Dan Van Dyke, Steve Mazur, Chris Lorion, Tom Stahl, Shaun Clements
Oregon Department of Fish and Wildlife
4034 Fairview Industrial Dr SE,
Salem, OR 97302

Chrysten Lambert
Dean Finnerty
Trout Unlimited
1777 N. Kent Street, Suite 100
Arlington, VA 22209

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RE: Stakeholder comments on the Rogue-South Coast Multi-Species Conservation and Management Plan – First Draft

Trout Unlimited (TU) appreciates the effort put in by ODFW to convene the stakeholder group and develop the Rogue-South Coast Multi-Species Conservation and Management Plan (RSP), and this opportunity to provide comments on the draft plan. TU hopes the enclosed comments provide constructive input to the draft plan and our comments can be incorporated in the final document. These comments not only reflect our role as a stakeholder on the Rogue Stratum and South Coast Stratum workgroups but are also on behalf of our over 3,000 members in Oregon and over 300,000 members and supporters nationwide.

There is a long and storied history of steelhead angling in the Rogue and South Coast. Steelhead were once the most valuable anadromous fish in the region (Lauman 1972) with summer steelhead commanding most of the popularity. At that time, steelhead brought in nearly twice the annual revenue to compared to salmon species combined, and their population was nearly all wild. TU and its members are strongly interested in maintaining and rebuilding the storied wild steelhead fisheries on the Rogue and other South Coast rivers. We are also vested in protecting and restoring wild coho runs in the region, however we focus less on them here for several reasons. Since the Southern Oregon and Northern California Coho (SONCC) ESU is listed as threatened, these populations have already gone through a lengthy review identifying limiting factors and recovery strategies. Additionally, we anticipate that any fishing and hatchery actions for coho will undergo a thorough review process by NOAA with additional opportunity for public input. While cutthroat are an important native sport fish, their populations appear to be relatively healthy and do not have the same fishing and hatchery stressors that steelhead do.

Overall, the RSP contains many actions which TU agrees with and supports. However, we feel there are important gaps that place excessive risk on wild, native fish populations. These comments focus primarily on the Hatchery Actions and Fishing Actions sections. We feel the actions in these sections have the most direct effect on the biology and ecology of RSP species, and thus are of critical importance to the long term persistence and resilience of these populations.

The RSP acknowledges that there is a high degree of uncertainty in the current and future status of anadromous salmonids on the Rogue and South Coast. TU appreciates the difficulties of designing management plans, in the face of this uncertainty, that provide a range of fishing opportunities while ensuring wild populations remain stable or are allowed to rebuild. In order to accomplish these goals an abundance of caution is required when setting management targets. This is particularly true when there are critical information gaps regarding population trends and effects of management actions. Indeed, ODFW's Climate Change Policy highlights the need to approach management actions with caution due to the uncertain effects of climate change. Not accounting for the uncertainty and lack of biological information can place tremendous risk on some or all populations. Further, when there is a disparity in the health of populations, there are wide swings in abundance, and some populations may be below carrying capacity these risks are increased. For these reasons it is necessary to manage cautiously in the naer term until better data is collected and population health and fishery effects can be closely monitored.

Desired Status - Page 31-33 RSP

We feel the goal of maintaining the status of summer steelhead as sensitive is too low of bar and would like to see goals of increasing this to strong-guarded and strong. We appreciate that ODFW has put together a goal of increasing the status of coho to sensitive from sensitive- critical, but we feel it would also be beneficial to see this goal increased. This should include a list of actions that would need to be taken and what population metrics would be used to achieve strong guarded and strong designations. We recognize there are challenges to these populations that are related to habitat loss and climate change that are unlikely to be reversible. However, ODFW (2001) concluded that summer steelhead habitat was not fully seeded, indicating there were factors in addition to habitat limiting population productivity. Without aspirational goals and a list of actions needed to achieve them it will be more difficult to design management plans and restoration actions that can address primary limiting factors. Furthermore, the money spent to protect, restore and improve access to habitat throughout the Rogue Basin is intended to increase the abundance and resilience of wild populations. Not providing aspirational goals could create the appearance that we are simply managing to avoid extinction or ESA listings. While we don't expect this is ODFW's intent, we are concerned about the lack of aspirational goals and the message it sends.

Limiting Factors - Table 8. - Page 35

Hatchery Introgression – At a minimum this should be listed as a potential limiting factor for all populations with hatchery releases, although a primary or secondary limiting factor would likely be more appropriate. The estimates of PHOS provided in the RSP and supporting documents should be considered minimums and are likely significant underestimates for some populations and areas. This is due to a lack of accounting for uneven spatial distribution of adults, mature residual males and half pounders. Averaging PHOS estimates across multiple populations and broad spatial scales is not an appropriate way to evaluate PHOS and can produce misleading results. PHOS estimates should be generated at population levels and must include contributions from mature half pounders and residual males. We appreciate that ODFW is proposing to conduct several PHOS monitoring and research activities, which further suggests hatchery production should be indicated as a limiting factor.

Hatchery Competition – The RSP acknowledges that there are many residual steelhead in the Upper Rogue and likely in the Applegate, but only identifies this as a potential factor. There is abundant research on the negative interactions between immature residual hatchery and wild juveniles. This should be considered a primary or secondary factor for the Upper Rogue. We appreciate ODFW's interest in collecting more information on residual steelhead in the Applegate, however that is not reflected in table 8, at a minimum this should be a potential limiting factor. The proposed surveys around off-station release sites and acclimation facilities should include snorkeling or other methods which can identify small individuals to determine the number of residual hatchery steelhead which are distributed more widely throughout the watershed.

