2.2.8 Anadromous Fish Monitoring

Chinook and coho salmon and steelhead trout in California have complex life cycles, not only among the different species, but also among the different runs of species. As anadromous fish, meaning those that most of their adult life s reside rear in the ocean and return to freshwater to spawn. , adults and Jjuveniles and adults of some species may hold in freshwater for extended periods while others spend more of their life history in the ocean. Fisheries managers typically monitor adult escapement and juvenile outmigrants to determine the status and trends of fish populations. State, federal, and local agencies, tribes, and various private entities and landowners have collected and some are currently collecting fish population data in California. Available data varies from long-term, and abundant data to data that is limited, both spatially and temporally. Determining impacts to fish populations requires intensive, multi-year monitoring, as trends may not be determined for many years due to high natural variability as well as the complexity of fish life cycles. For example coho salmon typically have a 3-year life cycle so a minimum of 9 years of population data would be required to capture a minimum 3-year trend for each cohort. Also due to the complexity of fish life cycles, the quality and/or abundance of available data, and other confounding factors (such as climate change, ocean conditions, predator-prey dynamics, etc) it may be difficult to make any correlations between from timber harvesting impacts or restoration projects to fisheries populations, particularly at a reach or watershed scale.

Similarly, fishery biologists and other resource professionals ies managers monitor use stream habitat parameters and indicators monitoring such as habitat typing, benthic macroinvertebrate assemblages, spawning substrate, stream temperature, suspended sediment, flow regimes, turbidity, and riparian vegetation data to make inferences about determinations of project impacts to on fish populations. As with monitoring fish populations data , this type of monitoring is widely conducted across California by government agencies and private entities, using accepted protocols. Habitat data is relatively easy to collect, less costly, and less intensive than fish population monitoring. It is also easy to document any changes, either positive or negative, from timber harvesting or restoration projects on a reach or watershed scale within a short time frame. Sediment filling in pools and changes in stream temperature

can rapidly document negative impacts from projects, and similarly, changes in pool-riffle ratios and macroinvertebrate assemblages can provide quick results to determine project success. Elevated stream turbidity can impact growth and survival of fish by reducing their ability to forage and affecting gill function and condition. Continuous turbidity monitoring provides information on magnitude and duration of those values that can negatively impact fish. ~~This~~ These various types of monitoring allow~~s~~ managers to make inferences on impacts to fish populations from timber operations. For these reasons, EMC will focus primarily on ~~fisheries habitat~~stream habitat monitoring and, when available, will use fish population data as a basis ~~another line of evidence~~ to ~~document any changes.~~evaluate the effectiveness of specific Forest Practice Rules.

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