

QuickSilver
**Restoring Puget
Sound Steelhead
& Fisheries**



Steelhead – the official state fish of Washington

**Recommendations of the
Puget Sound Steelhead Advisory Group**

**Washington Department of Fish and Wildlife
Final Draft May 5, 2020**

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Acknowledgements. The following WDFW staff assisted the Puget Sound Steelhead Advisory Group in the development of the QuickSilver portfolio.

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“Providing a diversity of fishing opportunity is essential to ensure the support of the recreational fishing community. To the extent possible within conservation constraints, the portfolio provides for both catch & release and catch & keep fisheries.”

Gary Butrim, Fishing Gear Manufacturer
Mark Spada, Snohomish Sportsmen’s Club

“Clean water, scenic rivers, and wild steelhead go hand in hand, and my hope is that our recommendations will contribute to keeping the Puget Sound area a great place to live.”

Derek Day, Native Fish Society

“Puget Sound steelhead are threatened with extinction, so we must first do no harm. Responsible recreational fishing will require science-based planning, monitoring, and adaptive management with prudent thresholds that put the recovery of steelhead populations – not just holding the line – above all else.”

Jamie Glasgow, Wild Fish Conservancy

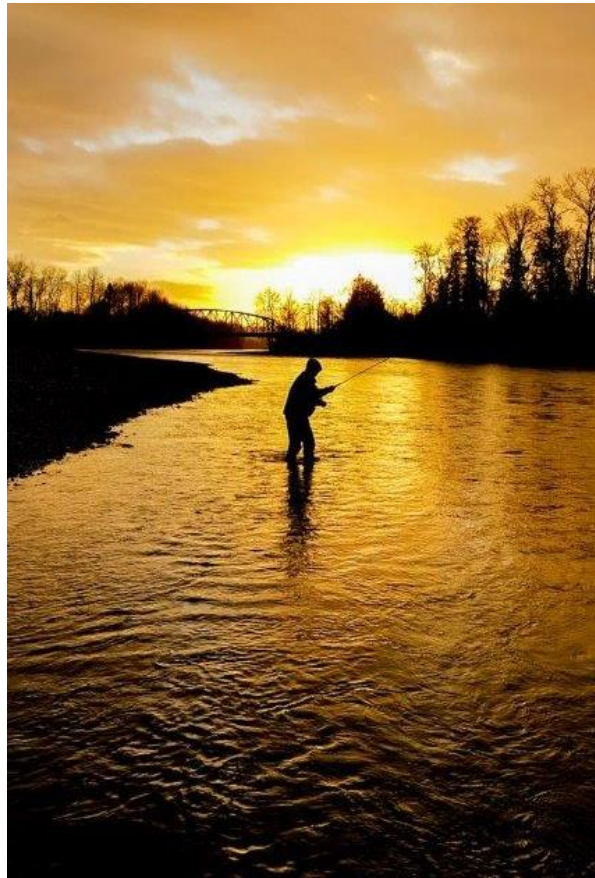


Photo: Chris Senyohl

“Now at less than 5-10% of historical abundance, restoration of steelhead, Washington’s official state fish, requires the leadership of WDFW, the cooperation and commitment of key Washington natural resource agencies, and the support of western Washington treaty tribes.”

Roger Goodan, Coastal Conservation Association

"Experience has taught us that responsive steelhead fishing requires a science-based approach to management with an abundance of consideration for the long-term health of the wild fish. Our recommendations reflect that approach. However, that represent only a small portion of the story. Healthy wild steelhead and other native salmonid populations require healthy rivers."

Curt Kraemer, Retired WDFW Biologist

“We must learn from the past, look to the future, and implement an experimental approach to provide for improved management. Fishery, hatchery, and stock monitoring are critically important.”

Andy Marks, Coastal Conservation Association

“The truth is we will only have the opportunity to fish for steelhead in Puget Sound – regardless of whether we want to fish for wild or hatchery fish – if we conserve wild steelhead. We believe that management should match the reality of conditions on the ground. We propose using common sense coupled with solid science to direct steelhead management and provide a diverse portfolio of steelhead rivers that achieve both conservation and fishery goals.”

Rob Masonis and Jonathan Stumpf, Trout Unlimited

“Today’s hatcheries are managed to have minimal impact on wild steelhead and are recognized in the portfolio as a tool to increase fishing opportunities. That recognition is tremendously important to many recreational anglers.”

Al Senyohl, Steelhead Trout Club of Washington

“With renewed will and conservation-oriented management we can restore Puget Sound steelhead runs and optimize angler opportunity, potentially open more rivers, provide longer seasons, and equitably share fisheries through recovery of steelhead in Puget Sound.”

Rich Simms, Wild Steelhead Coalition

“Steelhead are an important part of our cultural heritage on the Skagit River, and historically provided an important boost to the local economy. The portfolio is a step toward restoring our steelhead and steelhead fisheries.”

David Yamashita & Curt Wilson, Wildcat Steelheaders

Preface

We are steelhead anglers, “steelheaders” for short.

Some of us had the good fortune of having fished the rivers of Puget Sound when steelhead were bountiful, when anglers raced at daybreak in the misty, raw mornings of winter and early spring to rivers including the Skagit, Nisqually, and Skokomish in search of the Pacific Northwest’s premier sport fish. They did so with confidence that they would find them. The question, then, was not whether one would catch a steelhead; it was how many and how big. Others of us began fishing for Puget Sound steelhead after “the good old days” had passed, wild steelhead populations had declined sharply, and hatcheries, while providing fishing opportunity, were unable to sustain the fisheries of the past.

This is certainly not the only point of differentiation among us. Some of us are urbanites; others rural dwellers. Some of us fish with traditional spin and bait-casting tackle, others prefer to fly-fish. Some of us are on the political right, some on the political left.

But what we have in common that transcends our many differences is an abiding love of Puget Sound steelhead, the magnificent rivers they inhabit, and the opportunity to fish for them in our home waters.

This shared passion has brought us together to build a path to a brighter future for Puget Sound steelhead and steelhead anglers. A short-term future in which well-run hatcheries provide fishing opportunity in rivers that currently lack sufficient productivity to support fishable wild steelhead populations. A long-term future in which wild steelhead are no longer threatened with extinction and are healthy enough to support fishing. A future in which the rich tradition of steelhead fishing is continued and passed on to future generations of anglers.

Of course, our motivation is in part selfish – we love to fish for steelhead. But we also believe that having anglers on the water is good for conservation. When anglers are connected to rivers through fishing we are stronger conservation advocates, if for no other reason than that our fishing opportunity depends on high quality habitat and well managed fisheries.

But our desire to conserve also is borne out of a sense of responsibility toward, and reverence for, the rivers and steelhead that we get to know intimately through spending time on the water. In short, steelheaders have strong incentive to care for the places we fish and the fish we pursue.

We are not naïve. We know we can’t turn back the clock, that our aspirations must be grounded in the reality of today’s world. Our vision accounts for the region’s swelling human population, the legacy of habitat loss and degradation, and the depleted wild steelhead populations that we must manage conservatively if we are to rebuild them.

One of the primary lessons we have learned together is that we need better information than we currently have to improve our ability to manage steelhead. State and federal steelhead managers often must make decisions about harvest and hatchery management with limited data, and with models that do not account for crucial aspects of steelhead biology and ecology. Additional resources are needed to obtain critical data and develop life-cycle models that more accurately predict the effects of various management actions and enable better goal-setting.

But the burden of improving the state of Puget Sound steelhead does not rest solely on the shoulders of steelhead managers: anglers have a major role to play. Our opportunity to fish for steelhead – both wild and hatchery – requires that we conserve wild steelhead, accept fishing regulations that limit our impact, and build a culture of stewardship within our steelheader community. The words of Roderick Haig-Brown about the need for anglers to be stewards as we pursue our passion remain as relevant today as they were when they were written 60 years ago: “The real truth is that sport is made of and exists in just three things – tradition, ethics and restraint.”

In the following pages you will see our collective vision for steelhead management in 2019 and beyond. While we can't return to the past, we believe that we can achieve a brighter future for steelhead and for this and future generations of anglers. To be sure, there is still much to learn about steelhead and how to best manage them. But one thing we know with certainty is that steelhead are incredibly resilient. They will rebound if given the chance. It is our intent to give them that chance while keeping anglers on the water.

Executive Summary

A Vision for the Future

In 2017 the Puget Sound Steelhead Advisory Group (PSSAG) embarked on an unprecedented task – to develop a portfolio of watershed-specific conservation, fishery, and hatchery strategies for Puget Sound steelhead. It was not an easy task. Puget Sound steelhead returns are less than 5-10% of the historical level, and our passion for steelhead had often led to bitter disagreements on the path forward.

But through two years of meetings, more than forty presentations from steelhead experts, and hundreds of hours of challenging discussions, we built a broad consensus for a portfolio of proactive management strategies and actions.

Our ultimate goal is a future in which wild steelhead are no longer threatened with extinction and are healthy enough to support fishing.

Through the Eyes of Steelhead

Our rivers and Puget Sound once teemed with steelhead – about 450,000 – but many of these waters are no longer fish friendly. We face a legacy left by a century of hatchery, fishery, and habitat actions that threaten our vision of productive rivers and abundant steelhead for future generations. And despite our good intentions, our protection of seals and sea lions has resulted in a gauntlet in which many juvenile steelhead are eaten before they can successfully pass on to the Pacific Ocean. Through the eyes of steelhead, our waters no longer offer the cool, clean, accessible, and food-rich environment in which they thrived for eons.

