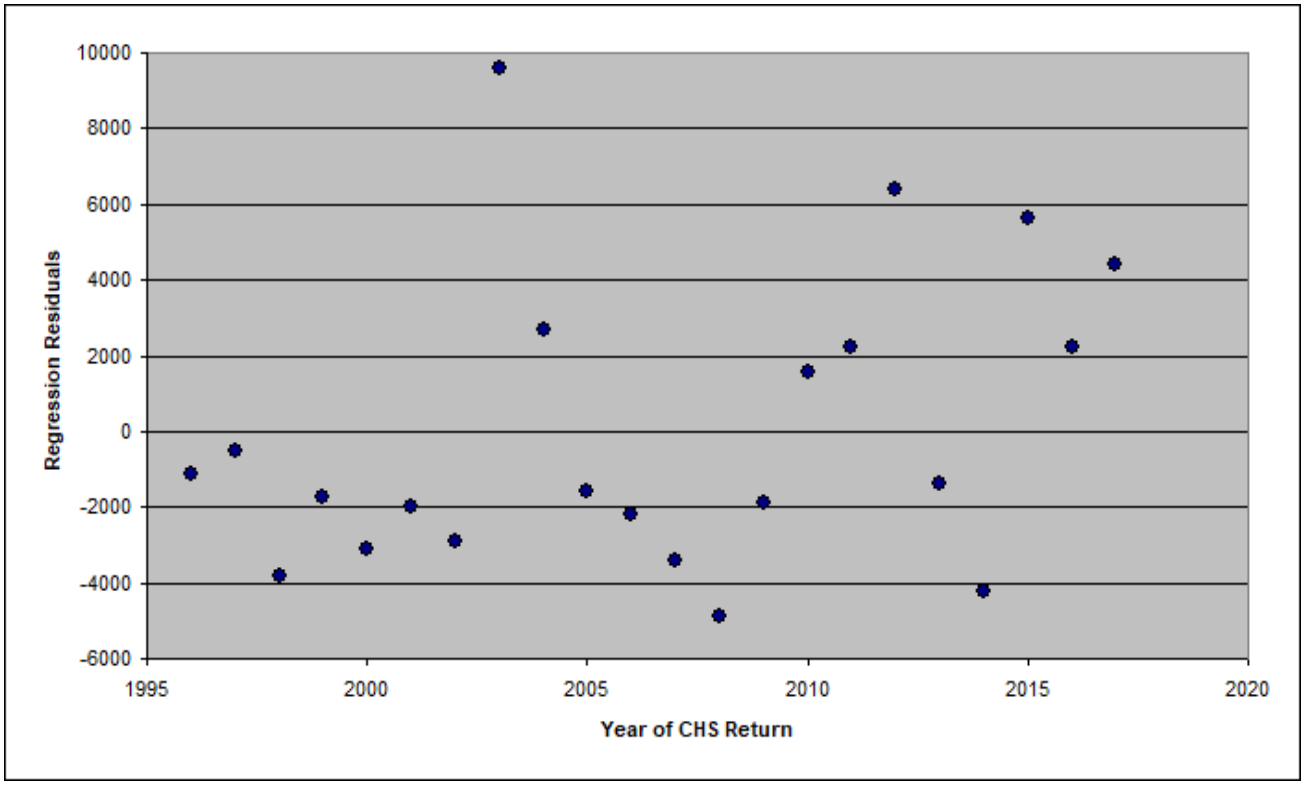
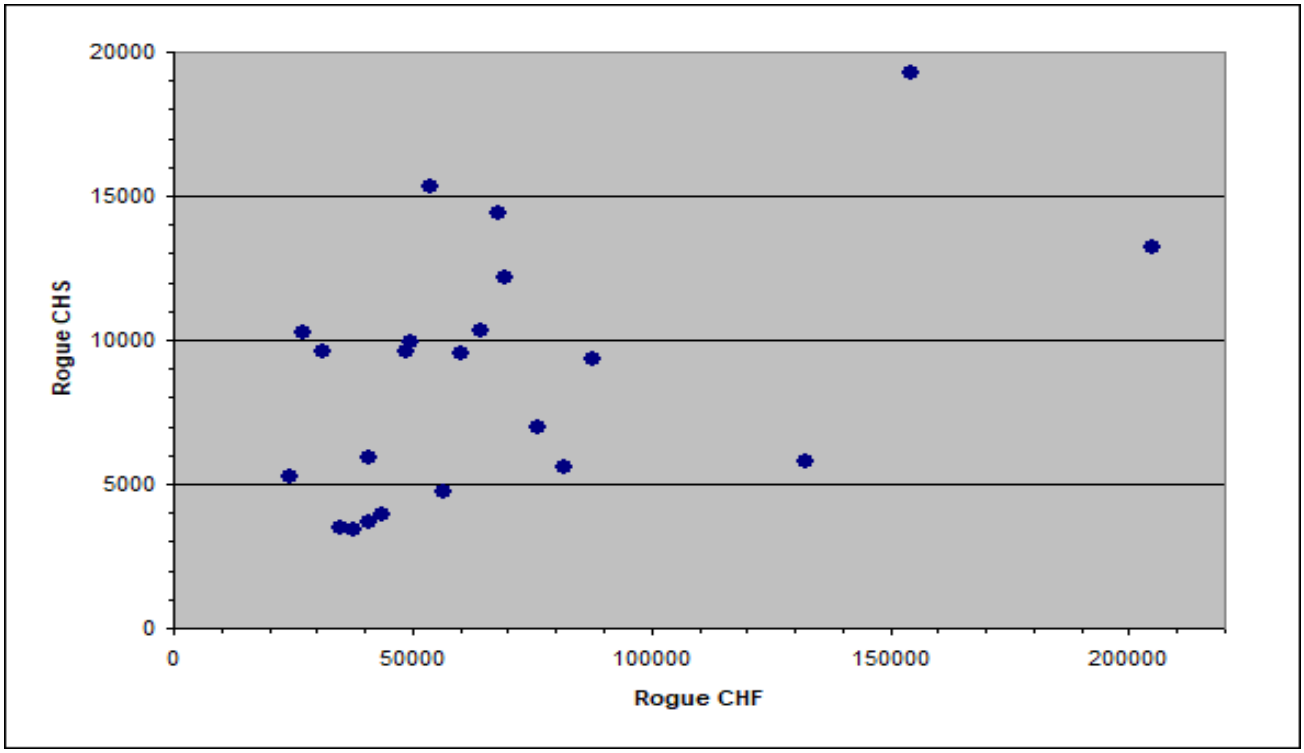


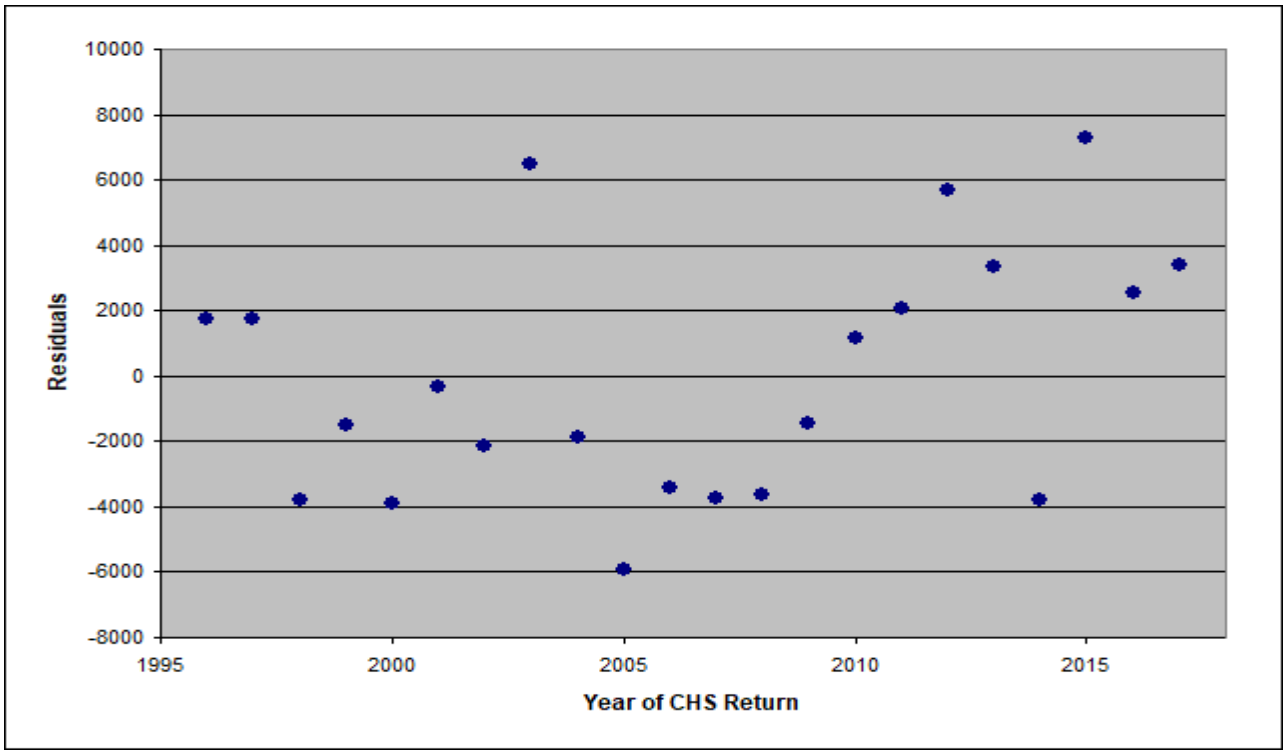
Appendix Figure A-1. Estimated passage of NP CHS at Gold Ray Dam plotted on the estimated passage of NP CHS at Winchester Dam on the North Umpqua River, 1995-2017. The counting station at Gold Ray Dam was removed in 2010. Counts of spawned carcasses were used to hindcast passage counts during 2011-2017, as described by ODFW (2011).



