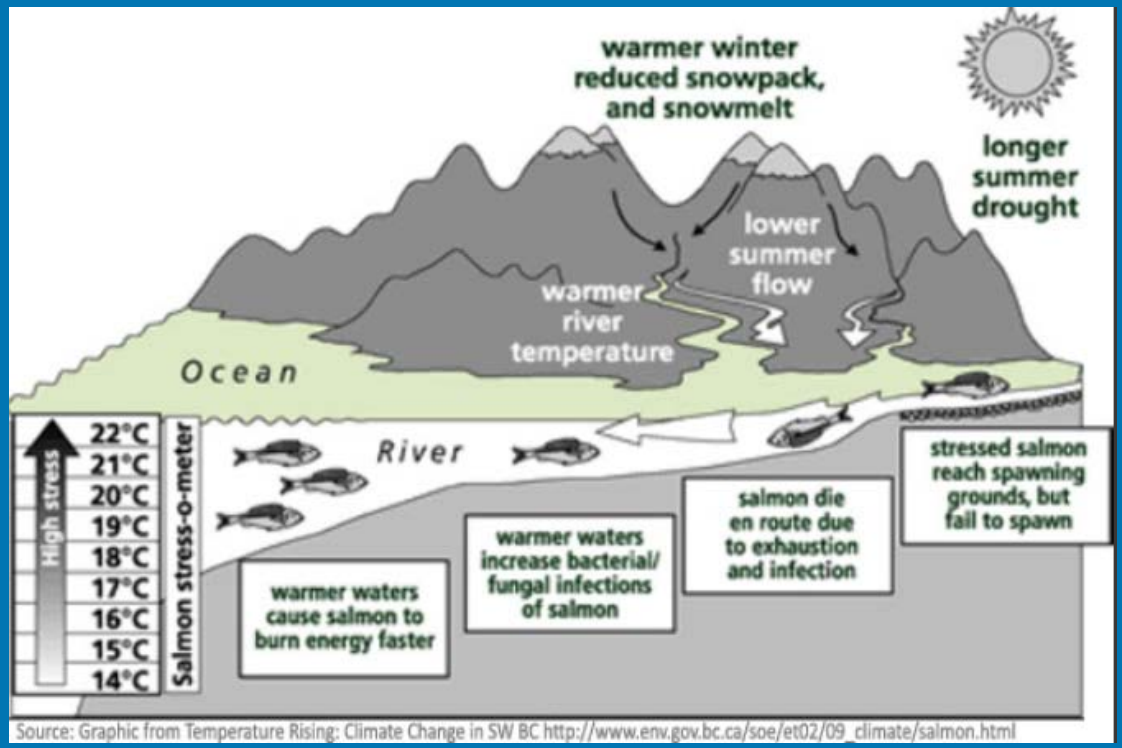
Green River Temperature and Salmon

Prepared by King County Science and Technical Support Section



Kollin Higgins presenting for Josh Kubo

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Technical Briefing Rationale

- Warm water temperatures influence salmonid survival in WRIA 9
- Three temperature TMDLs in WRIA 9
  - *Middle/Lower Green, Newaukum Creek (approved)*
  - *Soos Creek (underway)*
- WRIA 9 temperature-related conservation hypothesis (All-7)
  - *Protecting/improving water quality, specifically water temperature and chemical contamination conditions*

Factors Influencing Stream Temperature

- Climatic drivers
  - *Solar radiation, air temperature, precipitation, wind*
- Stream morphology
  - *Stream dimension, patterns, profile, bed material*
- Groundwater, hyporheic, tributaries, and tides
- Riparian corridor conditions

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Temperature Impacts on Chinook Life Stages

Adult Upstream Migration	• Increased metabolic demand and disease exposure • Delayed migration • Direct lethality
Adult Pre - spawning	• Increased susceptibility to disease, disease virulence • Decreased immune system condition • Reduced gamete quality and quantity
Adult Spawning	• Reduced fertilization success and embryo survival to emergence
Egg Incubation - hatching	• Reduced embryo success, hatching-emergence, condition, and survival • Increased abnormalities and mortality • Altered metabolic rates, metabolic energy deficits
Juvenile rearing and outmigration	• Reduced growth, feeding rates, competitive advantage with warm-water species, and survival • Increased susceptibility to disease • Altered development and migration timing

