

JOINT TRIBAL AND CDFW REPORT 1
SOUTHERN OREGON / NORTHERN CALIFORNIA COAST COHO
HARVEST CONTROL RULE

Background

The Hoopa Valley Tribe, the Yurok Tribe, and the California Department of Fish and Wildlife (CDFW) are jointly committed to the protection and recovery of Coho Salmon populations within the Southern Oregon/Northern California Coastal (SONCC) Coho Salmon evolutionarily significant unit (ESU), as well as the preservation of the cultural, economic, and ecological benefits that more abundant, co-occurring runs of salmon offer. The California co-managers therefore recommend the Council select a harvest control rule (HCR) that is governed by an understanding of both the risk that different HCRs pose to the ESU, and the multitude of efforts aimed at increasing the resilience of individual populations through habitat, hatchery, and harvest management actions. Here, the co-managers outline recommendations for a final action that reflects the weight of evidence developed through the Council's workgroup process and the efforts presently underway to improve the productivity of one of the weakest components of the ESU among those assessed, the Trinity River population aggregate.

The SONCC Coho Salmon ESU consists of 40 distinct populations¹, 19 of which are considered by NMFS as being "functionally independent", 11 considered as "potentially independent", and 10 as "dependent" populations. NMFS's recovery plan for SONCC Coho Salmon ranked the severity of stressors upon each of the populations within the ESU. Fishery harvest ranked the lowest among stressors considered for 39 of the 40 populations, including the Trinity River population aggregate, with the Smith River being the sole population for which harvest received a medium ranking. Hence, per the SONCC Coho Salmon recovery plan, harvest is not considered a substantial factor preventing the recovery of SONCC Coho Salmon generally, or the Trinity River population aggregate specifically, under the current harvest management regime.

In 2020, the PFMC formed an ad-hoc workgroup (WG) to develop a Risk Assessment (RA)² to evaluate alternative harvest control rules for SONCC Coho Salmon. This effort involved conducting stock-recruit analyses and a risk assessment for six of the independent populations which had an adequate time series of data available for such analysis. The stock-recruitment analysis, which relied on Bayesian hockey-stick model fits, indicates that the natural Trinity River population aggregate³ has extremely low productivity (0.2), by far the lowest of the populations assessed. The Trinity population aggregate also

¹ National Marine Fisheries Service. 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service. Arcata, CA. 1,841 pp.

² Pacific Fishery Management Council, 2021. PFMC Southern Oregon/Northern California Coastal Coho Salmon; Fishery Harvest Control Rule Risk Assessment, November 2021, Draft Final Report.

³ The WG assessed the Trinity River based on a single aggregate of three populations, including the Lower Trinity, South Fork Trinity, and Upper Trinity populations; it is referred to as the Trinity River population aggregate throughout, and is understood to encompass these three components.

has a very high proportion of hatchery origin spawners on the natural spawning grounds, with the proportion of hatchery-origin spawners [pHOS] averaging 78 percent between 1997 and 2019. It is likely that this high contribution of hatchery fish on the natural spawning grounds is a contributing factor to the low productivity of the natural Trinity River Coho population, along with the pervasive effects of habitat degradation and water management. Despite these impacts, the WG found that the Trinity River population aggregate had one of the highest capacities among the SONCC Coho Salmon populations that were assessed in the RA (capacity = 3,034), meaning that incremental improvements in productivity should yield immediate gains in population viability.

The co-managers, in conjunction with other partners, are currently pursuing several actions to increase the productivity, capacity, and viability of Trinity River Coho Salmon, as well monitoring trends in abundance across life stages and related population parameters. Many of these activities are prioritized and funded by the Trinity River Restoration Program, which was initiated pursuant to a Record of Decision signed by the Department of Interior and Hoopa Valley Tribe in 2000. The focus of the Trinity River Restoration Program is to restore natural fish populations within the basin, including Coho salmon, which were severely impacted by the construction of Trinity and Lewiston dams. A portion of these activities, and others, are detailed below, along with forthcoming initiatives that will further enhance efforts to improve the productivity of the population. We end with a consideration of how these efforts and related RA WG reports findings support an HCR that allows an impact rate of up to 17% on Trinity River Coho Salmon, while ensuring a rate of no more than 15% for the remaining ESU populations.