We are concerned by the current lack of focus on restoring the productive waters necessary for steelhead. Comprehensive recommendations regarding the protection and restoration of habitat are beyond the scope of our advisory group, but we would be derelict in our responsibilities if we did not speak to the preeminent importance of these factors in conserving and recovering Puget Sound steelhead. We offer principles to guide protection and restoration of our northwest natural heritage. These principles recognize that protecting what habitat remains is essential, protecting relatively intact



QuickSilver - living silver, something that moves or changes very quickly or that is difficult to hold or contain.

*While we can't return to the past, we believe that we can achieve a brighter future for steelhead for this and future generations of anglers. Steelhead are incredibly resilient. They will rebound if given the chance. It is our intent to give them that chance - for the good of our **State fish** - while keeping anglers on the water.*

watersheds is critical, and that diverse habitats and steelhead populations residing throughout our watersheds provide insurance for the future.

Experimental and Adaptive Approach

We recognize that our understanding of Puget Sound steelhead is incomplete, that learning more is essential to successful conservation and restoration, and that fisheries and hatcheries will need to be managed adaptively to achieve conservation and fishery objectives.

It is fundamentally important, and our overarching recommendation, to develop and implement an experimental design to test strategies and address key questions associated with Puget Sound steelhead conservation, recovery, and fisheries. We are aware that the tribes, WDFW, NMFS, and non-governmental organizations are conducting many excellent research and monitoring programs, but it does not appear that an integrated, coordinated and comprehensive program is in place to address some of the larger scale questions.

There remain uncertainties about the effects of hatcheries on wild steelhead and the ability of wild steelhead to recover in the face of development and climate change. That is why our recommended portfolio is structured to enable controlled experiments to answer these critically important questions. Based on what we learn we can adjust management to better meet conservation and sustainable fisheries objectives.

QuickSilver Portfolio

We believe that management should match the reality of conditions on the ground. We propose using common sense coupled with solid science to direct steelhead management and provide a diverse portfolio of steelhead rivers that achieve both conservation and fishery goals.

The **QuickSilver** portfolio (see graphic on final page of Executive Summary) was developed during two years of meetings with scientists conducting research on steelhead, biologists intimately familiar with the rivers and steelhead runs, recovery planners, and NMFS staff engaged in ESA-related analyses of fisheries, hatcheries, and habitat. Based on this foundational information, and through hundreds of hours of challenging discussions, we built a portfolio of proactive management strategies and actions.

The structure of our recommended portfolio is intended to provide the opportunity to test alternative strategies in different watersheds. It bears emphasis that this experimental approach is an essential component of the PSSAG recommendations. Experiments must be developed and conducted in a timely fashion to inform management and maintain PSSAG support for the **QuickSilver** portfolio.

Join with Us in Restoring the State Fish in Puget Sound Rivers

We ask you to join with us in supporting the funding, monitoring, hatchery production, and other actions needed to implement the **QuickSilver** portfolio. Together, we can conserve wild steelhead, restore fishing opportunities, and create a future in which the rich tradition of steelhead fishing is continued and passed on to future generations.

QuickSilver Portfolio

Wild Steelhead Catch & Release Fishery

Manage rivers exclusively for wild steelhead where habitat and the steelhead return are relatively good.

- Provide recreational catch & release fishing opportunities where consistent with conservation objectives.
- Proposed locations include:
 - Skagit River (implemented 2018)
 - Samish River (new)
 - Elwha River (new)
 - Nisqually (new, long-term)
 - Nooksack River (new, long-term)
 - Skokomish River (new, long-term)
- Effective fishery monitoring, conservative fishing regulations, and high compliance with recreational fishing rules are essential to maintain fishing opportunities.

Wild Steelhead Broodstock Hatcheries

Wild steelhead broodstock hatchery programs have potential to be an effective tool for the reintroduction and rebuilding of depleted runs, but must be carefully monitored.

- Test wild broodstock conservation programs in a number of rivers where habitat is relatively good but the steelhead run depleted.
- Proposed locations include:
 - Nooksack River (new)
 - Cedar River (new)
 - Skokomish (existing)

If wild broodstock programs prove effective, consider extending the purpose of the programs to provide fishing opportunities (for recreational fisheries, either catch & release or catch & keep).

- Potential locations include:
 - Green River (enhanced)
 - White River (existing)

Steelhead Harvest Hatcheries

Segregated hatchery programs can be used to provide recreational catch & keep fisheries, but they must be operated consistent with the Statewide Steelhead Management Plan and with the federal steelhead recovery plan.

- Segregated hatchery programs must be implemented in a manner to limit genetic and ecological effects to wild steelhead.
- Proposed programs include:
 - Snohomish Early Winter (existing)
 - Dungeness Early Winter (enhanced)
 - Quilcene Early Winter (new)
- Segregated programs must be carefully monitored to assess risks to wild steelhead and effectiveness at meeting fishery objectives.

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List of Abbreviations

DIP	Demographically Independent Population
DPS	Distinct Population Segment
ESA	Endangered Species Act
LEKT	Lower Elwha Klallam Tribe
MIT	Muckleshoot Indian Tribe
MPG	Major Population Group
NMFS	National Marine Fisheries Service
PEHC	Proportion Effective Hatchery Contribution
pHOS	Proportion Hatchery Origin Spawners
PNI	Proportionate Natural Influence
PSSAG	Puget Sound Steelhead Advisory Group
PT	Puyallup Tribe
SAR	Smolt to Adult Return
TBD	To be Determined
WDFW	Washington Department of Fish and Wildlife (Department)
WSMZ	Wild Steelhead Management Zone

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Introduction

In 2017 the Puget Sound Steelhead Advisory Group (PSSAG) embarked on an unprecedented task – to develop a portfolio of watershed-specific conservation, fishery, and hatchery strategies for Puget Sound steelhead. It was not an easy task. Puget Sound steelhead returns are less than 5-10% of the historical level, and our passion for steelhead had often led to bitter disagreements on the path forward.

But through two years of meetings, more than forty presentations from steelhead experts, and hundreds of hours of challenging discussions, we built a broad consensus for a portfolio of proactive management strategies and actions.

In advancing our recommended management portfolio, we acknowledge the limitations of available data and information (Cram et al. 2018). There remain uncertainties about the effects of hatcheries on wild steelhead and the ability of wild steelhead to recover in the face of development and climate change. That is why our recommended portfolio is structured to enable controlled experiments to answer these critically important questions. Based on what we learn we can adjust management to better meet conservation and sustainable fisheries objectives. Accordingly, our *QuickSilver* portfolio is intended to be dynamic and subject to change as our knowledge and understanding improves.

Our ultimate goal is a future in which wild steelhead are no longer threatened with extinction and are healthy enough to support fishing. A future in which the rich tradition of steelhead fishing is continued and passed on to future generations.

In developing this portfolio, we recognized that underlying habitat issues must be addressed, wild steelhead populations must be strengthened, and an integrated All-H recovery strategy is needed to restore Puget Sound steelhead. To contribute to that All-H strategy, we propose principles to guide habitat protection and restoration, conservation hatchery programs to maintain and restore steelhead, and hatchery programs and fishery management actions that are intended to provide a diversity of sustainable fishing opportunities without appreciably reducing the likelihood of the survival and recovery of Puget Sound steelhead.

Our hope is that the *QuickSilver* portfolio will inform implementation of NOAA Fisheries' recently released Puget Sound Steelhead Recovery Plan and discussions of the Washington Department of Fish and Wildlife



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While we can't return to the past, we believe that we can achieve a brighter future for steelhead for this and future generations of anglers. Steelhead are incredibly resilient. They will rebound if given the chance. It is our intent to give them that chance - for the good of our State fish - while keeping anglers on the water.

(WDFW) with the co-managers regarding fishery management and hatchery programs. Given the multiple years necessary to secure ESA coverage for fisheries and hatchery programs, we suggest that the Department immediately initiate discussions with the co-managers on the PSSAG recommendations. Our hope is that these discussions will lead to the timely development and submission to the National Marine Fisheries Service (NMFS) of fishery and hatchery resource management plans.

While we can't return to the past, we believe that we can achieve a brighter future for steelhead for this and future generations of anglers. Steelhead are incredibly resilient. They will rebound if given the chance. It is our intent to give them that chance - for the good of our **State fish** - while keeping anglers on the water.

Through the Eyes of Steelhead

Our rivers and Puget Sound once teemed with steelhead – about 450,000 – but many of these waters are no longer fish friendly. We face a legacy left by a century of hatchery, fishery, and habitat actions that threaten our vision of productive rivers and abundant steelhead for future generations. And despite our good intentions, our protection of seals and sea lions has resulted in a gauntlet in which many juvenile steelhead are eaten before they can successfully pass on to the Pacific Ocean. Through the eyes of steelhead, our waters no longer offer the cool, clean, accessible, and food-rich environment in which they thrived for eons.

The critical importance of habitat was highlighted in the proposed listing of Puget Sound steelhead in 2006 (71 FR 15666):

“In addition to being a factor that contributed to the present decline of Puget Sound steelhead populations, the continued destruction and modification of steelhead habitat is the principal factor limiting the viability of the Puget Sound steelhead DPS into the foreseeable future.”