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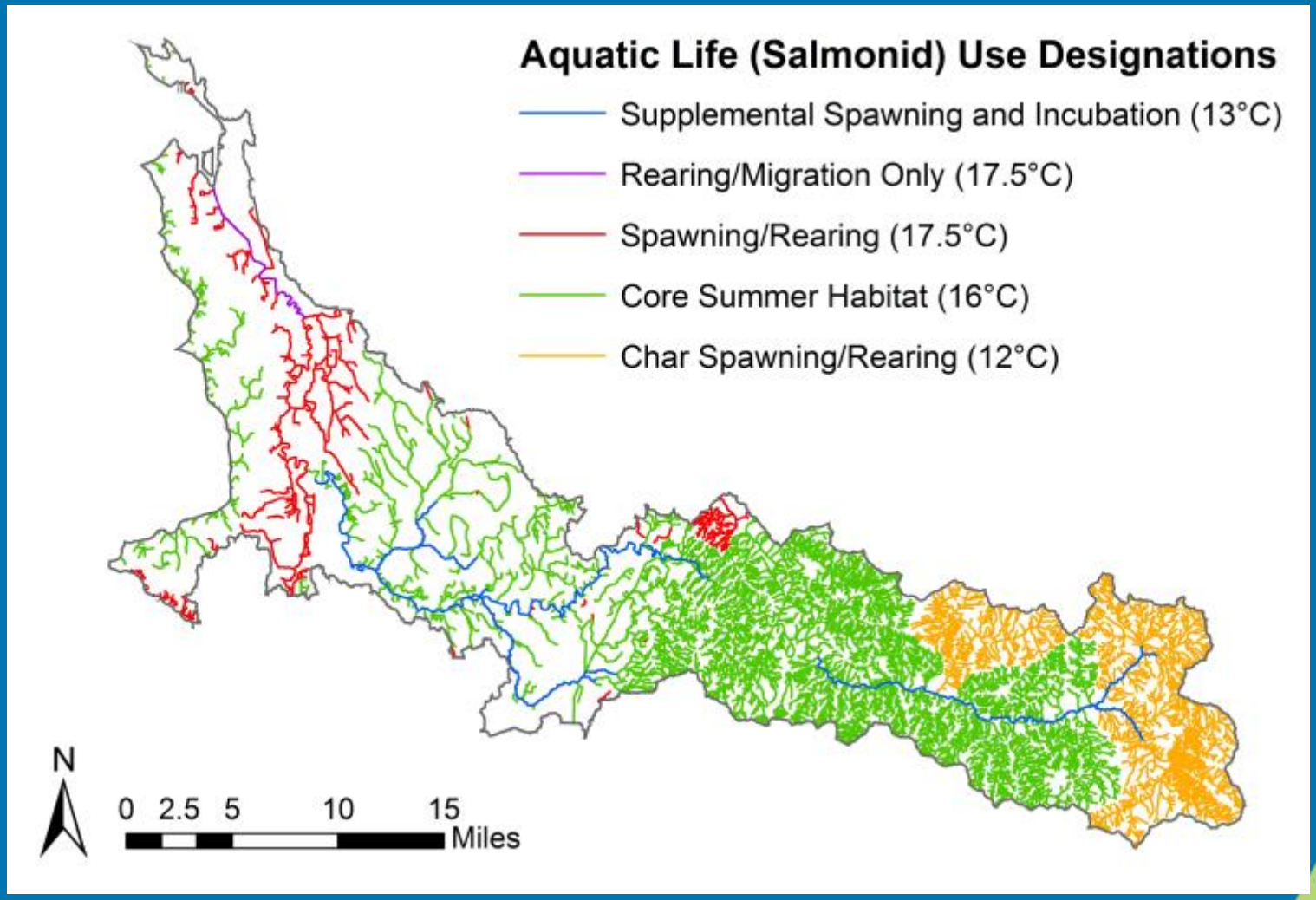