Monitoring Activities

CDFW has made run size estimates of Trinity River Coho Salmon returning to the basin since 1978 using mark/recapture methods at two weirs, Willow Creek weir (lower basin) and Junction City weir (upper basin). Separate estimates of returns to natural spawning areas, harvest, hatchery returns and hatchery vs. wild proportions (since 1997) comprise annual run size estimates upstream of weir sites. The Willow Creek weir has operated continuously since 1978, while Junction City weir was used to estimate Coho Salmon from 1978-1994 and then again beginning in 2021. CDFW has worked cooperatively with the Hoopa Valley Tribe since 1995 at both weir sites and beginning in 2021 with the Hoopa Valley and Yurok tribes at Junction City weir. Historically, tributary surveys were also conducted, with a focus on Chinook Salmon, however surveys did continue into late December when conditions for monitoring were favorable. The Hoopa Valley Tribe also conducts Coho Salmon surveys on select tributaries within their reservation.

Additionally, CDFW collaborates with Federal and Tribal partners to conduct redd and carcass surveys on the mainstem Trinity River. These surveys are primarily focused on Chinook Salmon, but Coho Salmon redds and fish are observed and recorded, which provides some limited information on spawning distribution and pre-spawn mortality.

Harvest monitoring is conducted by CDFW and the Hoopa Valley and Yurok Tribes. CDFW monitored harvest when it was legal prior to 1996 and continues to monitor for illegal Coho Salmon harvest using creel surveys in the lower Klamath River and through tag returns on the Trinity River. Tribal entities monitor their gill net, hook and line and weir fisheries using various protocols, parsing landed catch into hatchery or non-hatchery origin based upon 100% marks applied at both Trinity River and Iron Gate hatcheries.

Both CDFW and the Tribes report estimates of escapement and harvest in various annual reports or other documents. CDFW currently produces an annual report to the Trinity River Restoration Program and the US Bureau of Reclamation, and compiles counts and estimates of Coho Salmon escapement and hatchery returns across the Klamath basin annually, in the “Coho Megatable” spreadsheet. All available Coho Salmon data for Klamath Basin were recently summarized in SONCC Workgroup Risk Assessment Report.

Together, these monitoring activities provide the co-managers with a means to track the abundance of Coho salmon in the Trinity River, as well as to track the effectiveness of restoration actions upon Coho salmon.

Hatchery Management Actions

In 2019, NMFS approved a Hatchery Genetic Management Plan (HGMP) for the operation of the Trinity River Hatchery (TRH). A primary focus of the HGMP is for the natural environment to drive natural selection for the Trinity population aggregate, rather than the hatchery environment driving the selection process and resulting in domestication. Pursuant to the HGMP, efforts were initiated in 2021 to incorporate more natural origin fish into the broodstock at TRH, by trapping and transporting these natural origin fish from an Upper River trap to TRH. It is expected that increased use of natural origin fish as brood stock at TRH will provide for a population that has undergone increased natural selection in the wild, thereby being more fit to survive in the wild, and having increased productivity relative to what was determined by the RA.

Coho Salmon have been reared at this facility since its inception in 1964. Early attempts to raise Coho Salmon had limited success, so stocks from Washington, Oregon and California were obtained to supplement production. No such transfers have occurred since the 1970's. Coho released from TRH were initially coded-wire tagged in (CWT) low fractions in the 1980's to the early 1990's. With the federal listing of the SONCC ESU, CDFW started marking 100% of the production with a right maxillary clip. Coho Salmon produced at Iron Gate Hatchery are similarly marked with a left maxillary clip. This allows basin researchers to identify hatchery stocks and wild stocks independently.

In 2013, due to the lack of an approved HGMP for listed Coho Salmon, production was reduced from 500,000 yearlings to 300,000 yearlings. This interim measure was intended to reduce the deleterious effects of domestication selection on the natural-origin population. An HGMP was developed and approved by NOAA in 2019 and includes prescriptive measures for enhancing both wild and hatchery populations of Coho Salmon and metrics for informing future production levels. Measures include incorporation of wild broodstock captured at Junction City weir, evaluation of population metrics (proportion natural influence [PNI], run-size, hatchery survival metrics, pHOS, etc.) and associated take limits.

Additional prescriptive measures guide hatchery operations and implementation of monitoring. These measures include genetic-based mate pairing, mate pairing ratios, and ponding densities for hatchery operations, as well as methods of collection, handling, marking, and release of fish in juvenile and adult trapping operations for monitoring activities, among others. These measures are intended to reduce the effects of these actions on both natural-origin and hatchery-origin fish, and as the integrated population moves toward greater influence of natural-origin genetics, these actions are expected to provide greater

benefit to natural-origin production and overall production of Coho Salmon in the wild. Coho Salmon populations are to be evaluated periodically to assess current and future hatchery production goals.