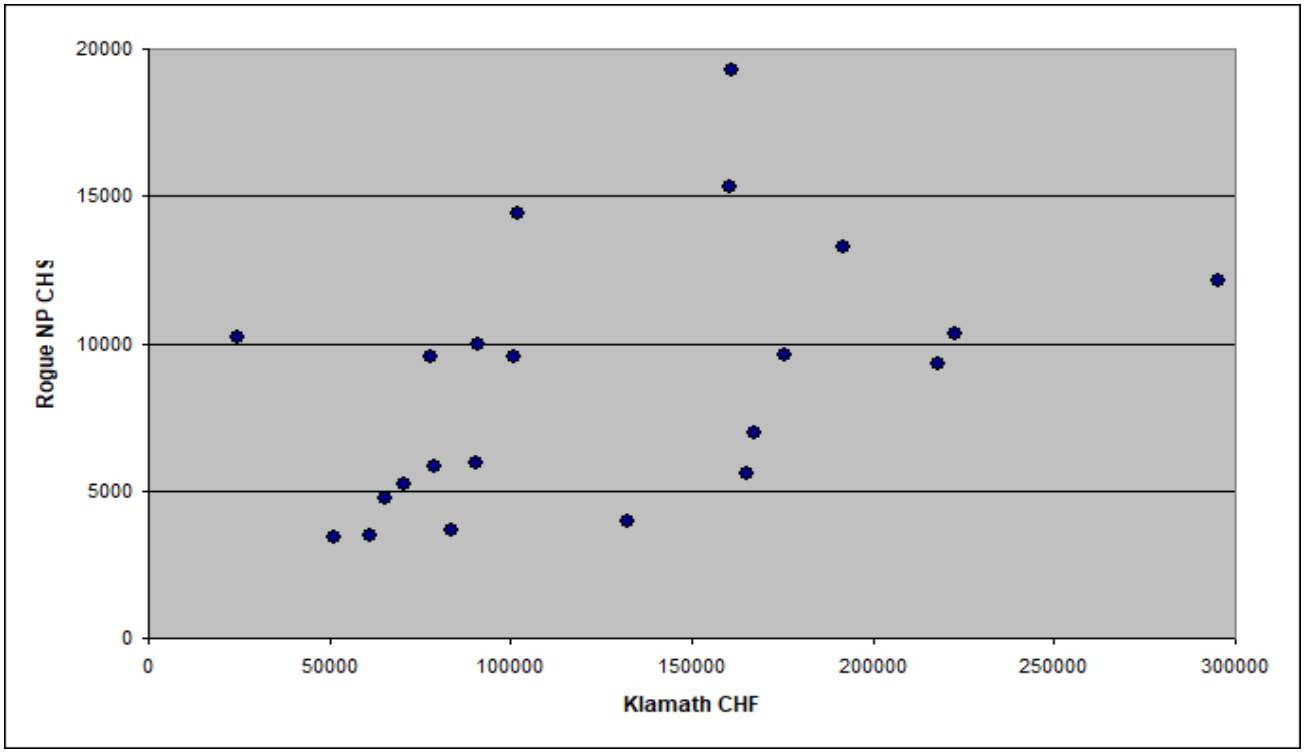
Appendix Figure A-2. Regression residuals from the relationship in Appendix Figure A-1 plotted on time (year).



