

Structured Decision Making for Washington's Lower Columbia River Tributary Fisheries Management and Evaluation Plan (FMEP)

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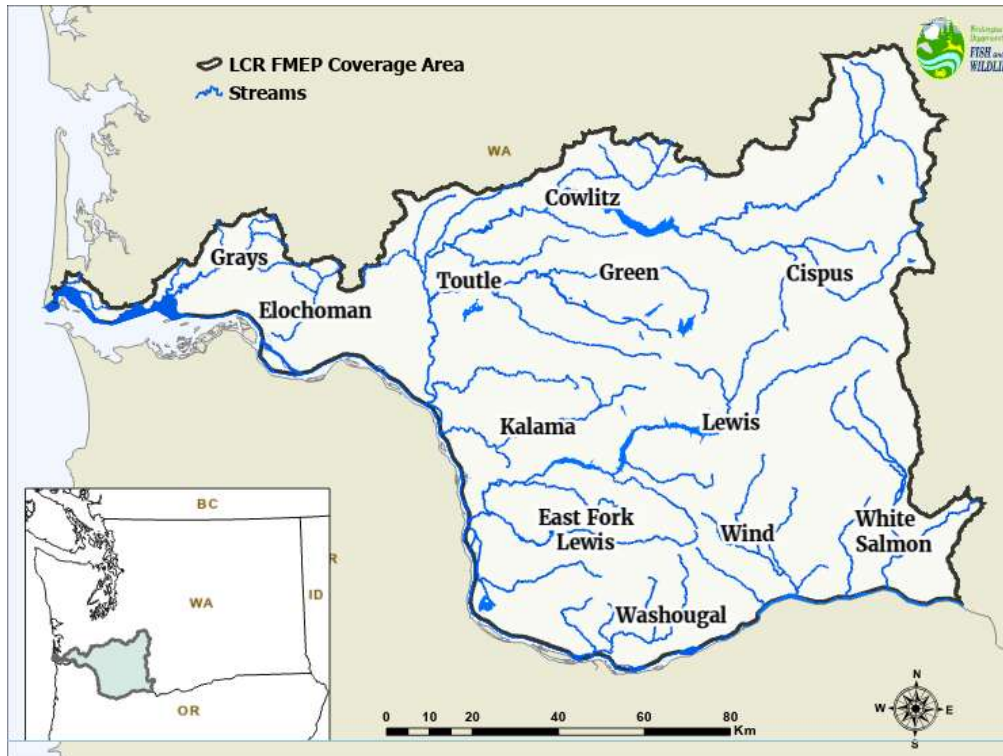
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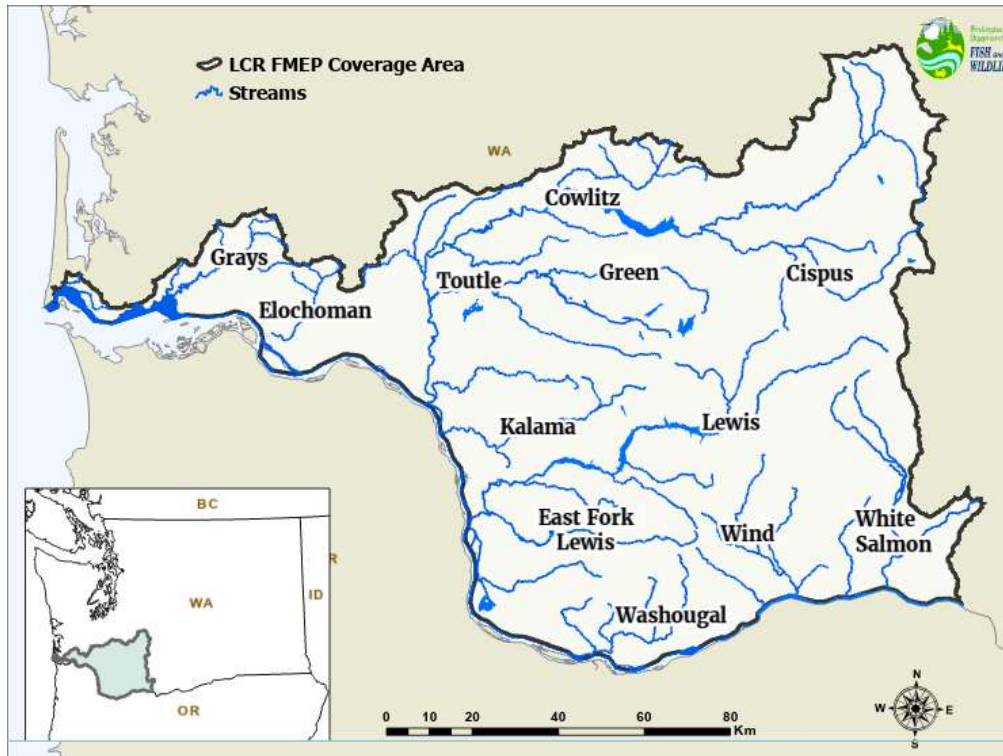
LCR Tributary FMEP -