Despite the recognized importance of habitat protection and restoration, we are concerned by the current lack of focus on restoring the productive waters necessary for steelhead survival and recovery. For example, the Puget Sound Partnership has identified Chinook salmon as an indicator for steelhead although significant differences exist between the life history of Chinook salmon and steelhead and the stressors constraining recovery. Both species are important, and it would be valuable to work with the Puget Sound Partnership to ensure that the habitat requirements of both species are considered. We recommend adding steelhead as a Vital Sign as a step toward recognizing the importance of these fish in the restoration of the Puget Sound ecosystem.

Comprehensive recommendations regarding the protection and restoration of habitat are beyond the scope of our advisory group, but we would be derelict in our responsibilities if we did not speak to the preeminent importance of these factors in conserving and recovering Puget Sound steelhead. We offer the following principles to guide protection and restoration of our northwest natural heritage.

- 1) Each of us must contribute to the conservation of steelhead. The importance of a holistic approach to

Through the eyes of steelhead, our waters no longer offer the cool, clean, accessible, and food-rich environment in which they thrived for eons.



We are all river stewards, for water flows downhill, and carries with it our imprint as well as those upstream of us.

Photo: John McMillan

conservation and recovery planning (Habitat, Hydropower, Harvest, and Hatcheries - or All-H management) is widely recognized, but perhaps less often do each of us think about what we could do to make our rivers and Puget Sound a better place for steelhead.

- 2) Diverse steelhead populations residing throughout our watersheds provide insurance for the future. This is particularly important as we face the rapid modifications in the pattern of river flows and temperature resulting from climate change. Steelhead once returned to our rivers throughout the year and occupied everything from small headwater streams to the large rivers entering Puget Sound. A diverse population requires a diversity of places to live. Restoring this habitat and population diversity, particularly with our changing climate, will provide steelhead with the raw materials to persist in an ever-changing landscape.
- 3) Protection of our existing habitat is as important as habitat restoration. Private, local, state, and federal funding for habitat restoration is likely to remain, at best, a small fraction of what is necessary to conserve and recover steelhead throughout the Puget Sound basin. Protecting what is left is essential and protecting relatively intact watersheds is critical.
- 4) Maintaining and restoring natural processes benefits people and fish. For example, we all enjoy a walk along a wooded shoreline, and those very same trees ensure cool, clear, productive water for steelhead. Wetlands can be effective in reducing flood damage and prevent the scouring out of steelhead eggs that have been deposited in the streambed. Nature can provide cost effective benefits – to people and fish alike – but your state legislature and Congress need to know that you support enhanced funding for salmon and steelhead restoration in Puget Sound.
- 5) We are all river stewards, for water flows downhill, and carries with it our imprint as well as those upstream of us. Even a small action, when joined with thousands of similar actions throughout the watershed, may become consequential as the river flows on its journey to the sea.
- 6) Participate with watershed groups, Lead Entities, Local Integrating Organizations, Regional Fishery Enhancement Groups, conservation and fishing organizations, the Puget Sound Partnership, and other entities working to conserve and improve our watersheds. Individually we have a small voice – collectively we can make a difference.

Perhaps an old proverb sums up our principles - “Where there is water there is fish. If we take care of the water, the fish will take care of us.”

Experimental and Adaptive Approach

The PSSAG recognizes that our understanding of Puget Sound steelhead is incomplete, that learning more is essential to successful conservation and restoration, and that fisheries and hatcheries will need to be managed adaptively to achieve conservation and fishery objectives.

The *QuickSilver* portfolio is designed to test management strategies and improve our ability to achieve conservation and fishery objectives. To work, the portfolio requires extensive monitoring of wild steelhead populations, fisheries, and hatcheries to evaluate management actions.

It is fundamentally important, and our overarching recommendation, to develop and implement an experimental design to test strategies and address key questions associated with Puget Sound steelhead conservation, recovery, and fisheries. We are aware that the tribes, WDFW, NMFS, and non-governmental organizations are conducting many excellent research and monitoring programs, but it does not appear that an integrated, coordinated and comprehensive program is in place to address some of the larger scale questions.

The structure of our recommended portfolio is intended to provide the opportunity to test alternative strategies in different watersheds. It bears emphasis that this experimental approach is an essential component of the PSSAG recommendations. Experiments must be developed and conducted in a timely fashion to inform management and maintain PSSAG support for the portfolio described in subsequent sections.

To promote and inform this experimental approach, the PSSAG recommends that WDFW provide every two years a status report for Puget Sound steelhead that includes: 1) trends in steelhead abundance, productivity, diversity, and spatial structure; 2) marine survival rates; 3) climate effects; 4) trends in quality, quantity, and diversity of habitat; 5) results from monitoring of hatchery programs and fisheries; and 6) important new steelhead research results.

Although the specifics of adaptive management for each fishery and hatchery program are beyond the scope of this document, we recommend the following general considerations for monitoring, evaluation, and adaptive management. Specific

LEARNING MORE IS ESSENTIAL
TO SUCCESSFUL CONSERVATION
AND RESTORATION



The QuickSilver portfolio is designed to test management strategies and improve our ability to achieve conservation and fishery objectives.

“We must learn from the past, look to the future, and implement an experimental approach to provide for improved management. Fishery, hatchery, and stock monitoring are critically important.”

Andy Marks
Coastal Conservation Association

Photo: Joe Anderson

timelines should be identified for monitoring as described for the early winter genetic steelhead monitoring program (Anderson et al. 2017).

- 1) Steelhead Populations. Focusing on the populations most important to recovery and potential fisheries:
 - a. Improve estimates of abundance, productivity, diversity, and spatial structure. Sonar counts are now being used to estimate the number of adult steelhead returning to several Pacific Coast rivers. We recommend pilot studies in the Nooksack River, Skagit River, and Deer Creek to test this technology in Washington.
 - b. Assess the survival of steelhead by life stage and identify bottlenecks to improving population status.
 - c. Update estimates of the productivity and capacity of habitat and steelhead populations and modify management objectives as appropriate.
 - d. Evaluate and implement strategies to reduce pinniped predation and disease.
- 2) Fisheries:
 - a. Account for the mortality of steelhead in all fisheries.
 - b. Improve estimates of the mortality of steelhead released in all fisheries.
 - c. Minimize bycatch in nontreaty commercial fisheries by avoiding areas and times with high encounter rates of steelhead, using species-selective gear, and by using gear types which allow the release of steelhead with minimal mortality.
 - d. Monitor and adaptively manage fisheries to maximize benefits, test assumptions, address the Puget Sound Steelhead Recovery Plan guidance, and meet applicable Section 7 consultation requirements.
- 3) Hatcheries:
 - a. Test new and existing hatchery strategies in a well-designed experimental approach.
 - b. Incorporate assessments of ecological impacts of steelhead hatchery programs into hatchery evaluations.
 - c. Measure the proportion effective hatchery contribution (PEHC) or other measures of gene flow from segregated hatchery programs to natural populations.
 - d. Prior to submitting a steelhead hatchery resource management plan for consideration by NMFS, request review of the proposed program by the Hatchery Scientific Review Group (or other independent scientific review entity) to evaluate the proposed program and identify potential improvements.
 - e. At least every second year, review the performance of hatchery programs and ensure implementation is consistent with the conservation and recovery of Puget Sound steelhead and that fishery objectives are achieved. The PSSAG might be an appropriate forum for this review. Reduce risks, as necessary, through management actions such as changes in fishery management (e.g., season, gear, location), trapping locations and protocols, time of broodstock collection and spawning, and the number of smolts released. Terminate programs that, after evaluation of potential management actions, are found to be impeding attainment of conservation objectives. Consider increasing program size where the increase would result in fishery benefits and risks would remain consistent with the conservation objectives for that population.

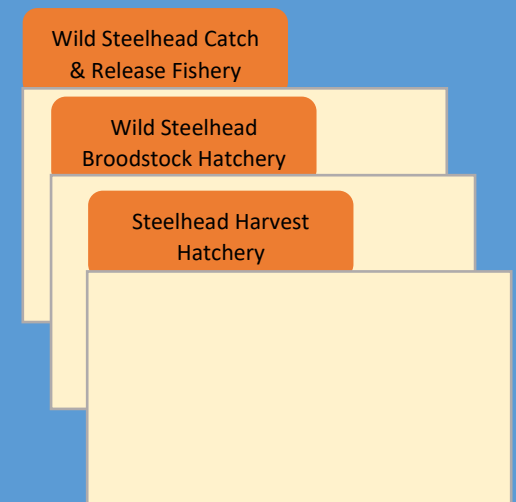
Portfolio of Conservation & Management Strategies

We recommend a portfolio of conservation, fishery, and hatchery management strategies. What does that mean? In the financial world a well-chosen portfolio of investments limits risks and maximizes growth potential. Our recommended portfolio:

- 1) Recognizes the reality of conditions on the ground – not all rivers have the same ability to contribute in the same time frame to the conservation and recovery of Puget Sound steelhead.
- 2) Identifies as conservation priorities a diverse and geographically dispersed set of wild steelhead populations managed to be free from the effects of steelhead hatcheries (e.g., Wild Steelhead Management Zones).
- 3) Protects wild steelhead by placing limits on key risk factors associated with hatchery programs.
- 4) Provides a diversity of fishing opportunities across the rivers of Puget Sound. We know that some steelhead anglers want to be able to harvest steelhead, and others want to catch-and-release wild steelhead.
- 5) Must be implemented in a manner consistent with *U.S. v. Washington*, including the sharing of harvestable steelhead.
- 6) Promotes an experimental approach to test and improve restoration, conservation, and management strategies. One component of that experimental approach are Wild Steelhead Management Zones, where steelhead are largely protected from the effects of hatchery programs, but anglers can continue to fish for wild steelhead.