Offsite collection of natural-origin broodstock for use at TRH began in 2021 and is intended to improve fitness of the population by increasing the proportion natural influence and reducing domestication selection at TRH. The natural-origin broodstock collection effort at Junction City weir is a collaborative effort between CDFW, the Hoopa Valley Tribe, and the Yurok Tribe. Removal of HOR Coho Salmon at the integration weir site shall also be implemented to further enhance the proportion natural influence. The integration weir may also be used to estimate both hatchery and natural origin Coho Salmon abundance in the integrated reach above North Fork Trinity River.

Steelhead production at TRH was also reduced by 44% (from 800,000 to 480,000 yearlings) in 2014 in the interest of addressing theoretical predation risk imposed upon natural-origin Coho Salmon juveniles by hatchery released steelhead. Hatchery practices to encourage rapid Steelhead outmigration timing such as diet and rearing conditions have also been implemented to this end.

The Yurok Tribe, in association with CDFW, has been planting carcasses collected from TRH spawning activities into tributaries with few natural returns to increase the distribution of marine derived nutrients throughout the Trinity basin. Increased carcass distribution is planned for future years with the additional aid of the Hoopa Valley Tribe.

Freshwater Habitat Actions

Additional efforts underway to increase productivity of the natural Trinity River population aggregate include a substantial restoration program. The Trinity River Restoration Program includes habitat restoration in the mainstem, and to a lesser degree the tributaries, variable flow management that includes increased flows, and sediment management in the mainstem river. All these restoration activities are subject to review through monitoring and an adaptive management program. Several of the mainstem restoration projects have resulted in improved conditions for Coho Salmon, by providing habitat such as side channels and off-channel ponds.

Since the formation of the Trinity River Restoration Program in 2000, State, Federal, and Tribal partners have collaborated to implement in-stream restoration projects in the 40 miles of the mainstem Trinity River downstream of Lewiston Dam. These projects include flow management, coarse sediment augmentation, and tributary restoration efforts to benefit juvenile salmon and steelhead. Of the 47 sites originally identified in 2000, 34 have been completed. Specific design elements that benefit rearing juvenile Coho Salmon include low-velocity floodplain habitat, addition or augmentation of side channels and backwater alcoves, construction of off-channel ponds, addition of large woody debris, and enhancement of riparian vegetation. Gravel augmentation enhances adult spawning habitat and improves habitat for benthic macroinvertebrate food resources. Tributary restoration has largely been focused on barrier removal to improve access to spawning and rearing habitat and road decommissioning to reduce fine sediment impairment. Restoration work in tributaries to the Trinity River are primarily focused on Coho Salmon and Steelhead because tributary habitat is used more by these species as compared to Chinook Salmon. The Trinity River Restoration Program annually solicits \$500,000 worth of watershed improvement contracts with a priority placed on Coho Salmon.

The Hoopa Valley Tribe has completed significant habitat restoration in the lower reaches of two anadromous tributaries on the Hoopa Valley Reservation to improve habitat quality and connectivity for the benefit of juvenile and adult natural origin Coho Salmon. These efforts are to be complemented with the introduction of artificially propagated Coho Salmon from the Hoopa Hatchery facility described earlier, with the intent being to restore viable populations of locally adapted Coho Salmon in the Lower Trinity River.

Re-introduction/Augmentation Efforts

Although NOAA has identified hatchery production as a major impediment to recovery of all three wild Coho Salmon sub-populations (Lower Trinity River, Upper Trinity River and South Fork Trinity River) of the Interior Trinity diversity stratum, they have deemed reintroduction efforts necessary to limit the risk of depensation due to small population sizes that currently occur in the Lower Trinity River and South Fork Trinity River sub-populations. The Hoopa Valley Tribe has refurbished their small-scale hatchery in Hoopa, for the purpose of rearing surplus TRH Coho Salmon eggs for release into restored tributaries within the Hoopa Valley Reservation. This effort is intended to re-establish the Lower Trinity River sub-population, consistent with the 2014 Recovery Plan, with the first rearing season planned for 2022. The future vision is to rely on locally adapted adult Coho Salmon for broodstock to promote local recolonization within the lower Trinity population.

Regulatory Actions

The State has prohibited the retention of Coho Salmon in all sport and commercial fisheries since the SONCC ESU was federally listed in 1994, as well as implemented additional small area closures at stream mouths (500 ft. on the Blue Creek, Scott, and Shasta rivers) and near weirs (750 ft. buffers) to reduce catch-and-release mortality. Compliance with these protections is monitored and enforced by the CDFW Law Enforcement Division. The mouth of the Klamath River is also closed once anglers reach 15% of the basin fall Chinook quota. While this closure is focused on fall Chinook harvest, it essentially closes this area to sport angling prior to the arrival of Coho Salmon in many years, further reducing catch-and-release mortality.