Harvest – Harvest is not listed as a potential limiting factor for any population, however there is considerable debate about the ability of the populations to support proposed levels of harvest. The effects of past harvest can persist even after it is stopped, particularly if stressors such as incidental fishing mortality and interactions with hatchery fish are not alleviated (Chilcote 2003). In the case of summer steelhead, hatchery production increased at the same time wild harvest was restricted. Given that ODFW found summer steelhead are below carrying capacity in the Middle and Upper Rogue (ODFW 2001) we feel it is critical that ODFW improve their modeling to generate better estimates of habitat capacity and productivity for each population. Without population specific data it is entirely possible that other populations of steelhead or coho are under seeded. We feel this is especially true for smaller coastal populations which are likely more sensitive than larger populations. The proposed target of an average harvest rate is further concerning because this does not account for natural fluctuations in abundance and could result in dramatic overharvest in some years. A better method would be based on biological goals for each watershed, e.g., escapement goal. In addition to modeling abundance and productivity this effort should include parameters for spatial distribution as described in greater detail later in these comments. We feel it is imperative that harvest is included as a potential limiting factor for all populations with proposed wild steelhead harvest fisheries, and especially in the smaller streams.

<u>Temperature</u> – Temperature is listed as a primary limiting factor in the Illinois, Middle and Upper Rogue stratums. We agree with this distinction for Coho but have some concerns for its application to steelhead. Steelhead are much more thermally tolerant, in some cases surviving summer temps of 30°C (86°F). It is important that upper incipient lethal temperatures are accurately described when assessing potential distribution and prioritizing habitat for protection and restoration. Some areas which may become unsuitable for coho could still sustain steelhead through the summer months. We did not see an area in the plan which addresses the differences in thermal tolerance between coho and steelhead juveniles and feel this is an important distinction that should be recognized in the final plan.

Table 17 - Page 72 RSP

A 15% harvest rate for the Rogue and Chetco was agreed to by consensus in the Rogue Stratum stakeholder group, however we view this as a compromise predicated on conducting the necessary monitoring and evaluation to assess the individual harvest rates in each population. A consensus was not reached on the other populations and we continue to have concerns about the risks placed on these smaller populations by harvest fisheries. We feel there are several issues and uncertainties which need to be addressed prior to implementing this plan and have covered them in more detail later in these comments. Additionally, there are two outstanding issue we did not see covered anywhere in the RSP or appendices.

- How is incidental fishery mortality going to be determined for summer and winter steelhead and what is the incidental mortality rate that will be used.
- A clear statement that incidental mortality will be included in the 10-15% allowable harvest rate.

Monitoring and Research Actions - pages 84-90 RSP

TU is generally supportive of the actions in this section and appreciates the work of ODFW staff to develop these proposals. We feel that the actions listed in the monitoring and research sections could be most effective if they were incorporated into larger integrated plans. Some of the actions are lacking a consistent basin wide strategy which might limit their usefulness in collecting data for multiple populations. For instance, creel surveys are proposed for the Upper and Lower Rogue, and possibly the Applegate but not the Middle Rogue, and effort surveys may be done on the Illinois. Also, wild steelhead catch is only stated to be collected for the Upper Rogue and we view this as an important piece of data that should be collected for all populations. A larger creel survey plan that included a regional creel survey estimate and guide logbooks for all populations could also help streamline and maximize the use of limited funding rather than parsing it out over several projects. Research and monitoring plans with prioritization of actions and clear timelines could also help with securing funding from the legislature, especially if these projects are tied to clear management outcomes of maintaining and rebuilding wild stocks and ensuring sustainable fishing opportunity.

Prioritizing research and monitoring actions may be most effective if there is a clear goal that all actions contribute to. For instance, a specific population dynamics model is chosen, this could be the Hockey Stick function used in the RSP or another ODFW deems appropriate for this region. Missing parameters or areas of significant uncertainty could then be identified, and research actions would be prioritized to answer these questions with specific timelines leading to a fully developed model at the 12 year review. ODFW has already identified and laid out much of the work that needs to be done to accomplish this, e.g., population estimates, creel surveys, etc. However, we did not find a clear goal stated in the RSP that encompasses all of the proposed actions into clear, cohesive plans. We recognize that ODFW staff has tremendous local knowledge that led into the development of the listed actions, and goals and strategies may be clearer to them. Still, we feel the RSP would be stronger with clearer language laying this out. Additionally, TU would be interested in assisting in the further development of research and monitoring plans and helping to secure funding from the legislature to implement them.

Coastal Stratum Monitoring Actions – pages 84-85 RSP

V.A.2 – We appreciate ODFW is planning to generate winter steelhead population estimates for individual watersheds, we feel this is a critical first step in data collection for these populations. Additionally, we would like to see the following modified in the next draft of the RSP:

- Near term actions – Escapement goals and/or adult population abundance thresholds in our mind remain a critical component of determining minimum run size thresholds to allow harvest or catch and release fishing, or even fishery closures as needed. We recognize that without existing population size data this would present some challenges to develop. However, we propose that ODFW's AQI data be used to generate estimates of habitat capacity for each watershed and the various population goals could be based off of that effort. This would be most effective in small coastal watersheds without the complexity of the Rogue River.
- We do not support using the QET values as triggers for conservation actions because of the inherent risk that is present when populations reach or even near that level, particularly when in season monitoring of fisheries is not feasible. Rather, we would like to see conservation thresholds set higher, particularly in large watersheds like the Rogue and Chetco where a drop to 150 -250 individuals represents a much greater decline than in coastal watersheds with smaller populations.
- Future Actions – We appreciate ODFW's commitment to further develop population goals. However, we do not feel it is prudent to wait for the 12 year review of the plan to develop these goals as proposed. Rather, the 12 year timeline should be to use data collected from the research and monitoring actions in the RSP to refine the existing biological goals up or down.