- SW WA- Lower Columbia River (LCR)
- ESA listed salmon & steelhead
 - **LCR Steelhead – May 18, 1998**
 - LCR Chinook Salmon – May 24, 1999
 - Columbia River Chum – May 24, 1999
 - LCR Coho – June 28, 2005
- Fisheries impacting these populations require ESA Coverage
- Fishery Management & Evaluation Plan (FMEP) – submitted to NOAA
 - establish allowable levels of “take” associated with fishing activity.
 - Harvest Control Rules (HCRs)
 - Not regulations



LCR Tributary FMEP



- WDFW's current LCR Tributary FMEP
 - Submitted in 2001 / Approved in 2003
- Current Steelhead Fishery Structure
 - HCR- Fixed Exploitation Rate $\leq 10\%$ for most populations
 - $\leq 4\%$ for summer-run above Bonneville
 - Direct harvest focused on hatchery fish – (i.e., "mark-selective")
- Time for an update!
 - 2+ decades old
 - Written prior to mass-marking for Chinook
 - More data and new tools available.



WDFW Management Goals for FMEP Update

- Ensure fisheries are compatible with ongoing recovery
 - Evaluate status-quo mark-selective fisheries
 - Identify areas where more conservation is needed or where populations can support increased opportunity.
- Better understanding public preferences for fishery structure
- Develop a standardized approach for WDFW Columbia River FMEPs
 - Repeatable analysis/ structure
 - Increase cadence of re-evaluation



Approach: Structured Decision Making (SDM)

- Provides a framework for careful decision-making at the science-policy interface
- Series of steps designed to achieve objectives
- Deals explicitly with uncertainty
- Responds transparently to societal values



Objective

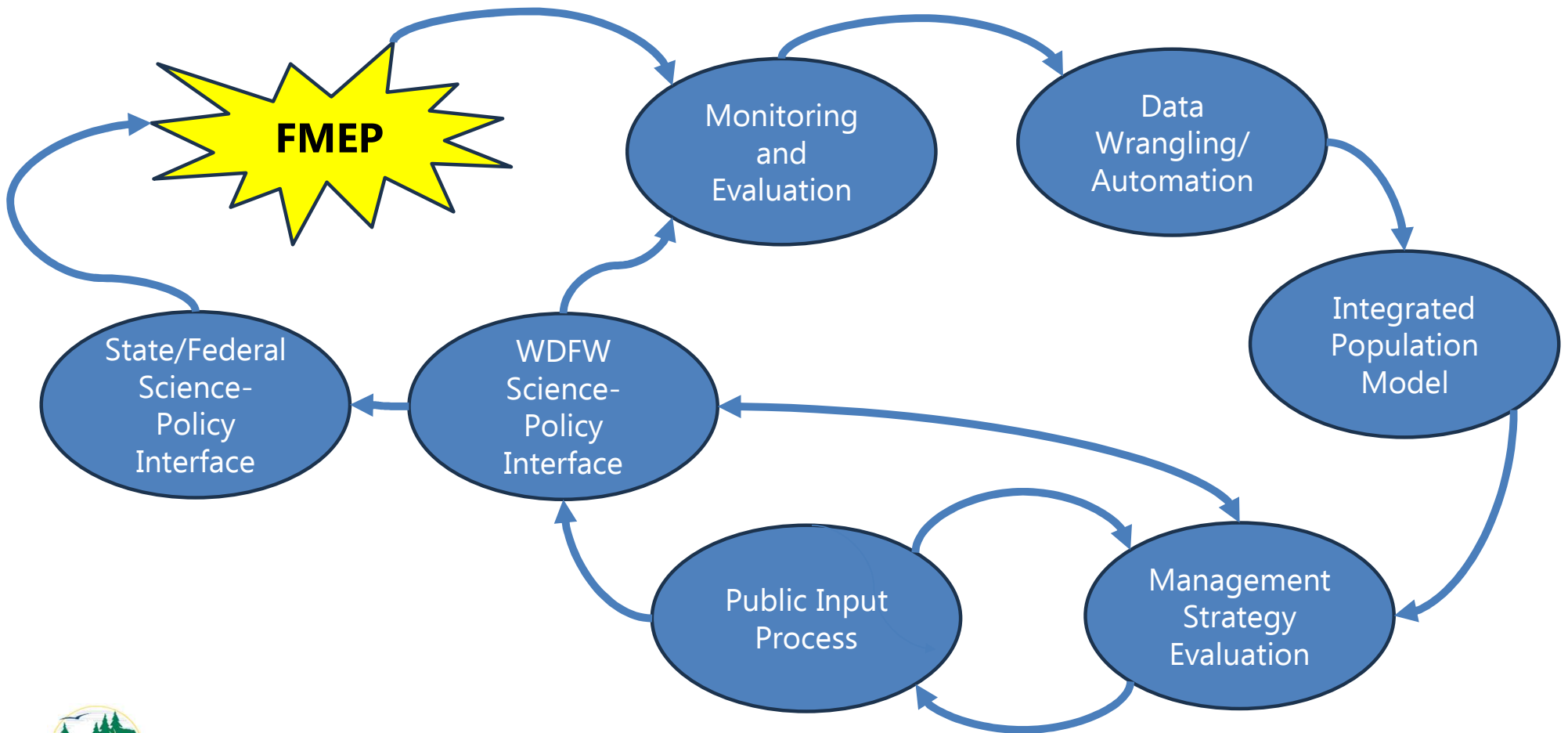
- Establish HCRs that allow for fishing opportunities without hindering recovery
- Utilize best available science
 - Integrated Populations Models
 - Management Strategy Evaluation
 - Public Input
- Create a streamlined and repeatable process for future updates