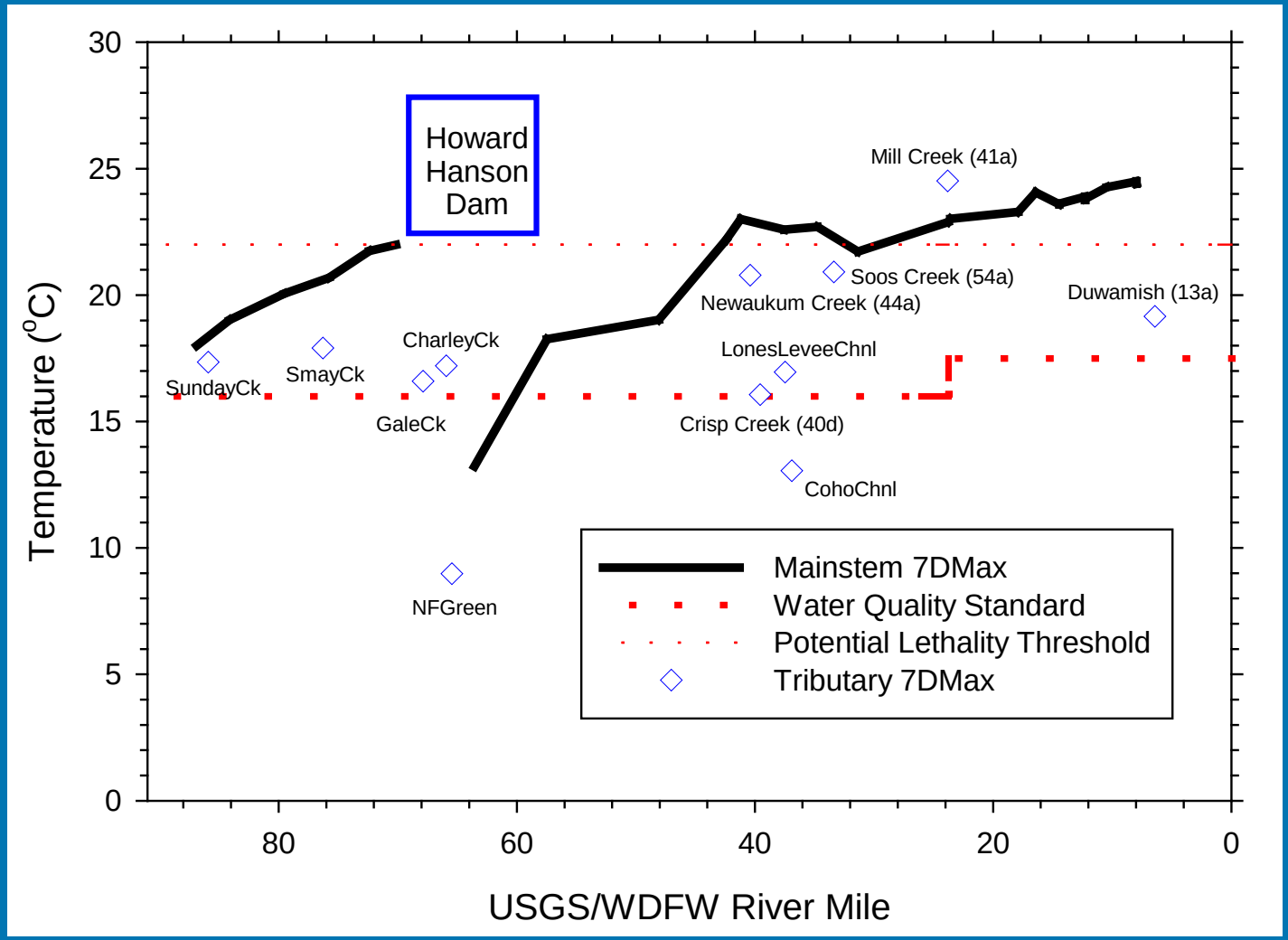
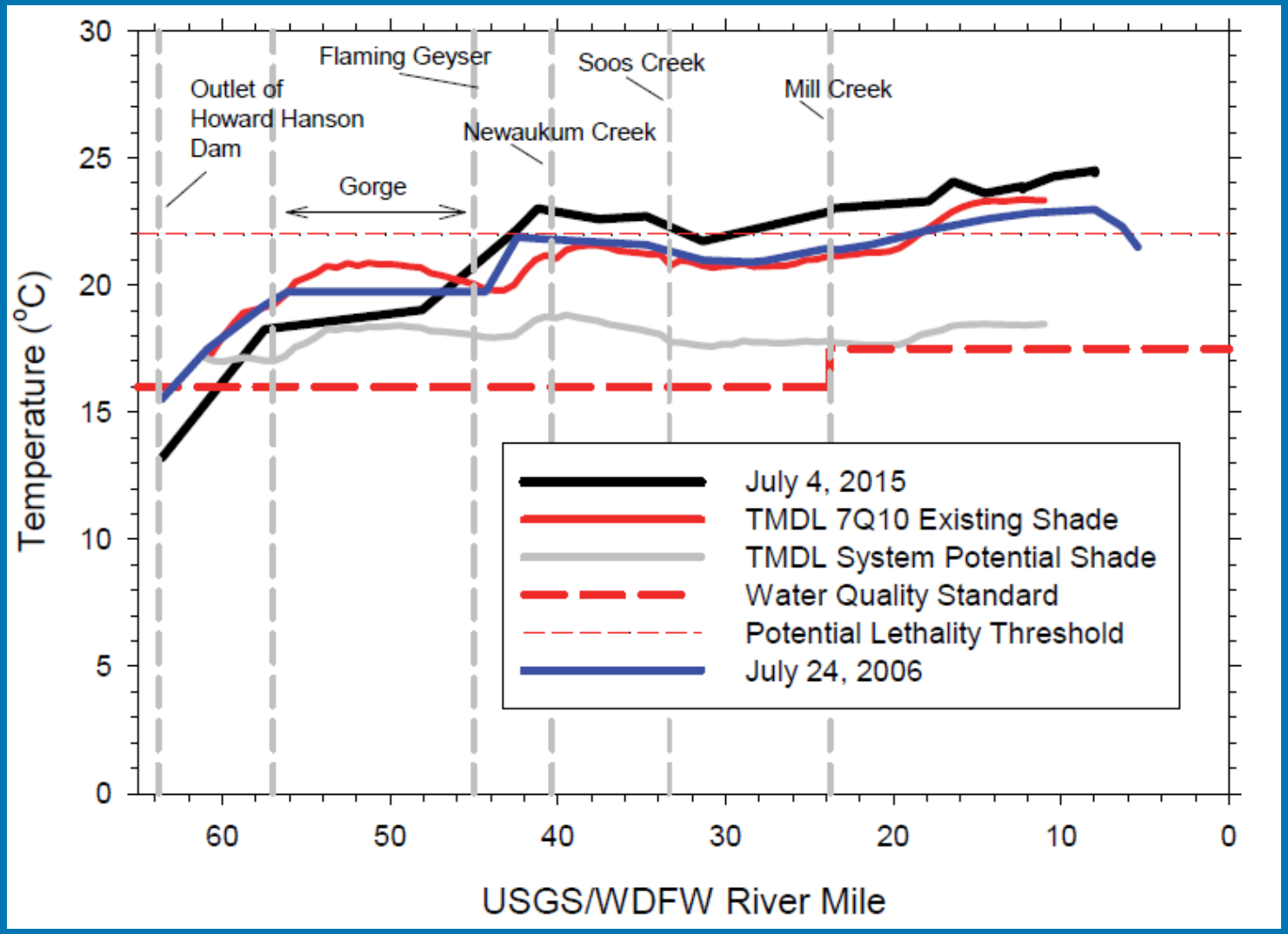
Washington State Water Temperature Standards - Thresholds