The *QuickSilver* portfolio of conservation and management strategies was developed through an iterative process anchored on the Statewide Steelhead Management Plan (SSMP) (WDFW 2008), the guidance of the Hatchery Scientific Review Group (2014), as well as biological opinions completed by NMFS (2016a, 2016b, 2019a), and the draft recovery plan, which was not finalized until after our recommended portfolio was completed (NMFS 2019b). We recognize that further development of the details of the proposed programs, and agreement with the co-

A PORTFOLIO LIMITS RISKS AND MAXIMIZES GROWTH POTENTIAL



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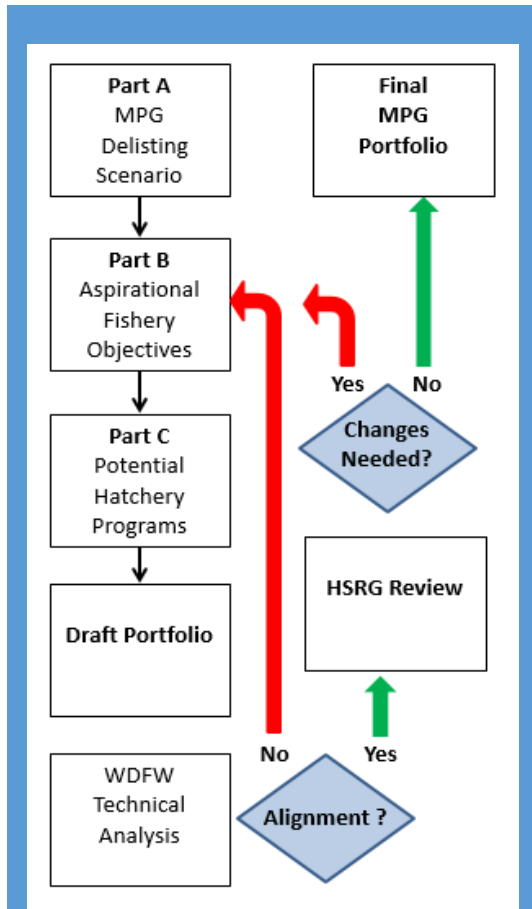
managers, will need to occur prior to the submission of a Hatchery Genetic Management Plan (HGMP) or fishery Resource Management Plan to NMFS.

The portfolio was developed during two years of meetings that included more than forty presentations from steelhead experts. These included scientists conducting research on steelhead, biologists intimately familiar with the rivers and steelhead runs, recovery planners, and NMFS staff engaged in ESA-related analyses of fisheries, hatcheries, and habitat. Then, through hundreds of hours of challenging discussions, we built a portfolio of proactive management strategies and actions.

The iterative process to develop the portfolio had the following steps. First, we identified the viability category for each population necessary to meet, at a minimum, the criteria for delisting identified in the Puget Sound Steelhead Recovery Plan (see Box “Recovery, Population Viability, and Delisting Scenarios”). The PSSAG then developed aspirational recreational fishery objectives and proposed artificial production programs intended to promote achievement of conservation or fishery objectives. The proposed artificial production programs were subsequently evaluated and modified until they were consistent with the guidance for hatchery programs associated with the viability criteria established for each wild steelhead population (additional details are provided in Part II (appendices) of this report).

Through this process, it became evident that we could not immediately attain our goal of providing a diversity of fishing opportunities year-round in multiple rivers flowing into each region of Puget Sound. The current status of Puget Sound steelhead necessitates strict limits on fishery impacts on wild steelhead. In the regional sections of our report, we provide an abundance index that is the ratio of the average terminal run from 2012 through 2016 to the upper extent of the recovery range (tables 6-8 of recovery plan). Values of the index are generally less than 10%.

Bearing this in mind, we recommend that the Department describe a path toward diverse and sustainable recreational fishing opportunities based on fishery and hatchery actions that do not impede the



The QuickSilver portfolio of conservation and management strategies was developed through an iterative process anchored on conservation objectives for Puget Sound steelhead.

conservation and recovery of Puget Sound steelhead. These could include region-specific objectives for angler days, catch rates, or other metrics for different types of fisheries (e.g., catch-and-keep or catch-and-release). To that end, we have provided recommendations for initial benchmarks for angler days that may be feasible in a short-to-moderate time frame. We projected angler days based on an average of 0.12 steelhead encounters per day and an economic impact of \$212 per day of angling (see Part II (appendices) of this report for additional information).

The portfolio includes recommended investments in hatchery programs in some regions of Puget Sound that have experienced poor survival in recent years. Why not just invest in hatchery programs that are projected to have the highest survival rates? We believe that approach would impede recovery of wild steelhead, would not build the broad, community-based support necessary for steelhead conservation and recovery, and would be inconsistent with our interest in providing fishing opportunities across the geographic breadth of Puget Sound.

The Puget Sound Steelhead Recovery Plan indicates that NMFS will assist state agencies, tribes, and Lead Entities in the development of six watershed chapters to add to the recovery plan in 2021 and the remainder in 2023. During that process, we encourage participants to assess, quantitatively to the extent possible, how hatchery, fishery, and habitat actions will lead to the abundance, productivity, diversity, and spatial structure of steelhead necessary for recovery. For example, a Management Strategy Evaluation would be a valuable tool to evaluate the performance of alternative fishery management approaches in achieving management objectives (see http://www.fao.org/fishery/eaf-net/eaftool/eaf_tool_50). Our hope is that the specific fishery and hatchery management actions recommended by the PSSAG will be evaluated during that process, and that habitat managers will invest a similar effort in the development and evaluation of strategies to provide the protection and restoration of habitat necessary for the recovery of Puget Sound steelhead.

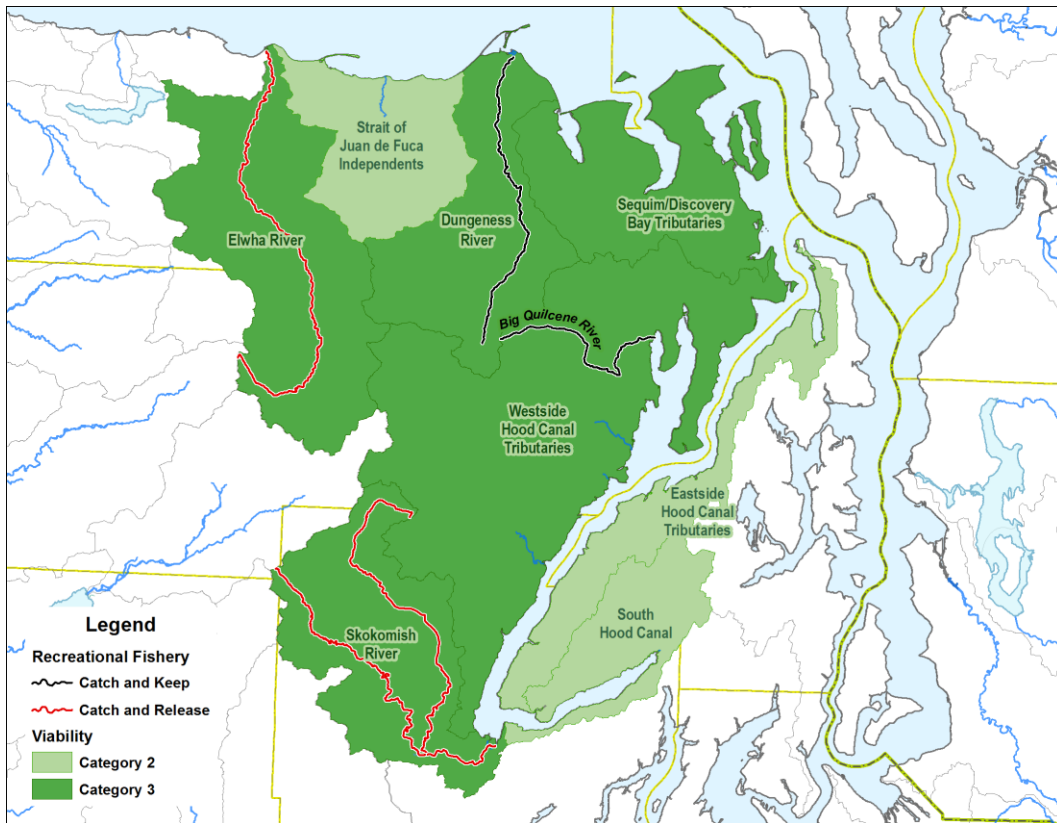
Recovery, Population Viability, and Delisting Scenarios

The *QuickSilver* portfolio is built on the conservation framework established by the recovery plan for Puget Sound steelhead. The plan identifies the biological conditions when listing as a threatened or endangered species under the Endangered Species Act is no longer warranted. These biological conditions, or viability criteria, are consistent with Puget Sound steelhead having a negligible risk of extinction over 100 years. Viability criteria are identified for steelhead populations, and for groups of populations within a geographic region such as the Northern Cascades.

Not all steelhead populations within a geographic region must be restored to the highest level of viability for delisting to occur. The recovery plan establishes categories of populations with varying levels of contribution to recovery. Category 3 populations have the greatest contribution to recovery and must have a high probability of viability. A Category 1 population is expected to have the lowest contribution to recovery and may have a low probability of viability. The recovery plan identifies some, but not all of the populations that must have a high probability of viability.