V.A.3 – V.A.4 – TU strongly supports the expanded use of Sonar for enumerating fish populations, and we appreciate ODFW's proposed adoption of this technology. We also feel that snorkeling has merits for evaluating PHOS but it is highly dependent on methods, i.e., number of surveys conducted annually, and it should be one component of a larger evaluation plan. Potential merits of snorkel surveys are the ability to examine the spatial extent of residual hatchery fish that could be mature and spawning naturally or competing with wild juveniles and better understand the distribution of naturally spawning adult hatchery fish. We request that ODFW address those two points when they develop a monitoring plan. As covered in greater detail below we would like to see PHOS evaluated mathematically for the Chetco and Rogue in addition to visual estimation methods which can be limited in ability to detect hatchery fish.

V.A.5 - V.A.6 – The effects of fishing on wild populations are not limited to direct harvest, as acknowledged in the RSP. Because of this we strongly feel the creel surveys should also collect information on how many wild steelhead are caught and released. Incidental fishery mortality is a fundamental component of any harvest management plan and the proposed creel surveys provide an avenue using established methods to collect this data. An additional data point that would provide valuable information would be determining the percentage of hatchery fish which are repeat spawners from the proposed scale sampling.

Rogue Stratum Monitoring Actions – pages 85-87 RSP

V.B.2 and V.B.3 – We are concerned with the lack of commitment from ODFW to generate population estimates for each population within the Rogue Basin. While index counts can provide some information about trends, this is insufficient in populations subject to harvest. It is not indicated in the plan what the frequency of the index surveys will be, in the recent past they have not been conducted within the typical 7-10 day resurvey window used by OASIS, which limits their ability for population inferences. Furthermore, ODFW has not fully committed to annual spawning surveys for the Illinois River. A lack of robust population estimates for steelhead populations which are subject to harvest was highlighted as a significant problem by many individuals and organizations prior to and during the stakeholder process. It appears that out of the six designated populations in the Rogue, total abundance will only be estimated for Upper Rogue winter steelhead. This is concerning since four of the six populations are open for harvest of wild steelhead. We realize population estimates are challenging in large watersheds but would like to see alternatives for how estimates could be reliably estimated.

V.B.6 - V.B.8 – These actions contain several good aspects TU strongly supports. We feel that they are lacking a consistent basin wide strategy however and that could limit their usefulness. We support the actions listed in these sections being expanded in time and scope and included in a regional creel survey effort. By developing a consistent and robust creel sampling strategy with a larger scope we feel that the usefulness of the data would be maximized. A single creel survey plan could also help streamline and maximize the use of limited funding rather than parsing it out over several projects.

V.B.11 – Only winter steelhead and Coho are listed here which is puzzling since summer steelhead and coho are likely the two populations which will be most affected by changes in flow and temperature. Steelhead have much higher freshwater thermal tolerances than Coho but summer steelhead are likely the most susceptible to flow since they have adapted to use many intermittent streams. Earlier onset of summer resulting in earlier drying of these streams may have negative effects on summer steelhead, and at a minimum will likely result in changes to spawn timing. Thus, we think it is imperative that summer steelhead be included in this section.

Coast and Rogue Stratum Research – pages 87-90 RSP

V.D.2, V.D.3, V.D.5 - V.D.7 – In general we support what is proposed for research in these sections. One theme that we think would have particular value is tailoring research to take advantage of the wealth of information that was collected on the Rogue from the 1960's through the 1990's. This older data would provide a much longer time series of data to draw upon to better determine status and trends of anadromous salmonids, particularly summer steelhead due to the wealth of research available. We appreciate that ODFW has included this in their research section and think it would be a critical component to direct and prioritize research within a comprehensive research plan.

V.C.7 and V.D.11 – Genetic methods of measuring PHOS could provide some value for populations which are spread over a large spatial scale such as in the Rogue. However, naturally produced hatchery offspring and hatchery and wild hybrids survive at poor rates compared to wild steelhead at all life stages. This means that accurately back calculating estimates of PHOS from adult data would require estimates of the survival of naturally spawning hatchery x hatchery and hatchery x wild crosses to compare to survival of wild fish. General values are available in Leider (1990) if local values are not available. An additional data point that is necessary to collect to measure PHOS is the sexual maturity of hatchery and wild half pounders. Several studies have documented that approximately 8% of half pounders are mature, but these studies generally do not distinguish between wild and hatchery. This information can easily be determined in the late summer and fall, up to 8 months prior to spawning, with a simple blood test even though the fish would have not yet reached maturity (Larsen 2004).

Consistency with Key Principles in ODFW's Climate and Ocean Change Policy

TU is concerned that the RSP is not wholly consistent with the Climate Change Policy in several areas listed below. These areas should be addressed in the next draft of the RSP.

Climate and Ocean Change Key Principles for Species and Habitat Management (635–900– 0017)

(4) The Department should proceed with a precautionary approach that is most likely to result in conservation of native species across as broad a range of future conditions as possible, including when faced with scientific and management uncertainty.

Anadromous salmonids and steelhead in particular have an incredible ability to adapt to a range of freshwater conditions. Resilient populations that can adapt must be abundant and inhabit a variety of habitat types over the largest spatial distribution possible. There are significant data gaps regarding the potential productivity of existing habitat and the current distribution of adults across the landscape. The level of uncertainty that is present in the plan is enough that assumptions might not just miss the mark a little, they could be entirely incorrect. Thus, we feel that more caution is warranted regarding harvest and hatchery actions.

(6) The Department should plan for real time adaptive management of hatcheries, wildlife areas, and harvest to account for potential impacts to fish and wildlife populations during periods of adverse environmental conditions, such as high water temperature, low river flows, low oxygen water, or fire.

The RSP does not include provisions for in season monitoring nor does it provide a list of actions that will be taken should conservation thresholds be reached. Low flows are highlighted as a primary limiting factor, yet the plan does not provide for fishing restrictions during low flow periods throughout the year when migrating adults may be susceptible to incidental and direct fishing mortality. This can happen due to high temperatures or low flows preventing fish from ascending spawning tributaries for extended periods of time. Similarly, there is no attempt to balance hatchery production with wild abundance to ensure ecological interactions and genetic effects between hatchery and wild fish do not increase if wild populations decline.