Starting in 2017 CDFW liberalized daily bag and possession limits for Brown Trout and authorized the Hoopa Valley Tribe to sacrifice Brown Trout caught at weirs to reduce their population size, thereby reducing predation and competition impacts to native salmonids, including Coho Salmon.

The Yurok Tribe has instituted Coho Salmon protection measures that include partial weekly closures to their fishery during Coho Salmon migration periods since the early 1990's, prior to when SONCC were listed under the ESA.

The Lake and Streambed Alteration (1600) permitting process, and various reviews under the California Environmental Quality Act (CEQA), of projects affecting aquatic environments conducted by CDFW prescribe avoidance and mitigation measures to ensure minimal take of Coho Salmon.

The Hoopa Valley Tribe has operated a selective-harvest weir on their reservation since 2016, which included harvest of HOR Coho Salmon. Reducing HOR presence on natural spawning grounds is intended to increase the fitness of the natural-spawning population by reducing any potential negative genetic influences created through the hatchery production process.

Future Actions Under Consideration by Co-managers

These concepts potentially offer multiple benefits to Coho Salmon including monitoring efficiency and breadth, reduction of handling stresses, improvement of the integration of natural-origin Coho Salmon into TRH broodstock, reduction of hatchery-origin influence in natural-spawning populations, and expansion of our knowledge base.

- Juvenile outmigration timing study (funding already approved for 2022 by US Bureau of Reclamation) -- This study will improve our understanding of juvenile outmigration timing for both hatchery and natural-origin Trinity Coho, as well as aid in the evaluation of how TRH Coho release strategies influence juvenile hatchery-origin migration rates.
- TRH infrastructure improvements and modernization (process began in 2021) -- This action would repair and modernize the aging TRH facility and review hatchery practices with the intent to increase hatchery efficiency, improve fish health, and reduce the environmental impacts on the Trinity River.
- 100% ad-clip CWT marking at TRH (and Iron Gate Hatchery) -- A right maxillary clip has been applied to 100% of Coho Salmon smolts released from TRH since 1996. Co-managers have been actively reviewing the utility of this mark compared with 100% adipose-clip coded-wire-tagging (ad-clip CWT) of TRH Coho. Implementation of CWT on Trinity Coho would improve the ability to quickly determine if fish are of hatchery or natural origin; max clips can be confused with hook scars in adults and can be missed on juveniles during out-migrant monitoring, ad-clips are more easily seen and commonly recognizable during surveys while monitoring fishery harvest. Overall, researchers and fishers outside of the Trinity Basin will be able to identify TRH Coho Salmon as hatchery origin due to the widespread use of ad-clips as a hatchery-origin identifier. Looking for alternative marks is not common practice in surveys occurring outside the basin. Contemporary information on the temporal and spatial distribution of TRH Coho Salmon could also be obtained from current marine fishery sampling of directed salmon fisheries or sampling of bycatch in other fisheries. Use of the AutoFish automated marking and tagging systems would improve hatchery efficiency and likely reduce handling stress as marks would be applied at a younger age, without need for bone excision. As previously stated, implementation of CWT for TRH Coho would conform with the standard currently employed throughout the West Coast.
- Consolidation of Willow Creek and Hoopa Weir Operations -- This action would reduce the number of migration barriers encountered and potential handling stress on natural-origin Coho Salmon. This potential action would also consolidate management effort. In addition, utilization of a more flow tolerant resistance board design could lead to a more protracted season of operation. Having a jointly managed weir that is staffed 24/7 during the operation season allows fish passage during periods of weir openings to be estimated by incorporating observation and counting protocols, potentially increasing the accuracy of run-size estimates.
- Relocation of Junction City weir to North Fork confluence and replacement with floating weir design -- The action would allow for the representation of additional Upper Trinity natural-origin broodstock in the TRH Coho program and allow for the removal of hatchery-origin fish from the system which might otherwise have dispersed into creeks or spawned in the mainstem

downstream of the current Junction City weir location. The more flow resistant floating weir design may also provide higher resilience during high runoff events.

- Planting of fingerling Coho in tributaries that have historic but no current spawning populations -- This would imprint juveniles on underutilized streams in hopes of jump starting naturally reproducing populations. Furthermore, this practice would encourage natural selection processes during juvenile rearing and reduce domestication effects, as well as reduce feed and other rearing costs for the hatchery compared to rearing to the smolt stage.
- Increase efforts to enumerate natural and hatchery-origin fish on spawning grounds --Increased spawner surveys on mainstem trinity and tributaries would help co-managers better understand the status of Trinity Coho, and the presence of hatchery fish on the spawning grounds.
- Use of semi-natural rearing conditions at TRH and the Hoopa Tribal facility and addition of live feed supplement --Artificial habitat structure in hatchery raceways and the addition of a live invertebrate diet supplement could help reduce the domestication effects of hatchery production.

