**WRIA 9 Climate Change Impacts on Salmon: Technical Briefing Excerpts**

February 9, 2017 Watershed Ecosystem Forum Meeting – *DRAFT - for Discussion Purposes Only*

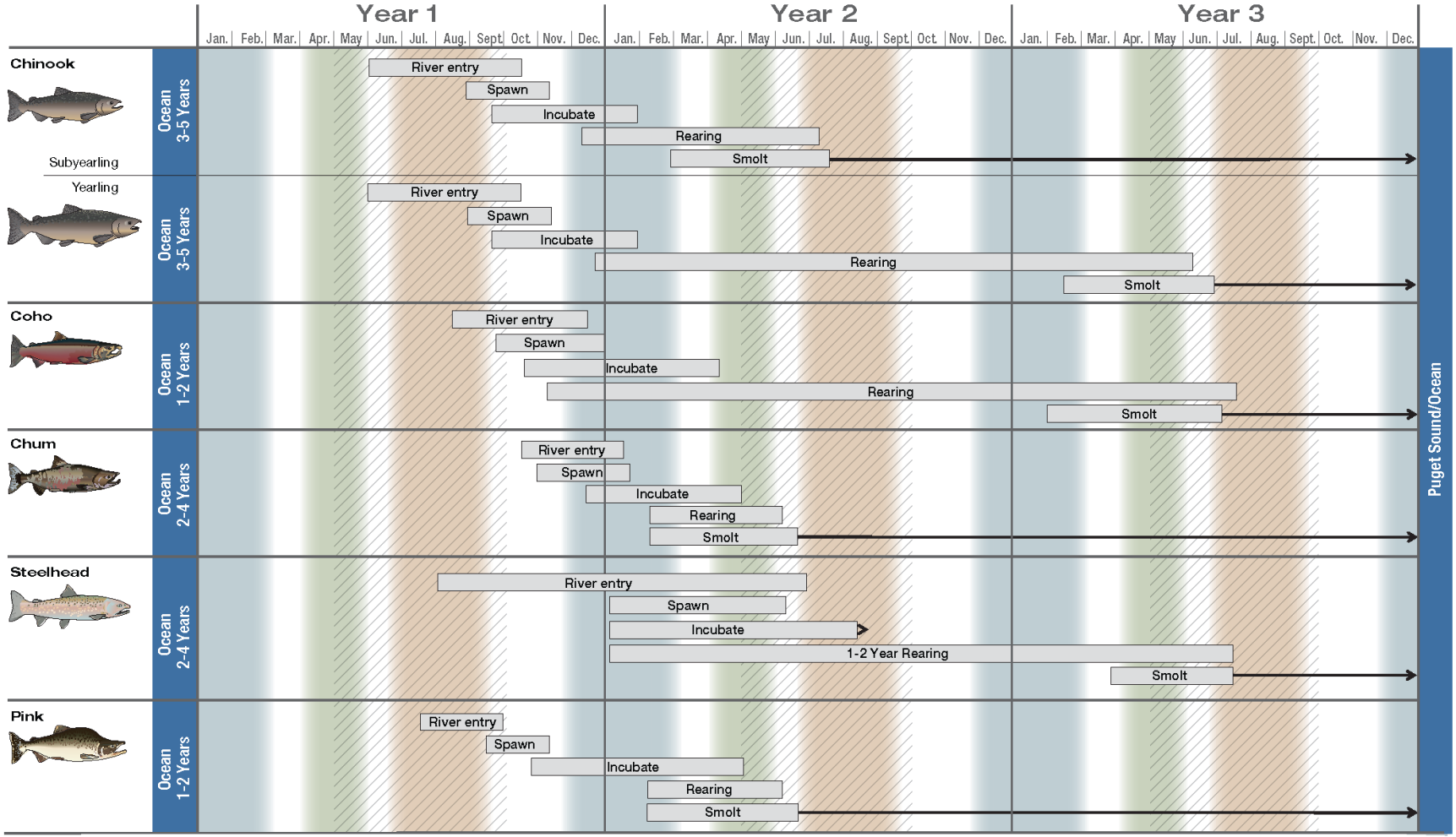
Anticipated climate effects, impacts to salmon, and geographic areas where effects will occur in WRIA 9.

| Climate impact | Salmon impact | Primary geographic area |
|---|---|---|
| Hydrology – higher winter flows, less spring runoff, and lower flows in summer | Shifting timing of life cycle transitions; scouring/smothering redds; stranding redds and juveniles; loss of thermal and flood refugia; less complex habitat; migration barriers due to extreme low and/or high flows | Upper Green, tributaries and nearshore drainages, especially where it is currently snow-dominated in winter will have the greatest impacts – Soos, Newaukum, Mill, Mullen creeks (and other lower elevation tributaries) will be impacted primarily by increased winter rain intensities and lower flows as they are not directly affected by mainstem flow management. Impacts to the Middle and upper Lower Green spawning reaches may be somewhat mitigated by water management at the HHD. |
| Higher water temperature | Can be lethal above 22 degrees C; sub-lethal effects above 17 C include developmental abnormalities, altered growth rates, non-fertilization of eggs; altered food web; altered migration timing; altered predator/prey relationship; reduced disease resistance | Temperature will be a concern for the whole watershed. However, the Green River mainstem is generally warmer than the tributaries and will likely to remain so into the future. |
| Stormwater runoff – higher flow and more chemical and temperature impacts to water quality | Increased water pollution causing chemical contamination of juvenile salmon and their prey, decreased oxygen, food web alteration, pre-spawn mortality; increased peak flows and reduced summer base flows causing channel scour and incision, altered food web, and compounding other hydrologic effects | Developed areas throughout the watershed are at risk given the lack of stormwater controls in the Middle, Lower Green, and Duwamish subwatersheds, and urban nearshore drainages. |
| Sedimentation – increased erosion and fine sediments | Lethal conditions, smothering of interstitial spaces in redds and choking of gills; interference with migration cues; decreased resistance to disease; altered /decreased habitat | Upper Green, Middle Green |
| Sea level rise | Shifting habitat range; loss of estuarine habitat; altered food web; could create passive gains in habitat depending on nearby infrastructure constraints, elevation, and vegetation gradients | The Puget Sound nearshore including the Green/Duwamish River. Lower lying areas and armored shorelines in the Central Puget Sound watershed nearshore (West Point to Federal Way and Vashon-Maury Island) and Duwamish estuary are most at risk to habitat shifts/loss |
| Ocean/Puget Sound acidification and increased temperature | Altered food webs; decreased food availability; decreased ocean survival; diminished dissolved oxygen affecting metabolism; altered migration pattern | Puget Sound, Salish Sea, and Pacific Ocean |

# Climate Change Impacts on WRIA 9 Salmonids

Adapted from Beechie (2012) fish timing represents typical fish behavior

King County
Department of Natural Resources and Parks




**Increased summer temperature** may decrease growth or kill juvenile salmon where temperatures are already high and block/delay migration. May also decrease spawning fecundity (e.g. Chinook).

**Decreased summer low flow** may contribute to increased temperature, decrease rearing habitat capacity for juvenile salmonids, and decrease access to or availability of spawning areas.

**Increased winter floods** may increase scour of eggs, or increase mortality of rearing juveniles where flood refugia are not available, displace juveniles to less desirable habitats.

**Loss of spring snowmelt** may decrease or eliminate spawning opportunities for steelhead, may alter survival of eggs or emergent fry for other salmonid species, cause early dewatering of off channel and side channel habitats, and reduce connectivity to the floodplain.

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