Climate and Ocean Change Key Principles for Science (635–900–0015)

(1) The Department should ensure that it is monitoring the appropriate metrics to document the changing climate and ocean conditions (e.g., flow, temperature, dissolved oxygen, ocean pH) and the impacts of those changes on fish, wildlife, and their habitats (e.g., distribution, survival, disease).

The RSP does not explicitly state what values it is using for evaluating habitat suitability for steelhead but appears to assume that some streams will reach incipient lethal temperatures for steelhead. Given the stream temperature models we are not sure that is the case and feel it is necessary to accurately evaluate the potential thermal tolerance of steelhead before making assumptions about climate change predictions and changes in habitat use by steelhead.

(2) The Department should use appropriate analytic approaches to determine how species, biological communities, and habitats may respond to the changes in climate and ocean conditions on a time horizon that is relevant to a specific species' life history.

The PVA plays a primary role in determining the status of populations, yet it is unable to account for climate change. There is not an explicit plan in place to improve the modeling effort in the future to account for climate change scenarios or diversity and spatial distribution. The RSP would be made much stronger if it contained a research plan which laid out a path for developing biological goals which could account for the effects of climate change.

Additional Edits:

On Page 11 of the RSP it is stated that summer steelhead are capable of surviving to spawn multiple times. While this is true a more accurate statement would be to remove summer or add "and winter" to reflect that all steelhead are iteroparous.

The RSP states that they have successfully maintained separation of summer and winter life histories in the hatchery, but no details are provided. Can ODFW provide details on broodstock management techniques that have maintained isolation between summers and winters and provide a path for how that will be maintained?

The RSP does not include explicit provisions for changes to angling regulations should population status drop or if conservation thresholds are reached. Additionally, considerations for changing angling regulations in response to environmental triggers should be considered. Solutions we would like to see addressed in the plan include thresholds for run sizes where limitations on harvest would occur. Hoot owl regulations are also commonly employed to minimize angling impact on wild fish during periods of warm water where the stress of angling could increase incidental mortality rates. A less common but important environmental factor to consider is low flow. Steelhead and coho both spawn in small tributaries which can be subject to extended periods of low flow conditions during spawning seasons. During these times adults may stage for weeks, or months in the case of steelhead, near their natal spawning streams. This can increase their susceptibility to angling or lead to fish being caught multiple times (Hooten 1986) or tributary mining where certain life histories or populations are differentially harvested. Restricting angling or harvest in specific areas during these conditions can help to alleviate negative impacts from angling.

Supporting Information

We appreciate that ODFW has addressed each of the 4 Viable Salmonid Population (VSP) parameters in the RSP. However, there are shortcomings in the approaches taken with regard to answering critical questions that will allow the populations to adapt and persist through climate change.

The Population Viability Analysis (PVA) attempts to assess extinction risk of a population based on current values related to abundance and productivity. First, TU does not believe that merely staving off extinction is the goal we should all be working for. Second, the status of populations covered by the RSP is largely defined by the PVA but there are reasons that we feel these assumptions could lead to incorrect conclusions about population status. Since the PVA is based on abundance and productivity it misses important relationships that exist between the 4 VSP parameters. One important area of research is the relationship of the spatial distribution of spawners and density dependence in fry. We appreciate that ODFW cited Foldvik (2012) because this paper addresses this issue, however we don't see how ODFW plans to incorporate spawner distribution into a modeling effort which can be used to improve estimates of abundance and productivity. Below we provide some additional background on this issue and recommendations for incorporating this into improving harvest management in the RSP.

Spatial distribution of spawners has important implications for how habitat capacity is estimated, and appropriate harvest rates are determined. Specifically, not accounting for distribution of spawners can result in estimates of capacity that are below the true carrying capacity. Furthermore, it is unclear in the RSP what ODFW believes the relationship is between the productivity of individual populations and the capacity of the habitat. For instance, ODFW (2001) noted that while winter steelhead populations in the Upper Rogue and Applegate were fully seeded, Upper and Middle Rogue Summer steelhead were only 70% and 34% seeded respectively. This strongly indicates there are factors in addition to habitat driving the abundance and productivity of Rogue River summer steelhead.

Dispersal distance is an important metric because it could help improve estimates about the timing and strength of density dependence in steelhead. For example, studies on Atlantic salmon found that as a result of the sheer number of fry produced by even a single anadromous female, aggregations of multiple redds in close proximity may induce higher levels of density-dependent effects than when redds are more dispersed (Einum et al. 2008, Teichert et al. 2011). Additionally, In the Keogh River it was suggested that spatial contraction of spawners, due to poor marine survival, may have resulted in an increase in density dependent population regulation and a reduction in smolt production of steelhead (Atlas 2015). To account for this effect scientists have started incorporating spatial parameters (i.e., estimates of distribution of adults and dispersal of larvae/fry) into modeling frameworks (e.g., Finstad et al. 2013), an approach that is also being increasingly used in models for marine species (Ospina-Álvarez et al. 2013; Lowerre-Barbieri et al. 2017, 2019).

Density dependence can occur at all freshwater life stages in salmonids (Milner et al. 2003, Matte et al. 2020) but the strength of specific regulating factors can shift between discreet life stages. For example, density dependence is thought to manifest as mortality at the fry stage but influence individual growth at the parr stage (Milner et al. 2003). Elliott (1989b) described a critical period of density dependent mortality in brown trout as lasting only 30-40 days during the period of fry dispersal from the redd, after which mortality became density independent. The majority of studies which have focused on density dependence in fry are on Atlantic Salmon and brown trout, however it has been suggested that density dependent mortality occurs in the first year of life among steelhead in several studies (Hume and Parkinson 1987, Close and Anderson 1992, Ward and Slaney 1993, Keeley 2001, Sogard et al. 2009).

