Daly, Elizabeth – Oregon State University

Presentation Title: The Changing North Pacific Ecosystem and Potential Impacts on Steelhead

Abstract for the 2021 Pacific Coast Steelhead Management Meeting

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The ocean condition that juvenile steelhead *(Oncorhynchus mykiss*) have been migrating into for the last seven years have included some of the warmest temperatures ever recorded. Adult steelhead returns to the Columbia River since the 2014 outmigration year have been some of the lowest of the last 30 years, with the fish that went to sea in 2014-2019 returning as adults in extremely low numbers in 2015-2020. Numerous Columbia River and Northwest coastal river steelhead populations were listed under the US Endangered Species Act after the last dramatic declines in adult returns observed in the 1990s. Population increases were observed for most of the first 10 years of the century, followed by steep declines since 2014. There is growing evidence for a negative correlation between these steelhead populations and ocean temperatures. In 2015-2020, anomalously warm ocean conditions (including the 'warm blob' of 2015 and a strong warm El Niño in 2016) persisted in the northern California Current and substantially affected the marine ecosystem. Juvenile steelhead prey resources have been dominated by taxa typically found in offshore waters such as rockfish and Northern anchovies, a situation that typically corresponds to lower marine survival for steelhead. We show the interannual variability in juvenile steelhead marine diet composition, size, and body condition across 13 years (2001-02, 2004, 2006-2011, 2015-16, 2018-2019). This period included both the recent marine heatwave years as well as other warm, cold, and average ocean condition years. Steelhead from 2015 and 2019 exhibited some of the poorest body conditions in the time-series. Steelhead diet composition varied significantly with ocean conditions, with steelhead consuming more insects, juvenile rockfish, and rare and unidentified fish in warm years. Using a

bioenergetic model on a subset of the data, we found that interannual variability in growth could be explained by changes in temperature and feeding conditions in the marine environment. Significant differences in growth between warm and cold ocean years became apparent by day two of the simulated marine residence. These findings highlight the potential for warm ocean years to influence the diet composition and condition of declining Columbia River steelhead populations, and may lead to a better understanding of what affects survival of juvenile steelhead in their early marine residence.