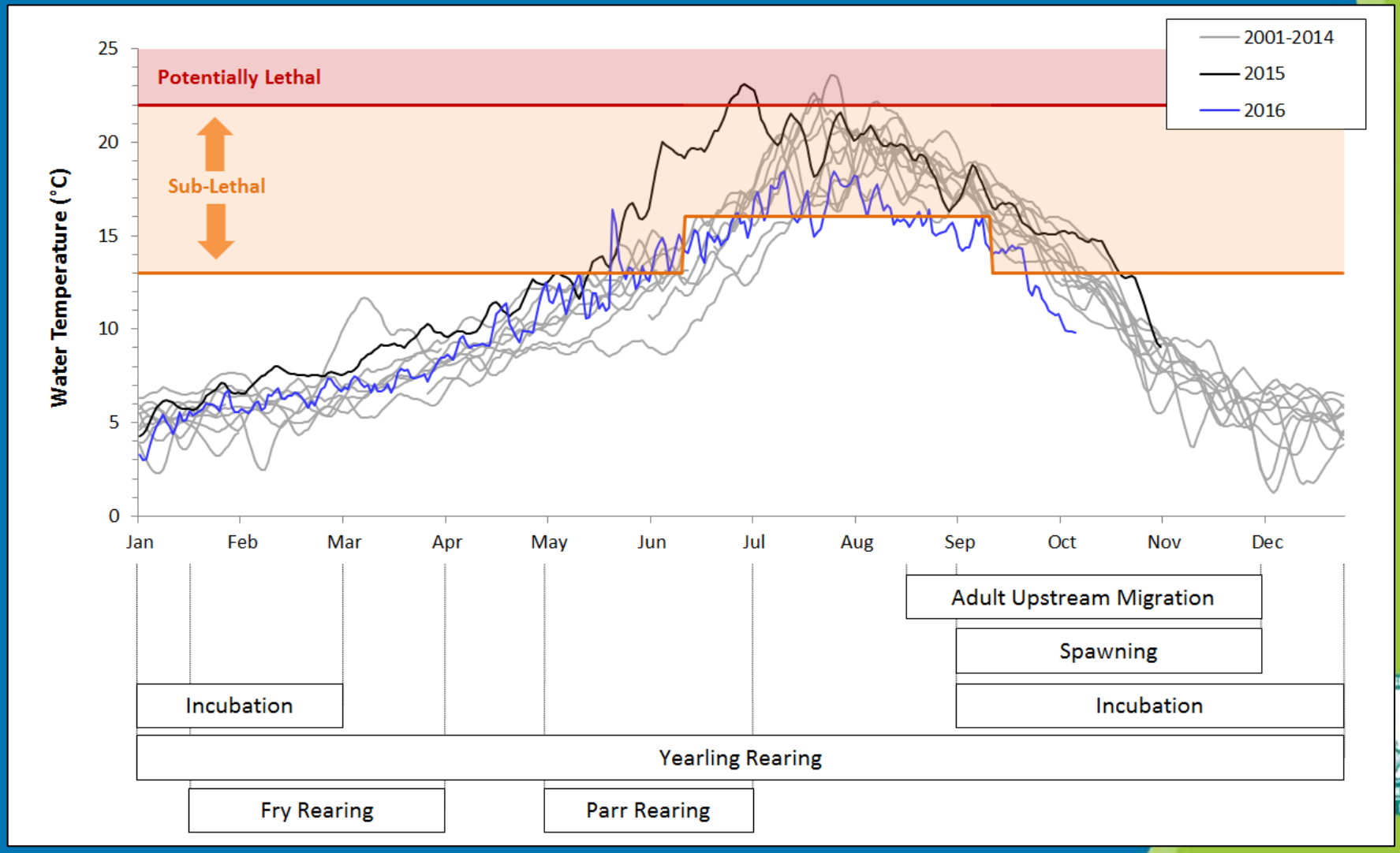
Potential Temperature-related Impacts to Chinook in the Green River