Keeley (2001) found that the ability of density dependence to regulate populations in age 0 steelhead is proportional to the ability to emigrate. In artificial channels where emigration was restricted density dependent effects on growth and mortality were increased over populations where emigration was allowed. The fry life stage appears unique in that during the first few weeks of life fry appear to have a limited ability to successfully disperse from the redd (Einum 2008). Our review of the literature has so far found that limited dispersal ability early in life has been suggested for steelhead, e.g., Sogard et al. (2009) but accurate measures of dispersal distance and timing are lacking. However, juvenile steelhead exhibit territory sizes most similar to Atlantic Salmon (Keeley and McPhail 1998) which may be due to both species having relatively long residence in freshwater as juveniles. This provides some support for using Atlantic Salmon as an analog for steelhead when steelhead specific research is not available. Fortunately, some dispersal information has been collected on the Elwha Rivers in Washington (unpublished data, John McMillan), and a study is beginning on the Skagit River which will collect steelhead specific data.

Similar results for steelhead could inform how we think about modeling density-dependence and generating accurate estimates of habitat capacity. For example, a stock-recruit model by Einum et al. (2008) incorporated the spatial effects of spawner dispersion and found increased dispersion of spawning adults altered patterns of density-dependent mortality and increased equilibrium adult abundance and maximum sustainable yield (MSY). Similarly, a model by Finstad et al. (2013) underestimated spawner target goals because it overestimated the amount of habitat that fry could actually reach. Lastly, the research implies that by dispersing spawners and reducing the effects of density-dependence, the estimated capacity of the watershed would be increased (Einum et al. 2008).

Without knowing the strength of density dependence at individual life-stages it is more challenging to develop management plans that sustain fisheries, establish recovery goals, and guide habitat restoration actions. For instance, the RSP identifies late summer and fall as a population bottleneck (page 48) however the largest bottleneck may have already occurred shortly after emergence. If that is the case, then addressing late summer temperatures and flows may not have the desired magnitude of effect. Rather, actions which increase the density of juveniles in fry habitat could increase recruitment to the parr stage (Mortenson 1977). If there is a discrepancy in habitat seeding between winter and summer steelhead which occupy the same general area it indicates that large scale processes such as ocean conditions, trends in freshwater habitat, or predation are not entirely to blame. Increasing the spawning distribution of summer steelhead should be a priority in the RSP and management actions that would accomplish this should be identified. The clearest way to increase adult distribution is to increase abundance in our opinion. Summer steelhead are the most susceptible to fishery actions due to their duration in freshwater (Everest 1973), which underscores the major theme of this document that without knowing the fundamentals it is impossible to adequately manage steelhead fisheries.

Snorkel Surveys and Juvenile Distribution

Using Juvenile steelhead as a metric for distribution and abundance of steelhead has significant problems that need to be addressed in the final plan. Using juvenile steelhead counts as an indicator of spawning distribution could produce results which are misleading or completely inaccurate. For example, steelhead can adapt to poor ocean survival by adjusting the frequency of their life histories. In the Utkholok river in Kamchatka a steelhead population shifted the sex ratio of resident mykiss from nearly all male to nearly equal in response to a dramatic decrease in ocean survival due to significant overharvest. Because the success of the anadromous life history, which is predominantly female, was dramatically reduced the population shifted to one dominated by resident fish (Savvaitova 2002). Snorkel surveys alone are unable to account for this type of adaptive behavior in steelhead and could result in incorrect assumptions and inaccurate pre-season forecasts. While the harvest rates were much higher in that example than what are proposed for the Rogue and South Coast, one could expect a gradient where the female resident life history would become increasingly successful as the success of anadromous females decreased. This could be due to many factors related to fishery mortality or changes in marine survival. Without monitoring sex ratios and knowing the proportion of juveniles which are the progeny of resident or anadromous parents it is impossible to determine if the juveniles which are being counted are in fact indicators of the distribution of spawning adult steelhead throughout the South Coast. Accordingly, we feel that ODFW's research and monitoring should map distribution of spawning adults within each major watershed marking redds with handheld GPS units. Snorkel surveys for juveniles could then be used to help determine the relationship between spawner and juvenile distribution, although the GRTS sampling design may not be appropriate to adequately describe a relationship between spatial distribution of redds and densities of juveniles. We would welcome a conversation with ODFW on how this type of data would be useful and could be collected within the context of a larger framework to incorporate spawning distribution into a population model. Regardless, we feel it is important to map the distribution of adults and begin working toward developing a spatial distribution model parameter.

Harvest Rate and Incidental Mortality

A 10-15% harvest rate has been applied for winter steelhead broadly across the RSP area. This puts tremendous risk on certain populations and/or life histories for several reasons. First, run sizes fluctuate, sometimes dramatically, and small populations are more vulnerable to harvest in some years than others. Additionally, Ricker (1963) expressed concern over harvesting populations with more 12-15 age groups at rates over 5%, concluding that it could negatively impact population structure and abundance, particularly with regard to older fish. Steelhead in the Klamath, which is the most analogous population to the Rogue on the West Coast, were determined to exhibit 38 different age groups (Hodge 2016). Smaller watersheds likely exhibit fewer life histories but still more than 15 which is a clear cause for concern. Further, many of the older steelhead are repeat spawners which have a higher fecundity and survival of their offspring (Christie 2018) and are an important component of a diverse and resilient population. Repeat spawning rates have declined across the range of steelhead and this is likely at least in part due to their increased exposure to harvest pressure over first time spawners (Hooten 2001). Without accurate run size predictions and a response from managers adjusting seasons or closing harvest in years when abundance is predicted to be low, we could end up harvesting far more than the 10-15% in some populations in some years. Further, this would likely occur in years with reduced run sizes when populations are the most vulnerable.