A delisting scenario is a combination of population designations that meets or exceeds the recovery plan criteria for delisting of Puget Sound steelhead. The scenario represents one of many possible combinations of populations and viability levels that could result in delisting. Although multiple scenarios may fulfill the biological requirements for delisting, the scenarios may differ in terms of feasibility, cost, implications for All-H management, and implementation timing. Selection of a scenario is a policy decision informed by scientific, biological, social, cultural, political, and economic considerations. Additional information on these topics can be found in Part II (appendices) of this report.

Hood Canal and Strait of Juan de Fuca



Location	Abundance Index	Wild Catch & Release	Wild Broodstock ¹	Segregated Hatchery Harvest
Elwha ^{1/}	45%	● 2,000 days \$430,000	● Conserv. Program	
Dungeness	15%			● 1,600 days \$340,000
B. Quilcene ^{2/}	1%			● 300 days \$69,700
Skokomish	13%	● 2,100 days \$450,000	▨ Conserv. Program	

● ESA Approved ▨ ESA Review Pending

● High priority for co-manager discussion ● Lower priority for co-manager discussion

^{1/} Includes both natural- and hatchery-origin fish. See recovery plan.

^{2/} Abundance index is for West Hood Canal population.

Introduction

The Hood Canal and Strait of Juan de Fuca region has strong potential for restoration of wild steelhead with significant parts of many watersheds in the Olympic National Park or in other public ownership. However, steelhead returns to Hood Canal rivers are currently among the weakest of the Puget Sound DPS and fishing opportunities are limited to a small fishery in the Dungeness River.

The QuickSilver portfolio recognizes that rebuilding of steelhead runs in this region must be our primary focus. Significant restoration actions are underway. The removal of two dams on the Elwha River provided steelhead with access to miles of pristine habitat in the Olympic National Park and the potential for large, sustainable runs. The Cushman Settlement Agreement provides for increased flows in the Skokomish River and other actions that should help to restore what was formerly the largest steelhead run in this region. As rebuilding occurs, low impact fisheries in the Elwha and Skokomish Rivers will become an option, and we recommend that anglers be provided an opportunity for catch and release fisheries.

In the short term, we recommend enhancing fishing opportunities by implementing new or enhanced early winter steelhead programs on the Dungeness and Big Quilcene Rivers designed to have minimal impacts on the rebuilding of wild steelhead.

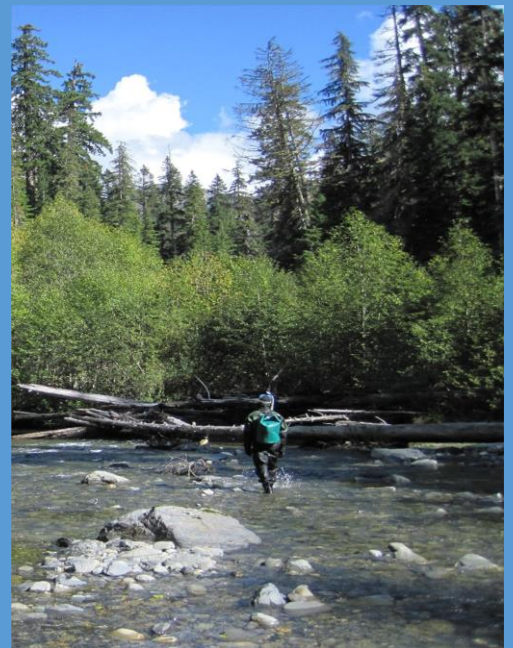
Viability Criteria

The Elwha and Skokomish Rivers are the two largest rivers in this region and, with ongoing restoration efforts, have the potential to support large, sustainable, and fishable wild steelhead runs. Consistent with the recovery plan, we support identifying these populations for rebuilding to the highest level of viability (category 3).

We also recommend the highest category of viability for the Dungeness River Summer/Winter Run, the Sequim/Discovery Bay Winter Run, and the West Hood Canal Winter Run. These populations occur in river basins with a variety of hydrologic regimes, and generally have a substantial proportion of the basin in public ownership.

We recommend category 2 viability for the Strait of Juan de Fuca Independent Winter Run, East Hood Canal Winter Run, and South Hood Canal Winter Run. Although important to the diversity of

ELWHA RIVER RESTORATION



The removal of two dams on the Elwha River provided access to miles of pristine habitat in the Olympic National Park and the potential for a large sustainable run of wild steelhead.

Photos: John McMillan (top); Joe Anderson (bottom)

the steelhead, these populations were generally smaller and occur in watersheds where restoring the habitat necessary for a high level of viability will be challenging for the foreseeable future.

Our recommended portfolio exceeds viability criteria for this region identified in the recovery plan:

Geometric Mean Viability \geq 2.2: Yes (2.58)

At least 50% Viability Category 3: Yes (62%)

At least one Summer/Winter Run Category 3: Yes (2)

Portfolio

Development of the Hood Canal and Strait of Juan de Fuca portfolio is challenging due to the generally poor status of steelhead populations. Our recommendations prioritize rebuilding of wild steelhead with an initial objective of providing catch and release fishing opportunities in the Elwha and Skokomish Rivers, testing conservation hatchery programs as a rebuilding tool, and providing catch and keep fishing in the Dungeness and Big Quilcene Rivers.

Wild Steelhead Catch & Release Fishery

The Elwha and Skokomish Rivers provide the greatest potential for future catch and release fisheries in this region.

Elwha River. The removal of the two hydroelectric dams from the Elwha River in 2012 provided access to an additional 40 miles of spawning and rearing habitat, much of it inside Olympic National Park. As the legacy effects of the dams diminish, natural production of steelhead is anticipated to increase, with the potential to have the largest wild steelhead runs in tributaries to the Strait of Juan de Fuca. Studies have found that the river's native winter steelhead population remains genetically distinct despite releases of early winter hatchery fish conducted until 2011. The Department designated the Elwha River as a Wild Steelhead Management Zone in 2016.

NMFS provided 4(d) approval for a Lower Elwha Klallam Tribe hatchery conservation program that will be phased out as the number of natural-origin spawners increases in the Elwha River. The PSSAG did not review this program but encourages the Department to closely monitor program performance to ensure that the full potential for wild steelhead recovery in the Elwha River is realized. Consistent with NMFS' 4(d) approval of the hatchery program, the Elwha's designation as a Wild Steelhead Management Zone and our determination that the Elwha wild steelhead population should be managed to achieve the highest level of viability, we recommend that the hatchery program be discontinued once the natural-origin spawner target has been reached. The river is currently closed to fishing to promote rebuilding of the steelhead run.

Skokomish River. The Skokomish River currently supports the largest wild steelhead run of all tributaries to Hood Canal. Increased runsizes are likely in the future as a result of the increased river flows provided by the Cushman Settlement Agreement and substantial habitat restoration efforts.

The Settlement Agreement for the Cushman Hydroelectric Project requires Tacoma Power to operate a hatchery reintroduction and restoration program for winter steelhead in the North Fork Skokomish River for a minimum of 12 years.¹ Consistent with our determination that the Skykomish wild steelhead

¹ License Article 417 of the Cushman Settlement Agreement required Tacoma Public Utilities to provide a plan to implement the fish supplementation program. Regarding the length of the program, the plan states "These efforts

population should be managed to achieve the highest level of viability, we recommend that the hatchery program be terminated at the end of the 12-year period unless it is determined that the benefits to wild fish of continuing the program outweigh its negative impacts.

The Skokomish River has not been open to recreational fishing for steelhead since 2006 when wild spawners dwindled to around 200 fish annually. Spawner levels have subsequently increased, and limited impact fisheries may be possible if further increases in abundance occur.

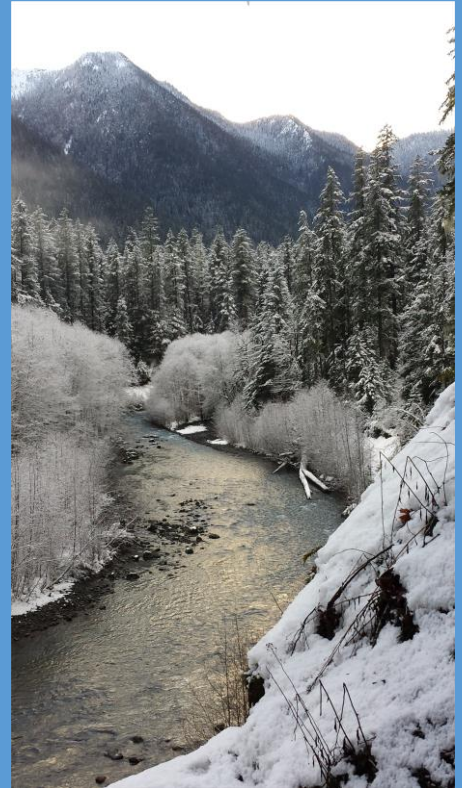
Given the multiple years necessary to secure ESA coverage for fisheries, we recommend that the Department immediately initiate work with the comanagers on a Resource Management Plan that includes triggers for the initiation of a catch and release fishery.

Hatchery Programs Supporting Conservation or Harvest

Conservation hatchery programs are currently operated in the Elwha (see discussion in previous section), Skokomish (see discussion in previous section), and a long-term study is nearing completion in a number of Hood Canal rivers (see box on page 15). We strongly support the Hood Canal study and recommend that the Department use the results to shape the implementation of conservation programs for Hood Canal steelhead populations.

