

Salmon Session Summary

It is difficult to overstate the importance of salmon in the Northwest to native peoples, fishermen, and the economy, as well as their role in terrestrial and marine ecosystems. Salmon are preferred prey of Southern Resident killer whales (SRKWs), and the consumption of salmon by pinnipeds likely has important consequences for some salmon stocks. This session provided information on the importance of salmon in the diets of SRKWs and pinnipeds, and the status and trends of salmon stocks of importance to SRKWs or those affected by pinniped consumption.

Dr. Mike Ford summarized data demonstrating the importance of Chinook salmon to SRKWs throughout the year, and especially during the summer and early fall when the entire population is typically in the Salish Sea feeding almost exclusively on a variety of Fraser River Chinook populations (runs). In the fall, winter and spring, when the whales disperse to the Puget Sound and the outer coast, Coho and chum salmon, steelhead, and variety of other fishes (e.g., lingcod and flatfish) become important. During the winter, a diversity of Chinook runs are part of the whales' diet, illustrating the importance of the availability of a broad range of Chinook runs throughout the year. Both wild and hatchery salmon are part of SRKWs' diets.

Dr. Ford also related that, in recent decades, the local abundance of harbor seals, California sea lions, and Steller sea lions have increased by 8-10, 6 and 4 times, respectively. While marine mammal consumption of Chinook salmon has more than doubled since 1980, fisheries takes have declined a similar amount. Nonetheless, Mike described evidence that SRKWs are nutritionally stressed – changes in body shape and high fetal loss rate – presumably due to a lower availability of Chinook salmon and other species.

Dr. Ford provided information about the status of Chinook salmon runs. Historical estimates of Chinook run sizes are larger than current-day estimates in every region, especially for the Columbia River runs, which once numbered over 4.5 million adult, returning fish, but now number less than 1.0 million. Although the numbers are smaller, large declines also occurred in every other region (Puget Sound, Washington coast, Oregon coast, southern Oregon / California coast and Central Valley) except for the Klamath River system. More importantly, Dr. Ford pointed out that 40% of Chinook runs are now extirpated, and a large proportion of those remaining are listed as Threatened or Endangered. On the plus side, following decades of little change, Chinook salmon abundance in the Columbia River system has doubled in the last fifteen years. Interestingly, data on hatchery release times and smolt size have converged over the last 70 years, which could translate into a loss of temporal diversity of returning salmon years later.

Finally, Dr. Ford discussed several salmon recovery efforts in the area, including habitat restoration, harvest and hatchery changes, dam removal and passage improvement, and reintroduction. An amazing map showed the locations of 31 thousand salmon habitat-restoration projects in the Northwest, with \$1 billion being spent to date.

Dr. Erik Neatherlin addressed increases in pinnipeds in the Puget Sound and what influence that has had on salmon and steelhead. Harbor seal numbers have increased in Washington and in British Columbia,

and appear to have reached carrying capacity. However, salmon make up only a small proportion of their diet (2% to 7% for Chinook). California sea lion numbers have been increasing exponentially since 1975, and just recently are showing signs of leveling off. Their diets are dominated by whiting and pollock, but salmon occurs in 5-25% of stomachs that have been examined. Numbers of Steller sea lions have also increased steadily in recent decades. Roughly 10% of their diet is composed of salmon, 18% of which is Chinook.

Dr. Neatherlin also discussed a recent study that estimated the consumption of Chinook salmon by killer whales and pinnipeds, based on their energetic requirements. That study estimated that consumption of Chinook by these predators has increased from 5,800 to 14,200 metric tons (5.0 to 31.4 million fish) since 1975. At the same time, commercial and recreational fishing yield declined from roughly 16,400 to 9,600 metric tons (3.6 to 2.1 million fish), resulting in little net change in the number/biomass of Chinooks removed from the population. While harbor seals remove the largest number of salmon, killer whales and fishermen, because they target large individuals, remove the largest portion of biomass.

Dr. Neatherlin emphasized that ecosystem-level changes in the Salish Sea complicate the task of understanding the relationship between prey availability and predator responses. He pointed to concomitant decreases in several species of fish, forage fish, kelp and sea grasses, and increases in human population, water temperatures, harbor porpoises, white-sided dolphins and pink salmon. He illustrated the complexity of the system by describing some of the many factors that affect the abundance of steelhead