Catch and release mortality can be a significant component of the fishing related mortality in steelhead populations. This is generally incorporated in escapement estimates, for example Washington Department of Fish and Wildlife (WDFW) uses a 10% rate in all steelhead fisheries (WDFW 2008). ODFW acknowledges a 4% catch and release mortality in the RSP, we agree that this seems to be a reasonable value for what is generally reported in the literature for steelhead, although some studies have shown it can be as high as 15% (Twardek 2018). However, there is a growing body of research, including from ODFW, which suggests there are sublethal effects for anadromous salmonids associated with angling stress and air exposure (Richard 2013, Twardek 2018, Johnson 2020) which can further reduce the productivity of wild steelhead. Additionally, while most studies focus on upstream migrating adults there is a higher catch and release mortality associated with kelts and particularly with bait (Hooten 2001), and an unknown mortality rate associated with juveniles. TU feels a 10% rate consistent with WDFW (2008) is a reasonable value, but we are open to discussion with department staff.

ODFW is assuming that the timing and spatial extent of the open areas and seasons for winter steelhead in the Rogue are sufficient to protect summer steelhead however there are several reasons this may not be the case. First, documented summer steelhead spawning distributions begins at Whiskey Creek and extends upstream, with peak spawning occurring from late January to early February (Everest 1973). ODFW's online Fish Habitat Viewer shows the extent of summer steelhead distribution extending downstream to near the Josephine/Curry County Line, although it is unclear if this is documented or assumed distribution. With the harvest season proposed to open February 1st for the Upper and Middle Rogue there will still be a significant portion of the summer steelhead run in the mainstem waiting to ascend tributaries after February 1st, particularly in low water years where low flows may prevent fish from ascending spawning tributaries for extended periods of time. There will also be numerous kelts migrating downstream during this time period. Kelts begin feeding after spawning and are very susceptible to angling. Everest (1970) noted a harvest rate on summer run kelts that ranged from 1.1% to 2.7%. One only has to spend a few minutes on social media in winter to see that anglers are quite poor at distinguishing fresh fish from out migrating kelts which have lost or begun to lose their spawning colors in preparation for returning to the ocean. This indicates that some degree of summer run kelts are still likely killed in the winter kill fishery. We would like to see ODFW address how many pre and post spawn summer runs are being taken in the winter fishery. A rough estimate could be generated using the data in Everest 1970, or by sampling harvested steelhead throughout the Rogue Basin. Combining estimates of incidental catch and release mortality and harvest rates in the wild kill fishery is not only essential for monitoring status and trends of the target winter population, but of the summer population as well.

<u>The RSP does not adequately address the risks of hatchery production on wild fish in several areas.</u>

Precocious parr and resident male mykiss can provide substantial genetic contributions to wild steelhead populations (Christie et al. 2011). Hatcheries produce both residual immature males and females, which remain in the system and compete for food and resources, as well as sexually mature precocious males, which are able to spawn immediately after release (Hausch and Melnychuk 2012). Historically, precocity rates have been documented as high as 64% in hatchery steelhead (Schmidt and House 1979) although rearing practices have changed since that time and current rates are likely much lower. ODFW has reported residualism rates of about 5% and 2.5% (Jonasson 1995 and 1996 respectively) for steelhead in Little Sheep Creek. Jonasson (1995) noted the sex ratio of juveniles in the hatchery were essentially equal, yet 91% of residual steelhead were male. The majority of these fish were not mature during the first summer however many of them which survived were maturing in the fall and by spring the majority were mature. Interestingly, although the number of residual females was small, the majority of them were also mature the following spring. Hatchery programs that rear fish for one year tend to produce smaller individuals, which may have a reduced percentage of sexually mature males compared to programs which rear smolts for two years (Tattara et al. 2019). Similarly, a larger size at release has also been found to increase the rates of residualism (Partridge 1986). However, precocity rates of 2-3% have been measured in segregated hatchery programs rearing juveniles for one year and using volitional release strategies (Craig and Anderson 2018). The large size at release (4 fish per pound) which is targeted for steelhead reared at Cole Rivers indicates that they likely have a higher precocity rate than what was measured in Little Sheep Creek. Accordingly, 2% should be considered a minimum rate of precocity for steelhead hatchery programs unless a different rate is verified through additional monitoring efforts.

Residual parr appear to have a high mortality rate within the first year following release (Viola 1991, Jonasson 1995, Snow 2013) and thus many of them will not survive to reproduce the next year. However, in the Rogue and Chetco steelhead smolts are released mid-April, near the peak of spawn timing of wild steelhead, providing opportunity for precocious males to immediately spawn with wild female steelhead. It is important to note that although most residual steelhead are found within 0-10km of the hatchery (McMichael 2001; McMillan et al. 2007), they can move a substantial distance and have been documented moving 25-40 km downstream of their release site and up to 39 miles (63km) upstream (Jonasson 1994). Furthermore, USFWS (1994) reported that most residuals were detected within about 10 km or release locations in a review of studies associated with the Lower Snake River Compensation Plan but noted that most studies have focused their efforts near release sites and the broader distribution was unknown. Indeed, Jonasson (1995) found that the highest densities of residual steelhead were near release sites, but residual steelhead were widely distributed throughout the Grande Ronde and Imnaha watersheds. If we estimate that residual steelhead can move over 100km from their release site it is possible that they are distributed quite broadly across the landscape with a large potential breeding zone. This is particularly true when they are released at multiple places within a watershed. Accordingly, we are highly concerned with the proposal to implement additional acclimation facilities in the Rogue. Second, an off station release site exists in Gold Hill for summer steelhead. We do not see any mention or evaluation of how off station releases or acclimation sites could affect PHOS or competition among juvenile steelhead in the RSP and it is a critical component of understanding the potential distribution of hatchery adults and both immature and mature residual steelhead.