Opportunities for catch & keep fisheries are currently extremely limited in this region. To enhance fishing opportunities and contribute to the portfolio for this region, we propose increasing the current program at the Dungeness Hatchery and initiating an early winter steelhead program on the Big Quilcene River. The hatchery programs are summarized in Table 1 and additional information on the proposed new programs can be found in Part II (appendices) of this report.

JEWELS OF HOOD CANAL



“I spent most winters hiking and fishing the jewels of Hood Canal – the Skokomish, Duckabush, Dosewallips, Hamma Hamma, and even smaller rivers like the Union and Dewatto.

But wild steelhead have dwindled to near extinction, and no longer do hardy anglers brave the winter weather to fish in these beautiful waters.

I am committed to our plan for restoring Hood Canal steelhead and our cultural heritage.”

Rich Simms

will continue for three winter steelhead generations (twelve years based on a typical four-year life history) or other time frame as determined by the FHC {Fisheries and Habitat Committee}.”

Table 1. Summary of hatchery programs contributing to portfolio for the Hood Canal and Strait of Juan de Fuca region.

Watershed	Program Operator	Purpose	Type	Run Timing	Current Release	Proposed Release	Comments
Elwha	LEKT	Conservation	Integrated	Native-Timed	175,000	See comment	NMFS provided 4(d) approval for a conservation program that will be phased out as the number of natural-origin spawners increases.
Dungeness	WDFW	Harvest	Segregated	Early Winter	10,000	58,200	Increase in release level contingent upon average gene flow rate remaining < 2%.
Big Quilcene	WDFW	Harvest	Segregated	Early Winter	-	12,000	
Skokomish	TPU	Conservation	Integrated	Native-Timed	15,000	See comment	Program operated pursuant to settlement agreement and FERC license Article 417. See text for discussion of expected duration of program.

Evaluating the Risks and Benefits of Conservation Hatchery Programs

We received a presentation from Dr. Berejikian (NMFS) regarding a study underway in Hood Canal to assess conservation hatcheries as a tool for maintaining and rebuilding wild steelhead populations. Partners in the study include NOAA Northwest Fisheries Science Center, US Fish and Wildlife Service, Long Live the Kings, Hood Canal Salmon Enhancement Group, WDFW, Skokomish Tribe, US Forest Service, University of Washington, Evergreen State University, and Point No Point Treaty Tribes

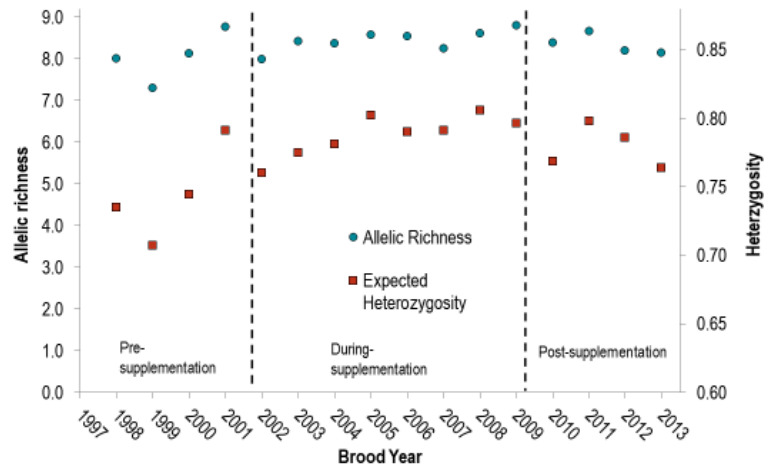
Eggs were collected from wild steelhead redds, the fish reared to maturity and spawned, and the subsequent progeny released as smolts. Releases occurred in the Hamma Hamma River from 2002 through 2009, and in the Dewatto, Duckabush, and Skokomish Rivers from 2011 through 2018.

To assess what would have happened in the absence of the hatchery conservation programs, steelhead were monitored but no releases of smolts occurred in the Little Quilcene River, the Dosewallips River, Big Beef Creek, and Tahuya River. Abundance, growth, diversity, and many other characteristics of steelhead will be monitored through 2022.

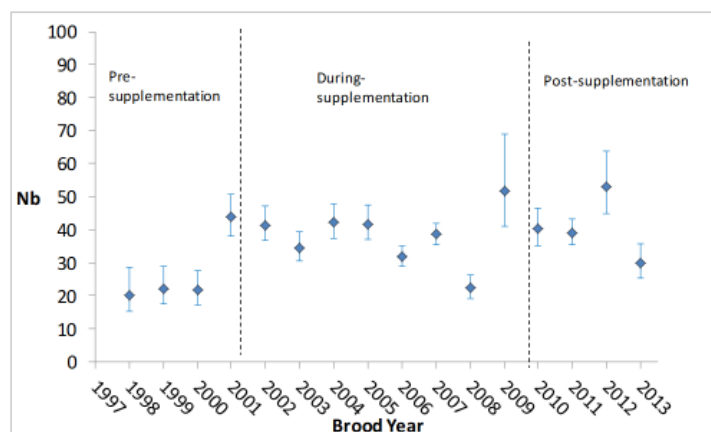
Initial results in the Hamma Hamma River were encouraging with genetic diversity (top figure) and the effective number of breeders (bottom figure) increasing both during and post supplementation. Different responses are anticipated in different environments and with different stocks.

We strongly support this study and recommend that the Department use the results to inform the design and implementation of hatchery conservation programs.

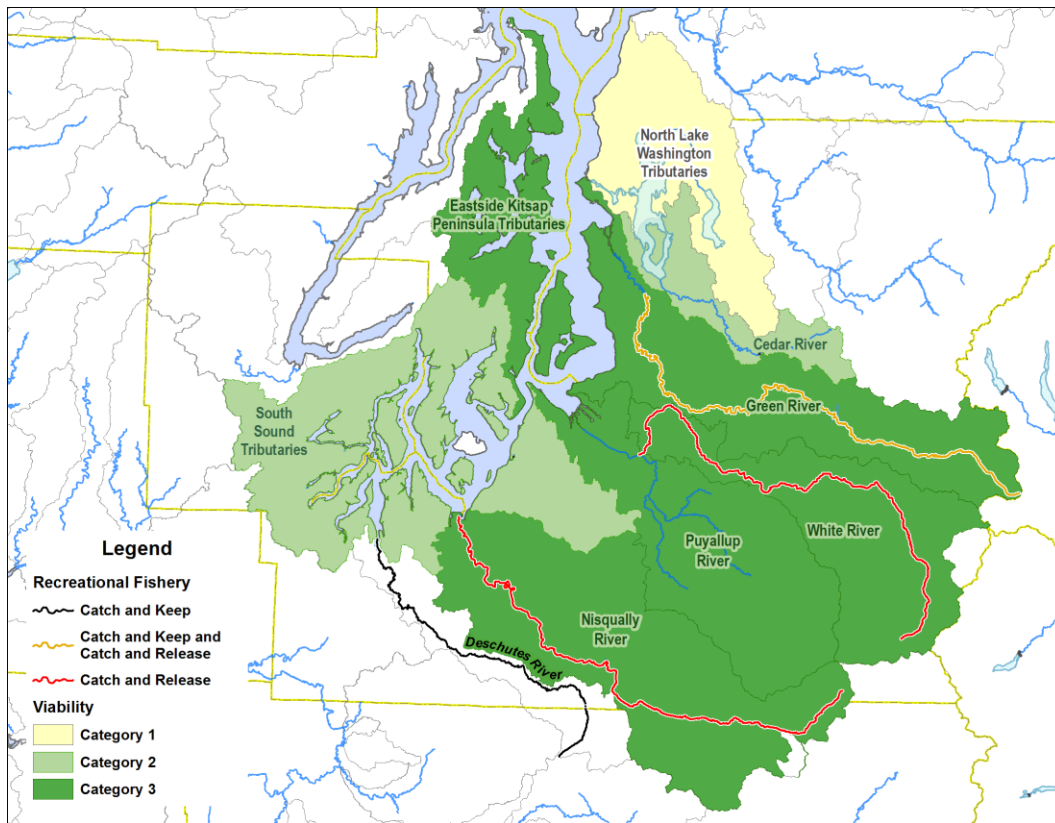
Genetic Diversity in the Hamma Hamma River pre-, during-, and post-supplementation.



Effective Breeders in the Hamma Hamma River pre-, during-, and post-supplementation.



Central and South Puget Sound



Location	Abundance Index	Wild Catch & Release	Wild Broodstock	Segregated Hatchery Harvest
Sammamish	NA			● 225 days \$48,000
Cedar	0.1%		● Conserv. Program	
Green	6%	● 3,100 days \$660,000		● 3,600 days \$760,000
Puyallup	5%	● 2,100 days \$450,000	▧ Conserv. Program	
White	5%			
Nisqually	5%	● 3,100 days \$660,000		
Deschutes	NA			● 500 days \$110,000

● ESA Approved ▧ ESA Review Pending
● High priority for co-manager discussion ● Lower priority for co-manager discussion

Introduction

Many of the rivers in the Central and South Puget Sound region have been substantially degraded by poorly planned development and industrial-scale logging during the 1900s. Dams on the Cedar, Green, White, and Nisqually Rivers have reduced access to historical habitat or substantially altered river processes. The Nisqually and White rivers likely have the greatest potential for rebuilding wild steelhead runs and extensive restoration efforts are underway. However, steelhead runs throughout the region are low.