Temperature related Impacts to Chinook in the Green River-daily scale

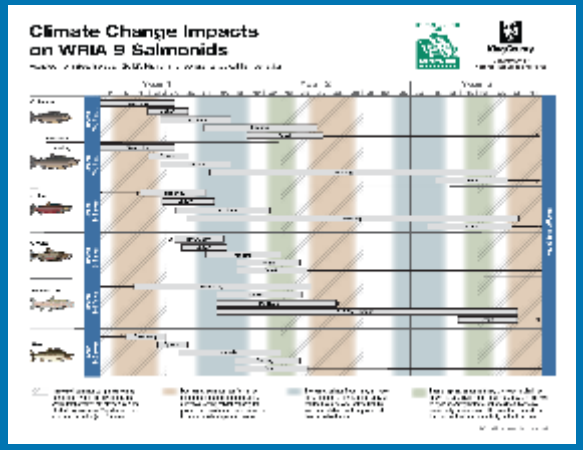


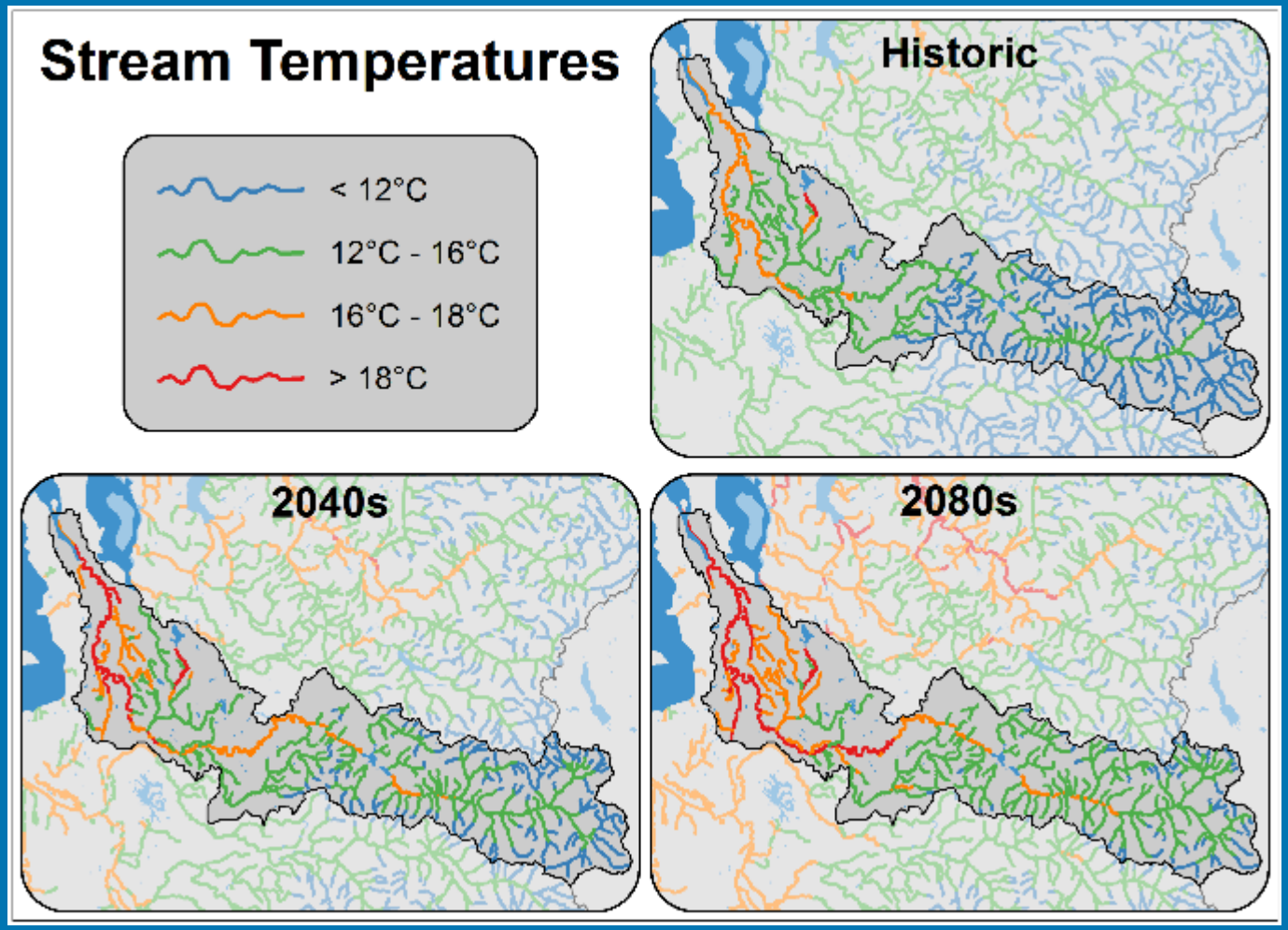
Seasonal Temperature related Impacts to Chinook in the Green River



Potential Climate Change Impacts

- Changes in precipitation and temperature regimes
- Shift from rain-snow and snow-dominant to rain-dominant
- Increased flood magnitude and frequency
- Shifts in biological processes, ecological connections, and life history patterns/timing





By the 2080s

Number of river miles exceeding thermal tolerances are projected to increase by greater than 70 miles for salmon

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Human Alterations to River Thermal Regimes

- Dams (altered thermal and flow variability)
- Water withdrawals (reduced instream flows)
- Channel engineering (reduced connectivity and extent)
- Vegetation removal (reduced insulating properties)
- Land-uses (altered hydrologic regime)
- Climate change (altered precipitation, hydrologic, and thermal regimes)

Strategies for Cooler Water Temperatures

- Protect riparian forested areas
- Plant wide, contiguous riparian buffers of tall trees
- Protect existing cold water refugia (temperature conditions beneficial for cold-water species such as salmonids)
- Protect and restore areas of hyporheic exchange and groundwater recharge
- Reduce water withdrawals from the watershed, encourage low impact development, and retrofit developed areas