Population Status and HCR Alternatives

Currently, per modeling conducted for the RA, the prognosis for the natural Trinity River Coho Salmon population is not good. This population was estimated to have a 64% probability of going extinct within the next 20 years, even if there are no fishery impacts upon the population and with a modeled stray subsidy. While TRH has likely contributed to the low productivity of the natural Trinity stock, it is also likely that TRH serves as a buffer for this stock, via straying, as the above-mentioned ongoing efforts to improve upon the productivity of the stock continue.

The Trinity River stock typically receives more harvest impacts than the rest of the SONCC Coho Salmon ESU populations, owing to its more interior location and the sequence of ocean and downstream fisheries. In addition to the ocean fishery impacts, and the Lower Klamath River fishery impacts, this stock is also subject to harvest in the Trinity River, unlike the rest of the SONCC Coho Salmon populations. This means that developing a one-size-fits-all ESU-wide allowable impact rate based primarily on the Trinity River (only three of the 40 SONCC populations) may not be appropriate, especially given its extremely low productivity and high hatchery influence.

Considering the extremely low productivity of the Trinity River natural population, its inland location, and the fishery-independent efforts underway to improve its productivity—at minimum bringing it to a level supportive of stock replacement—we recommend the PFMCC consider adopting an HCR for this population that distinguishes it as an exception among the ESU. Accordingly, we recommend a 15% exploitation rate (ER) limit (HCR 5) for 37 of the 40 populations³ within the SONCC ESU, and that an exception exist for the Trinity River population aggregate.

The RA report provides insight on what exploitation rate this exception should be, given the status, productivity, and capacity of the Trinity today, as well as what the population could support under an improved-productivity scenario. The RA report suggests that exploitation rates above 17% result in spawner levels that begin to approach a critical abundance threshold for the Trinity aggregate, with the risk of quasi-extinction increasing linearly/proportionally over the range of ERs considered by the WG, out to an ER limit of approximately 20%. Further, this finding and Trinity-related report conclusions are

based on RA simulations that assumed the most pessimistic/low-productivity parameterization (i.e., the hockey-stick model) among the spawner-recruit models fit to data for the Trinity population aggregate. Beverton-Holt model productivity and capacity parameters for the Trinity population aggregate, which are similarly supported given the data (e.g., Table 14 of final WG report²), are consistent with those for the report's 'Type C' generic population which exhibits a very low level of risk at a 17% ER. Given that model uncertainty points towards lower rather than higher risk at this impact level, the assessment suggests that 17% is an adequately protective impact limit for the Trinity population aggregate.

In terms of implementation, this hybrid HCR would be applied in a preseason context in a manner similar to those that exist for other ESUs/stocks with multiple populations that experience a common ocean ER but potentially different freshwater fishery impacts. For the specific populations considered by the WG, this means demonstrating that under the season's proposed fisheries the projected total ER for each Freshwater Creek (ocean impacts only), the Klamath Basin's Scott River, Shasta River, and Bogus Creek populations (ocean + freshwater impacts), and the Rogue River population aggregate (ocean + freshwater impacts) is below 15%; and the total ER for the Trinity River population aggregate (ocean + freshwater impacts) is below 17%. For all populations, ocean impact projections would be estimated using Coho FRAM, whereas freshwater projections would be estimates using the best methods available for each population. It is anticipated that a 3-year postseason average ER obtained from run reconstructions will suffice in the absence of terminal fishery models or other methods. This approach ensures that all assessed components can simultaneously satisfy the proposed HCR limits under the approved fishing regime.

Considering these observations and the broader SONCC Coho Salmon ESU context, the Hoopa Tribe, Yurok Tribe, and state of California jointly recommend the Council adopt a hybrid HCR that requires impacts to the Trinity River Coho Salmon population unit to remain under an ER limit of 17% (HCR 7) while holding all other populations of ESU to a limit that is effectively 15% (HCR 5). When combined with a broad suite of ongoing and new recovery actions specifically designed to increase productivity of natural-origin SONCC Coho Salmon, such an action offers the necessary conservation benefit to the ESU as a whole, including the Trinity population aggregate, and does not appreciably increase risk of extinction, while also providing the necessary flexibility for state and tribal fisheries. Finally, this action and careful consideration of risk and benefit is also consistent with both the ESA and Magnuson-Stevens Fishery Conservation and Management Act, and the guidelines and goals outlined within.