With this backdrop, the QuickSilver portfolio recommends:

- 1) The use and evaluation of hatchery conservation programs to maintain and rebuild winter steelhead runs on the Green and White Rivers, and the reintroduction of winter steelhead in the Cedar River. After the conservation objectives have been achieved, and if monitoring and evaluation demonstrate that these programs can be operated in a manner that does not impede achievement of recovery objectives, the programs should be considered for transition to a dual purpose conservation and harvest program.
- 2) Maintaining a summer steelhead program on the Green River, and initiating two early winter steelhead programs to provide catch and keep fishing opportunities. The early winter programs would be located where rebuilding the wild steelhead populations is unlikely (Sammamish River) or in a location where wild steelhead were not historically present (Deschutes River).

Viability Criteria

The recovery plan establishes the Green Winter Run, Nisqually Winter Run, and either the Puyallup/Carbon Winter Run or the White River Winter Run as category 3 (highest viability). Given the extensive development in this region and uncertainties of protective or restoration actions, we recommend the identification of both the Puyallup/Carbon and White as category 3 populations. We also recommend identifying for the highest level of viability a population with a “Lowland” hydrologic regime to increase the diversity of habitat types associated steelhead life histories. The East Kitsap tributaries is the best candidate based upon geographic isolation from the Seattle-Tacoma-Olympia corridor.

The remainder of the populations currently have few, if any steelhead. We recommend the Cedar River Winter Run and South Puget Sound Tributaries Winter Run as category 2, and North Lake Washington and Lake Sammamish as category 1 (lowest level of viability).

Our recommended portfolio exceeds viability criteria for this region identified in the recovery plan:

Geometric Mean Viability \geq 2.2: Yes (2.36)

At least 50% Viability Category 3: Yes (62%)

Portfolio

The portfolio for Central and South Puget Sound recognizes that habitat degradation and past fishery and hatchery management have substantially reduced the abundance of wild steelhead. Wild steelhead broodstock programs have the potential to be an effective tool for the reintroduction and rebuilding of depleted runs, but must be carefully monitored. Segregated early winter and early summer hatchery

programs can be used to provide catch and keep fisheries, but they must be operated consistent with the Statewide Steelhead Management Plan and the federal recovery plan.

Wild Steelhead Catch & Release Fishery

The Nisqually, Puyallup/White, and Green Rivers provide the greatest potential for future catch and release fisheries in this region. Spawner levels were very low in the late 2000s and sustained increases in the number of spawners will be necessary before low impact fisheries can be implemented. Additional information on each of these rivers is provided in the following sections.

Nisqually River. The Department designated the Nisqually River as a Wild Steelhead Management Zone in 2016. Substantial habitat protection and restoration actions, active engagement of the community through the Nisqually River Council, and the absence of releases of any hatchery-origin steelhead into the Nisqually River since 1982 were among the reasons the Department cited for this designation.

The river is currently closed to fishing for steelhead and a sustained increase in steelhead spawners will be necessary before low impact fisheries can be implemented. The previous escapement goal for Nisqually River winter steelhead was 2,000 spawners, and the estimated spawners increased to as high as 2,000 spawners in 2016.

Puyallup and White Rivers. Recent actions to improve fish passage at the Buckley Diversion Dam, improved river flows resulting from the Muckleshoot-Puyallup-Cascade Water Alliance agreement, and the significant proportion of the basin in public ownership make the White River a good candidate for rebuilding wild steelhead runs.

Both Puyallup and White Rivers are currently closed to fishing for steelhead and a sustained increase in steelhead spawners will be necessary before low impact fisheries can be implemented. For the White River, the previous escapement goal was 974 steelhead and spawner levels reached more than 800 fish in 2016.

Green River. The Green River likely historically supported one of the largest steelhead run in this region. Substantial habitat degradation, including the blockage to fish passage created by the Howard Hanson Dam, have resulted in the number of spawners dwindling to less than 500 fish in 2009 and 2010. The numbers of spawners increased in subsequent years, but a sustained increase will be necessary before a low impact fishery may be feasible. The previous escapement goal was 2,000 spawners.

Hatchery Programs Supporting Conservation or Harvest

Wild steelhead broodstock programs currently occur on the Green River (operated by WDFW) and the White River (operated by Muckleshoot Indian Tribe (MIT) and Puyallup Tribe (PT)). The PSSAG proposes the initiation of a program to reintroduce winter steelhead in the Cedar River. We suggest a two-cycle reintroduction program followed by eight additional years of monitoring to test these hypotheses. The approach would be modelled after the conservation hatchery program implemented in Hood Canal (Berejikian 2018).

Opportunities for catch & keep fisheries in this region are currently limited to a summer steelhead fishery in the Green River. The PSSAG evaluated many options to increase catch and keep fisheries, but the low abundance of wild steelhead populations in this region limits the potential locations and program sizes.

Until wild steelhead populations abundance increases, we recommend a pragmatic approach of initiating new early winter steelhead programs where rebuilding wild steelhead populations is unlikely (i.e., category 1) or in rivers where wild steelhead were not historically present. To contribute to the portfolio for this region, we suggest initiating early winter hatchery programs in North Lake Washington and in the Deschutes River. The hatchery programs are summarized in Table 2 and additional information on the proposed new programs can be found in Part II (appendices) of this report.

Table 2. Summary of hatchery programs contributing to portfolio for the Central and South Puget Sound region.

Watershed	Program Operator	Purpose	Type	Run Timing	Current Release	Proposed Release	Comments
Sammamish	WDFW	Harvest	Segregated	Early Winter	-	30,000	
Cedar	WDFW	Conservation /Harvest	Integrated	Native-Timed	-	25-50,000	Broodstock source would be Green R.; and program would not be initiated until at least 2,000 steelhead spawned in the Green R. for 4 consecutive years.
Green	WDFW & MIT	Conservation /Harvest	Integrated	Native-Timed	55,000	100,000	
Green	WDFW	Harvest	Segregated	Early Summer	100,000	100,000	
White	MIT & PT	Conservation /Harvest	Integrated	Native Timed	60,000	60,000	
Deschutes	WDFW	Harvest	Segregated	Early Winter	-	50,000	

Northern Cascades



Location	Abundance Index	Wild Catch & Release	Wild Broodstock	Segregated Hatchery Harvest
Nooksack ^{1/}	9%	● 5,800 days \$1,230,000	● Conserv. Program	● 1,600 days \$340,000
Samish	18%	● 1,100 days \$230,000		
Skagit ^{2/}	55%	● 15,000 days \$3,200,000		
Stillaguamish	2%	● 4,800 days \$1,010,000		● 4,800 days \$1,010,000
Snohomish (winter)	7%			● 21,100 days \$4,480,000
Snohomish (summer)	5%		▧ 10,900 days \$2,300,000	

● ESA Approved ▧ ESA Review Pending

● High priority for co-manager discussion ● Lower priority for co-manager discussion

^{1/} The segregated program will be terminated when the wild broodstock programs receive ESA-approval.

^{2/} Abundance index based on interim recovery target of 15,000.

Introduction

The Northern Cascades region includes the largest and most diverse populations in the Puget Sound DPS, including most of the remaining populations of summer steelhead. The recovery plan identifies summer steelhead populations in the South Fork Nooksack, Deer Creek, Canyon Creek, North Fork Skykomish, and Tolt Rivers. With the exception of the Tolt River, little is known about these populations. The PSSAG recommends that the co-managers secure resources and direct assessment efforts toward these rivers so that management and restoration actions can be developed and evaluated.



NMFS approved in 2018 a co-manager resource management plan that allows for a recreational catch-and-release fishery in the Skagit River directed at wild steelhead, a first for Puget Sound. Catch-and-keep fisheries occur in the Nooksack, Stillaguamish and Snohomish Rivers for early winter steelhead.

Included in the **QuickSilver** portfolio are the following recommendations:

- 1) Initiate a pilot wild broodstock program on the Nooksack River to evaluate the effectiveness of a hatchery conservation program to maintain and rebuild the wild winter steelhead run. After the conservation objectives have been achieved, and if monitoring and evaluation demonstrate that this program can be operated in a manner that does not impede achievement of recovery objectives, it should be considered for transition to a dual purpose conservation and harvest program. Terminate the Nooksack early winter program one year after the wild broodstock program has been permitted by NMFS.
- 2) Evaluate the catch-and-release fishery in the Skagit River and determine the effectiveness in meeting fishery and conservation objectives.
- 3) Prepare for the implementation of low impact fisheries on wild steelhead, including recreational catch-and release fisheries, in the Nooksack, Samish, and Stillaguamish Rivers.
- 4) Implement the early winter steelhead programs on the Nooksack, Stillaguamish, and Snohomish rivers consistent

NORTHERN CASCADES DIVERSITY

The Northern Cascades region includes the largest and most diverse populations in the Puget Sound DPS, including the only remaining populations of summer steelhead.

The PSSAG recommends that the co-managers secure resources and direct assessment efforts toward these rivers so that management and restoration actions can be developed and evaluated.

Photo: Trout Unlimited

with the Statewide Steelhead Management Plan and requirements of the biological opinion. Terminate the Nooksack early winter program when the wild broodstock program has been permitted by NMFS.

Viability Criteria

Given the importance of these populations, the uncertainty of habitat protection and restoration, and climate change, the PSSAG recommends that all populations be defined as category 3 (highest viability) with the following three exceptions:

North Fork Skykomish. The genetic structure of the historical population has been affected by gene flow from the early summer program at the Reiter Hatchery. We recommend a category 2 for this population.

Drayton Harbor Tributaries Winter Run. The watersheds where this population existed historically have been substantially degraded and few, if any steelhead, remain. The PSSAG recommends a category 1 for this population.