For a rough evaluation of how many mature males could be released into the Rogue annually we estimated a 2% and 10% precocity rate over the ten year period from 2010-2019. First, we reduced the total numbers listed in the Fish Propagation Annual Reports by 8% to help account for the percentage of fish which are released into non-anadromous waters annually. Afterwards, an annual average at our assumed 2% minimum rate would produce 9,000 precocial males; a higher but still reasonable 10% rate would have produced an annual average of about 45,000 (Table 2). Some areas likely have minimal hatchery influence from precocious parr, but given the tremendous uncertainty, we feel it is imperative that ODFW begin monitoring of precocity rates among potential smolts and fund additional research to determine their spatial distribution and the extent of mating interactions of hatchery precocious parr and wild steelhead.

In addition to precocious parr approximately 8% of half pounders which enter the Rogue are sexually mature males (Hodge 2014, Everest 1973) and the proportion appears to increase dramatically as they are sampled further upstream, with as many as 30% being mature males in the Grants Pass area (Everest 1973). These mature males readily spawn with adult steelhead and can even make up significant portions of the spawning populations in some tributaries in some years, ranging from 0-26% (Everest 1970). Indeed, it was estimated that 4,000-6,000 half pounder males spawned in 1970 (Everest 1973).

Because of the difficulties in identifying half pounders and determining their origin (hatchery or wild) we suggest that estimates of the total numbers which return should be used to better inform estimates of PHOS. For example, the most recent 10 year average shows that 63.1% of half pounders were of hatchery origin with a high of 75% and a low of 51.9% (Table 1). Unfortunately, estimates of total run size of half pounders and adults were not available to us so we cannot generate even coarse scale estimates of PHOS which include half pounders and precocial parr. However, since a significant portion of smolts are released at Cole Rivers hatchery it is likely that they are traveling widely in the Upper Rogue and breeding with wild steelhead. Similarly, half pounders primarily stay below the former Gold Ray Dam site and are likely spawning with wild summer and winter steelhead in addition to precocial parr which are released near Gold Hill, in the Applegate and from Green and Skunk Creek acclimation sites. This means that the estimates of PHOS are almost certainly underestimates and likely dramatically so. This is particularly concerning since ODFW has recently estimated PHOS as high as 21% in the Applegate River (ODFW 2001) when only accounting for adult steelhead.

Not only is it difficult to see and identify half pounders and resident trout in spawning aggregations, it is nearly impossible to tell whether they are of hatchery or wild origin while doing spawning surveys. Fortunately, there is ample literature describing the behavior and distribution of immature and mature half pounders. Coupled with ratios of hatchery to wild half pounders from Huntley Park seining it should be relatively simple to determine the escapement of mature hatchery half pounders onto the spawning grounds. Furthermore, it is possible to do a simple blood test many months in advance and determine if an individual will mature the following winter (Larsen 2004). This could be done to assess the potential contribution of mature hatchery and wild half pounders at Huntley Park.

Everest 1973 demonstrated that PHOS is not evenly distributed across the landscape, it was measured near zero in some tributaries while being above 10% in others, and it varied year to year. Wild steelhead abundance appears to have declined since that time, at least for summer steelhead but likely other populations, and hatchery releases have increased dramatically. Regardless, relying on the number of strays into Elk Creek or sporadic spawning surveys with poor ability to identify hatchery fish is not sufficient to conclude that PHOS is low across the landscape. TU recognizes that it is not feasible to survey the entire watershed, rather we suggest that a more accurate estimate of PHOS is simply to estimate the number of hatchery fish which escape the fishery, combined with an estimate of the number of hatchery precocial parr and half pounders as well. We appreciate that ODFW has attempted to account for this unequal distribution of hatchery fish across the landscape by designating Mixed and Wild Emphasis Areas (MEA's and WEA's respectively). However, we remain concerned that these are not wholly sufficient to ensure wild salmonid populations maintain broad distributions and genetic diversity, or help impaired populations rebuild, e.g., summer steelhead. In areas where PHOS levels are acceptably low, if the wild population declines at a greater rate than hatchery fish, PHOS will increase. Similarly, PHOS may be higher during periods of poor freshwater conditions which would place additional stresses on wild populations when they are struggling the most. For these reasons it is imperative that ODFW not rely solely on an average PHOS level for an entire SMU or stratum but rather determine PHOS rates for individual populations at a minimum. Thus, we would like to see a sample design presented for the Rogue and Chetco that would more accurately capture the total estimate of PHOS in mainstem and tributary reaches.

Last but not least, is that residual hatchery juveniles can have significant negative effects on juvenile wild steelhead. McMichael (1997) observed numerous behavioral exchanges between wild and hatchery juveniles and noted that wild fish generally lost competitive interactions due to their smaller size and would often hide or be displaced out of prime feeding areas. These types of effects are well documented in numerous studies and further support the need for ODFW to determine the number of residual hatchery fish which are being released annually.

Coho

TU is concerned about the proposed increase in hatchery production for coho and the potential for a wild harvest season. ODFW's own research (Jones 2018) has demonstrated that hatcheries and harvest can have strong negative effects on productivity, diversity, abundance and spatial distribution of wild coho populations. We are particularly concerned with ocean fisheries for Coho where hooking mortality can range from 7-33% (Cox-Rogers 1999) and has been measured as high as 69% (Vincent-Lang 1992). This is a significant problem in fisheries where anglers are targeting hatchery fish and releasing more abundant wild fish which are aggregated from many Oregon and California rivers. Even with limited harvest quotas this can remain a significant source of mortality and negatively impact the health of wild populations. We recognize that any changes to harvest and hatchery management of SONCC coho will need to be developed with NOAA and this plan only provides guidelines, however we hope that ODFW will use the utmost caution when developing those plans.