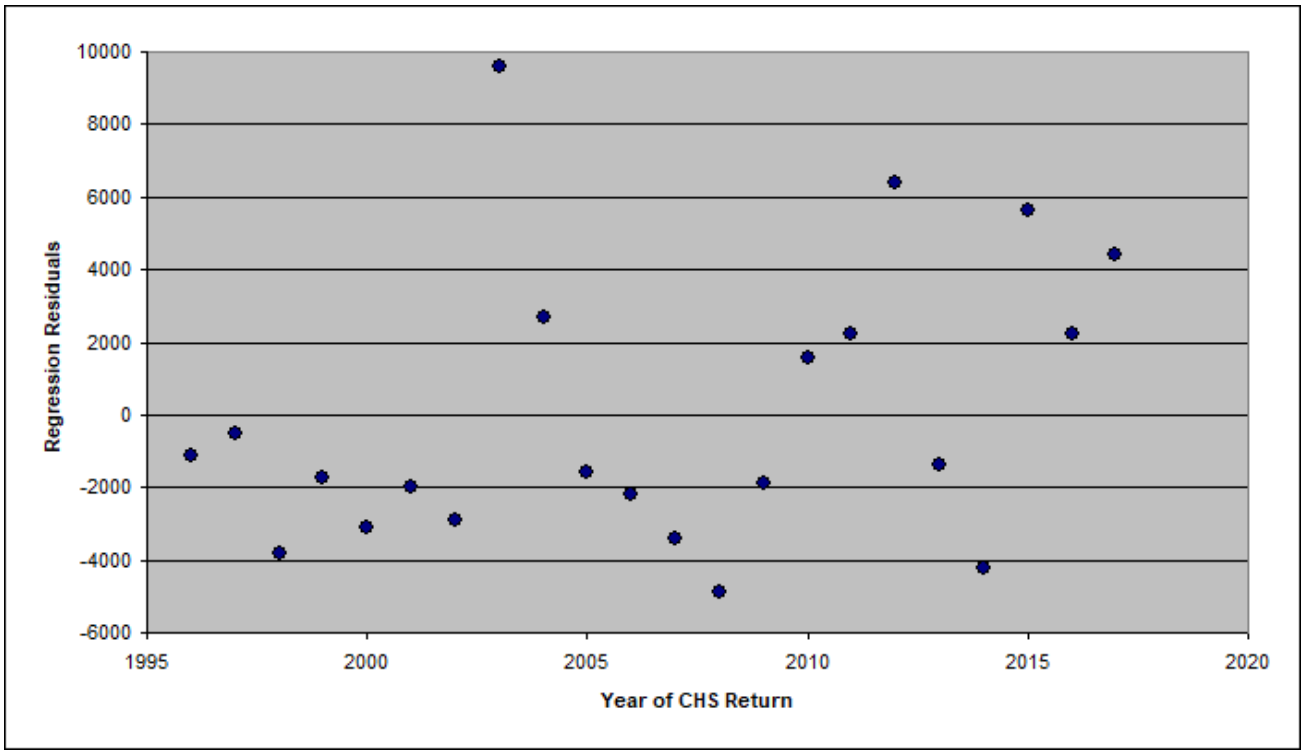
Appendix Figure A-3. Estimated passage of NP CHS at Gold Ray Dam plotted on the estimated passage of NP CHF at Huntley Park one year earlier, 1995-2017. Huntley Park is located at river mile 8 on the Rogue River. The counting station at Gold Ray Dam was removed in 2010. Counts of spawned carcasses were used to hindcast passage counts during 2011-2017, as described by ODFW (2011).



Appendix Figure A-4. Regression residuals from the relationship in Appendix Figure A-3 plotted on time (year).



Appendix Figure A-5. Estimated passage of NP CHS at Gold Ray Dam plotted on the estimated freshwater returns CHF in the Klamath River, 1995-2017. Klamath CHF estimates include wild and hatchery fish. The counting station at Gold Ray Dam was removed in 2010. Counts of spawned carcasses were used to hindcast passage counts during 2011-2017, as described by ODFW (2011).



Appendix Figure A-6. Regression residuals from the relationship in Appendix Figure A-5 plotted on time (year).