Photo Credit: Mollee Strand

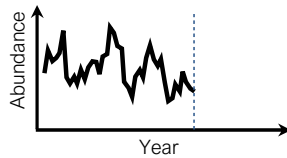


Structured Decision-Making Framework

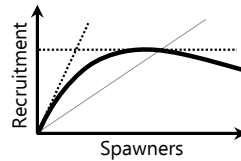


Initial SDM Steps

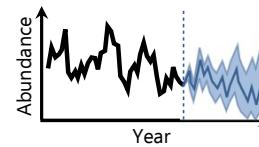
1. Gather data about fish (comes from monitoring programs)



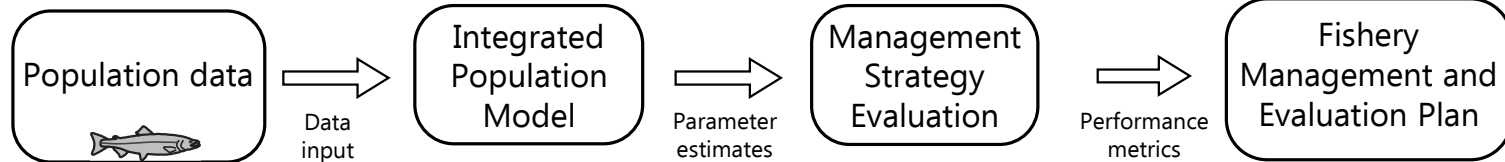
2. Fit a statistical population model based on the data