The stated purpose of the 25% increase in hatchery production is for improving wild population estimates. In general, this is concerning because hatchery fish typically exhibit differences in run timing spatial distribution and are likely subject to different harvest rates. We would like to see ODFW explore other methods of estimating wild coho abundance that would not rely on hatchery fish.

Climate change and adaptive potential

We agree that shifts in stream temperature and flow regimes related to climate change pose threats to wild steelhead due to factors such as increased high flows during spawning and decreased summer low flows during rearing. And we agree there will likely be dramatic changes in the attributes of wild steelhead populations. However, the inherent diversity in steelhead, including temporal and spatial variability in run and spawn timing, is unique among salmonids and helps dampen their negative and positive responses to short-term and long-term environmental variability (Moore et al. 2014; Kendall et al. 2015). Further, while juvenile steelhead will still have a relatively long rearing period in freshwater, as a species they are more thermally tolerant than many salmonids (McCullough 1999). Owing to these traits, and others, steelhead exhibit the broadest geographical range of any anadromous Pacific salmonid. This range encompasses a wide variety of climates and hydrologic regimes to which steelhead have adapted remarkably well, and where other species – such as Chinook and Coho Salmon – have either long gone extinct or are on their way. This is not to discount the potential effects of climate change on a species with an extended freshwater rearing period, rather, it is to ensure that the RSP accurately captures the biological capacity of *O. mykiss* relative to other species of salmonids. Without that context, it is easier to make assumptions or predictions about which habitats should be protected and what the potential distribution of steelhead may be in the future.

Average stream temperatures are predicted to reach as high as 28°C in the RSP area. Fortunately, this is under the incipient lethal temperature of many populations of *O. mykiss*, indicating that they have the adaptive potential to persist even in these conditions. In fact, Sloat and Osterback (2013) found that juvenile steelhead were able to survive throughout the summer in Southern California when stream temperatures did not exceed 30°C (86°F) and thermal refugia were generally not present. These temperatures would prove lethal to juvenile coho and chinook (Richter and Kolmes 2005), so while steelhead do have an extended freshwater rearing period, they are uniquely adapted among the salmon world to persist through increased summer temperatures forecast for the Rogue and South Coast.

Another example of the adaptive potential of *mykiss* can be found in the Firehole River in Yellowstone National Park where an introduced population of rainbow trout was successfully reproducing in a section of stream that was warm enough to cause abnormal gonad development in brown trout. One of the ways in which rainbow had adapted to the high stream temperature was by shifting their spawn timing from spring to fall. An important factor to note here is that rainbow are introduced in the Firehole River and the shift in spawn timing of several months occurred in only a few decades. This has important implications for summer steelhead in the Rogue. The juveniles in many streams used by summer steelhead must undertake downstream migrations within 60-90 days after emergence due to the streams drying up (Faudskar 1980). This is shortly after the critical period described by Elliott (1989) and coincides with the conclusions of Everest (1973) that significant movement early in life comes at a high cost. In order for steelhead to continue using these intermittent tributaries they will likely have to spawn progressively earlier to provide a long enough growing period for their offspring to reach a suitable size prior to stream drying. This type of adaptation is dependent on wild populations possessing a broad range of spawn timing across a diversity of habitat types. This is just one example of the type of diversity that wild steelhead populations need in order to adapt to climate change.

The bottom line is steelhead display remarkable plasticity and their life histories can change with a changing environment, but only if they have a reservoir of genetic and phenotypic diversity to draw upon. Ultimately it is the ability of wild steelhead to adapt to changes in habitat from human alteration and climate change that will determine whether they persist into the future, which is why we focus strongly on rebuilding diversity and maintaining/increasing the temporal and spatial distribution of wild steelhead in these comments. To provide a successful roadmap the final RSP must incorporate the information above into clearer strategies and actions that further reduce hatchery and harvest impacts, if they are deemed to be too great, to wild steelhead and especially to the life histories which are necessary for wild steelhead to persist into the future. Furthermore, it will be difficult to prioritize restoration actions if specific limiting factors and life stages are poorly understood, thus it is critical that more work is done to improve our understanding of the role of density dependence and distribution in regulating productivity of wild steelhead populations. While it may not be possible to collect this information before the publication of the final RSP, we hope ODFW will incorporate these ideas into well thought out research and monitoring plans and future RSP reviews so that protection, restoration and management actions can be implemented in the most effective manner possible.

Sincerely,

Chrysten Lambert

Oregon Project Director
Trout Unlimited / Chrysten.Lambert@tu.org

Tables and Figures

Year	**% Wild**	**% Hatchery**
2010	31.4	68.6
2011	45.7	54.3
2012	30.5	69.5
2013	46.5	53.5
2014	46.7	53.3
2015	39.7	60.3
2016	48.1	51.9
2017	30.8	69.2
2018	32.7	67.3
2019	25	75
2020	29.3	70.7
Average	**36.9**	**63.1**

Table 1. Composition of Huntley Park seine counts of half pounders for 2010 to 2020. Data accessed online at https://myodfw.com/huntley-park-fish-counts

Year	**Annual Release**	2%	10%
2010	592,539	10,903	54,514
2011	343,715	6,324	31,622
2012	480,629	8,844	44,218
2013	487,387	8,968	44,840
2014	345,776	6,362	31,811
2015	538,500	9,908	49,542
2016	531,978	9,788	48,942
2017	556,340	10,237	51,183
2018	513,776	9,453	47,267
2019	530,069	9,753	48,766
Average	492,071	9,054	45,271

Table 2. Course estimates of the potential number of precocial parr produced in the Rogue River annually. Smolts released includes the total number of steelhead listed for the Rogue in the Fish Propagation Annual Reports. We recognize that some of these fish are released into non-anadromous waterways but did not have sufficient time within the comment period to enter all the data. To help account for this in our rough estimates the smolt release numbers were reduced by 8% before calculating the potential number of precocial parr at 2% and 10% precocity rates.

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