Baker River Summer/Winter Run. This historical population has likely been extirpated by the dams on the Baker River. The PSSAG recommends a category 1 for this population.

Our recommended portfolio exceeds viability criteria for this region identified in the recovery plan:

Geometric Mean Viability \geq 2.2: Yes (2.55)
At least 50% Viability Category 3: Yes (82%)
At least one Summer/Winter Run Category 3: Yes (2)

Portfolio

Just as in the other regions of the Puget Sound DPS, steelhead runs in the Northern Cascades are a small fraction of the historical level. Protection and restoration of wild steelhead must remain the priority, but the slightly better status of some runs provides more short-term options for fisheries.

The re-opening of the catch-and-release fishery on the Skagit River in 2018 provided an opportunity to fish for wild steelhead on one of the renowned rivers of the west coast. To complement this unique fishery the PSSAG recommends early winter steelhead programs to support catch-and-keep fisheries, and the initiation of a wild winter steelhead broodstock program. Options for additional low impact fisheries, including recreational catch-and-release fisheries in the Nooksack, Samish, and Stillaguamish may be possible if further increases in abundance are sustained.

Wild Steelhead Catch & Release Fishery

In addition to the Skagit, the Nooksack, Samish, and Stillaguamish Rivers provide the greatest potential for future catch and release fisheries in this region. Spawner levels were very low in the late 2000s and sustained increases in the number of spawners will be necessary before low impact fisheries can be implemented. Additional information on each of these rivers is provided below.

Nooksack River. The river is currently closed to fishing during the return time period for wild winter steelhead. Estimating the number of spawners has historically been extremely challenging. Recent estimates indicate an escapement of approximately 1,700 – 2,000 fish, or about 40% of the previous escapement goal of 3,700.



Samish River. The Samish River is a good candidate for a catch-release fishery as the spawning escapements in recent years have been near or above the previous escapement goal of 700 fish.

Skagit River. The co-managers received ESA-approval of a 5-year resource management plan for a steelhead fishery in the Skagit River in 2018. The PSSAG encourages the Department to manage this fishery conservatively and to carefully monitor impacts to ensure that Skagit steelhead continue rebuilding.

Stillaguamish River. The river is currently closed to fishing during the return time period for wild winter steelhead. Recent escapements estimates have averaged approximately 2,000 fish, or about 65% of the current escapement goal of 3,059 spawners.

Hatchery Programs Supporting Conservation or Harvest

We recommend a multi-pronged initiative to improve stock assessment and test conservation hatchery programs for steelhead in the Nooksack River. Uncertainty exists in the estimated number of spawners due to the challenges of counting steelhead redds in this glacial river. To reduce this uncertainty, we recommend conducting a pilot study to test the use of sonar to count returning adult steelhead.

The PSSAG is interested in determining whether a wild broodstock program could help rebuild wild Nooksack winter run. Testing the potential to restore early-timed winter steelhead could be particularly beneficial given the concerns about the loss of this run-timing component. If the program proves successful and if monitoring and evaluation demonstrate that the program can be operated in a manner that does not impede achievement of recovery objectives, it should be considered for transition to a dual purpose conservation and harvest program.

SKAGIT RIVER

The re-opening of the recreational catch-and-release fishery on the Skagit River in 2018 provided an opportunity to fish for wild steelhead on one of the renowned rivers of the west coast.

“Steelhead fisheries are an important part of our cultural heritage on the Skagit River, and historically provided an important boost to the local economy. The portfolio is a step toward restoring our steelhead and steelhead fisheries.”

David Yamashita & Curt Wilson
Wildcat Steelhead Club

Photo: Chris Senyohl

Positive results from concurrent testing of a wild broodstock program could provide the basis to implement a mark-selective fishery in the future.

Catch-and-keep fisheries for winter steelhead are supported by ESA-approved early winter programs on the Nooksack, Stillaguamish, and Snohomish Rivers. Return rates for the Nooksack River program have been low, and the PSSAG recommends ending this program one year after the proposed wild broodstock program has been permitted. The hatchery programs are summarized in Table 2 and additional information on the proposed new programs can be found in Part II (appendices) of this report.

Table 3. Summary of hatchery programs contributing to portfolio for the Northern Cascades region.

Watershed	Program Operator	Purpose	Type	Run Timing	Current Release	Proposed Release	Comments
Nooksack	WDFW	Harvest	Segregated	Early Winter	150,000	0	The PSSAG recommends termination of the early winter program one year after the wild broodstock program is permitted.
		Conservation /Harvest	Integrated	Native Timed	-	TBD	
Stillaguamish	WDFW	Harvest	Segregated	Early Winter	130,000	130,000	
Snohomish	WDFW	Harvest	Segregated	Early Winter	241,600	241,600	
Snohomish	WDFW	Harvest	Segregated	Early Summer	116,000	0	The early summer program is scheduled to be phased out with the last releases in 2022.
		Conservation /Harvest	Integrated	Native Timed	-	116,000	

Additional Recommendations

Skagit. We received multiple presentations regarding the potential initiation of a wild steelhead broodstock program to enhance fishing opportunities on the Skagit River (summarized in Table 4). Public comments provided during the Department’s process to identify Wild Steelhead Management Zones demonstrated strong angler support for managing the Skagit for wild steelhead, but there are also some anglers who would a hatchery to support a harvest fishery. Concerns exist regarding the initiation of a hatchery program. These include conservation risks (competition, reduced productivity) as well as the potential to reduce the length of the fishing season when abundance is low.

Table 4. Summary of analyses presented by the Department regarding a potential wild steelhead broodstock program in the Skagit River.

Major Topic	Subtopic	Summary
Description	Purpose	Harvest - support catch & keep fishery
	Number Released	Maximum program size of 200,000 with current infrastructure
	Broodstock Origin	Natural-origin broodstock collected above the Sauk River
	Release Strategy	Volitional release, primarily age 2 smolts
Cost	Total Operating Cost	Estimated annual cost of program is \$208,024. NMFS may require additional monitoring programs that would increase the cost of the program.
Recreational Fishery	Catch	~60 to 400 depending upon abundance of wild steelhead
	Season Length	Hatchery program projected to reduce the length of the recreational fishing season when the abundance of wild fish is less than 6,000.
	Economic Value	Hatchery program projected to reduce the economic values of the recreational fishery when the abundance of wild fish is less than 6,000.
Ecological Effects	Competition & Predator Attraction	Negative correlation between number of hatchery fish released and productivity of wild population, based on retrospective analysis of former early winter segregated program at Marblemount Hatchery.
Hatchery Origin Spawners	Proportion Hatchery Origin Spawners (pHOS)	1) SSMP: pHOS maximum 0.30 2) Returning Adults – projected pHOS of 0.029 3) Residuals & Precocious Males - projected pHOS of 0.13 ^{1/} 4) Total(adults and residuals) pHOS of ~0.16 ^{2/}
Genetic Effects	Proportionate Natural Influence (PNI)	1) SSMP: PNI minimum 0.70 2) Returning Adults – projected PNI of 0.97 3) Residuals & Precocious Males – projected PNI of 0.89 4) Total (adults and residuals) PNI of 0.86 ^{3/}

^{1/} pHOS will likely vary according to wild population demographics, residualization rate and survival.

^{2/} Sensitivity analysis based on residual and precocious males assumptions suggests plausible range for total pHOS of approximately 0.06 – 0.27. pHOS values higher than this range would likely require exceedingly low wild anadromous adult abundance (< 2000).

^{3/} Variation in pHOS estimates (footnotes 1 & 2) would have cascading effects on PNI.

We discussed these risks and benefits in detail, and recommend the following course forward.

- Beginning in 2024, an annual assessment of fisheries and progress toward recovery will be initiated. Information to be discussed would include runsize, spawners, river-entry and spawn timing and spatial distribution, and fishing opportunity. By 2028, new information will be available to evaluate the performance of wild Skagit steelhead both with respect to recovery goals and fishing opportunity subsequent to the termination of the early winter steelhead program. We recommend that new management strategies, such as a wild broodstock hatchery program, not be implemented prior to that time.
- The Department should work with the PSSAG to more clearly define an adaptive framework with the PSSAG meeting each year to review the performance of the fishery and Skagit steelhead. Information that would inform the discussion would include:
 - Runsize, spawners, and other Viable Salmonid Population attributes – has the status of the population improved, degraded, or stayed about the same? In reviewing this information, recognize that the drought and Blob are likely to have a detrimental effect on steelhead returns in 2018 and 2019.
 - Recreational fishing season – was a full recreational season provided with a catch and release fishery?
 - Status of habitat – has the habitat been maintained, improved, or degraded?
- Establish the Sauk as a Wild Steelhead Management Zone.

Deer Creek and Stillaguamish Summer Steelhead. The Department terminated an early summer steelhead (Skamania-origin) hatchery program on the Stillaguamish River in the spring of 2019. Although return rates from the hatchery releases were low, fly fishing for summer steelhead was popular with many anglers. Immediate options for replacing the program are limited by the lack of an appropriate broodstock for a hatchery program, and an absence of information on the abundance of wild summer steelhead. We recommend that the Department aggressively work to test methods to estimate the number of summer steelhead in Deer Creek. Snorkeling, mark-recapture, and sonar are all methods that have worked in other locations and one or more of these methods should be immediately tested. When three years of escapement estimates are available, the PSSAG recommends identifying the steps necessary to restore a summer steelhead fishery.

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