3. Simulate what will happen to fish populations given different HCRs

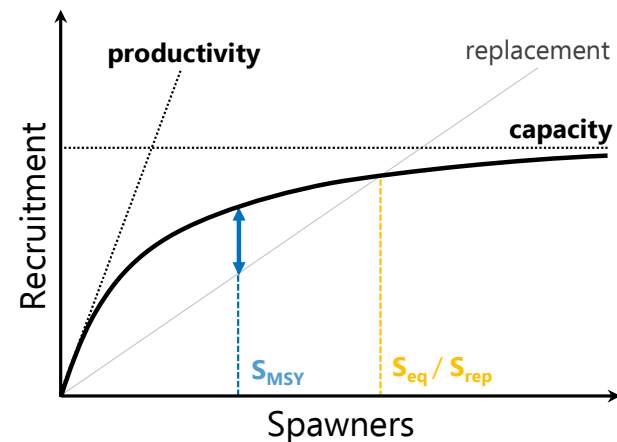
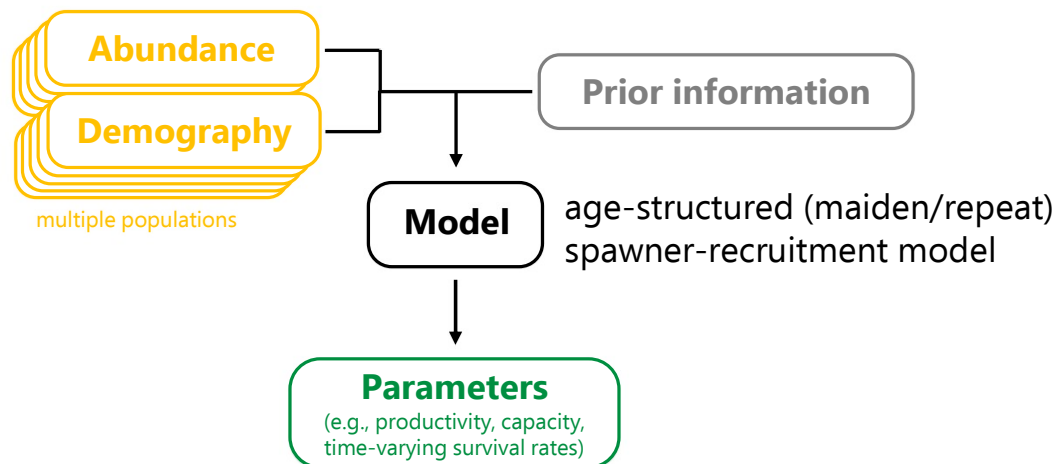


Assess the trade-offs associated with each HCR options



Integrated Population Model

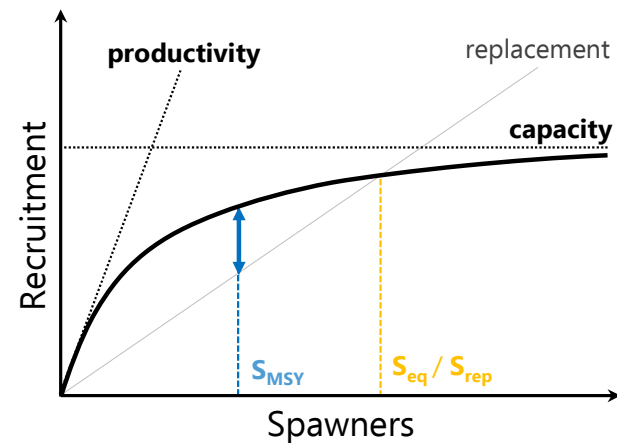
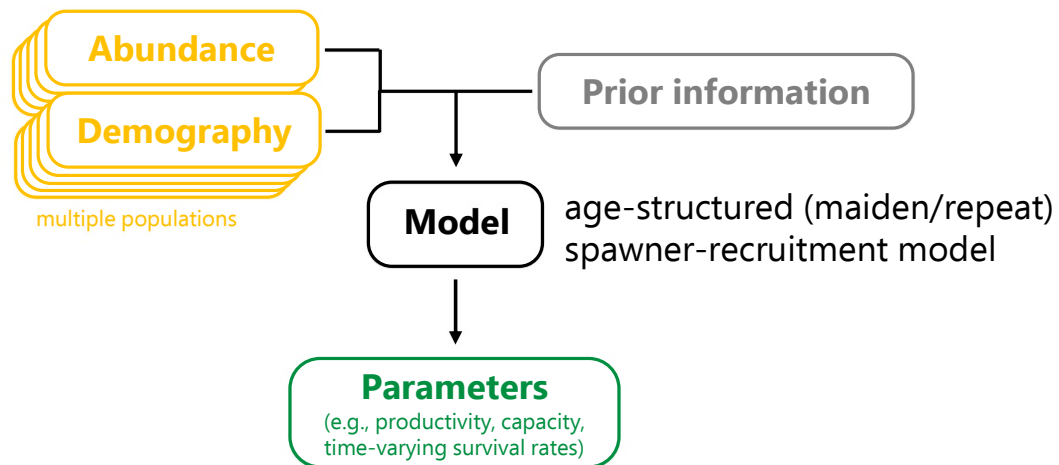
- salmonIPM R package
- Combined run-reconstruction and stock-recruitment model
- Integrates information on population abundances and demography
- Can incorporate prior information using a Bayesian approach
- Capture full uncertainty in the data by estimating a joint likelihood
- Hierarchical option



Integrated Populations Models

Parameterization and Priors

- Hierarchical adult-to-adult IPM – one model per species (3 to 14 populations per model)
- Beverton-Holt spawner-recruit relationship with time-varying recruitment residuals
- Steelhead model accounts for iteroparity and estimates kelt survival
- Differentiates between hatchery- vs. natural-origin spawners



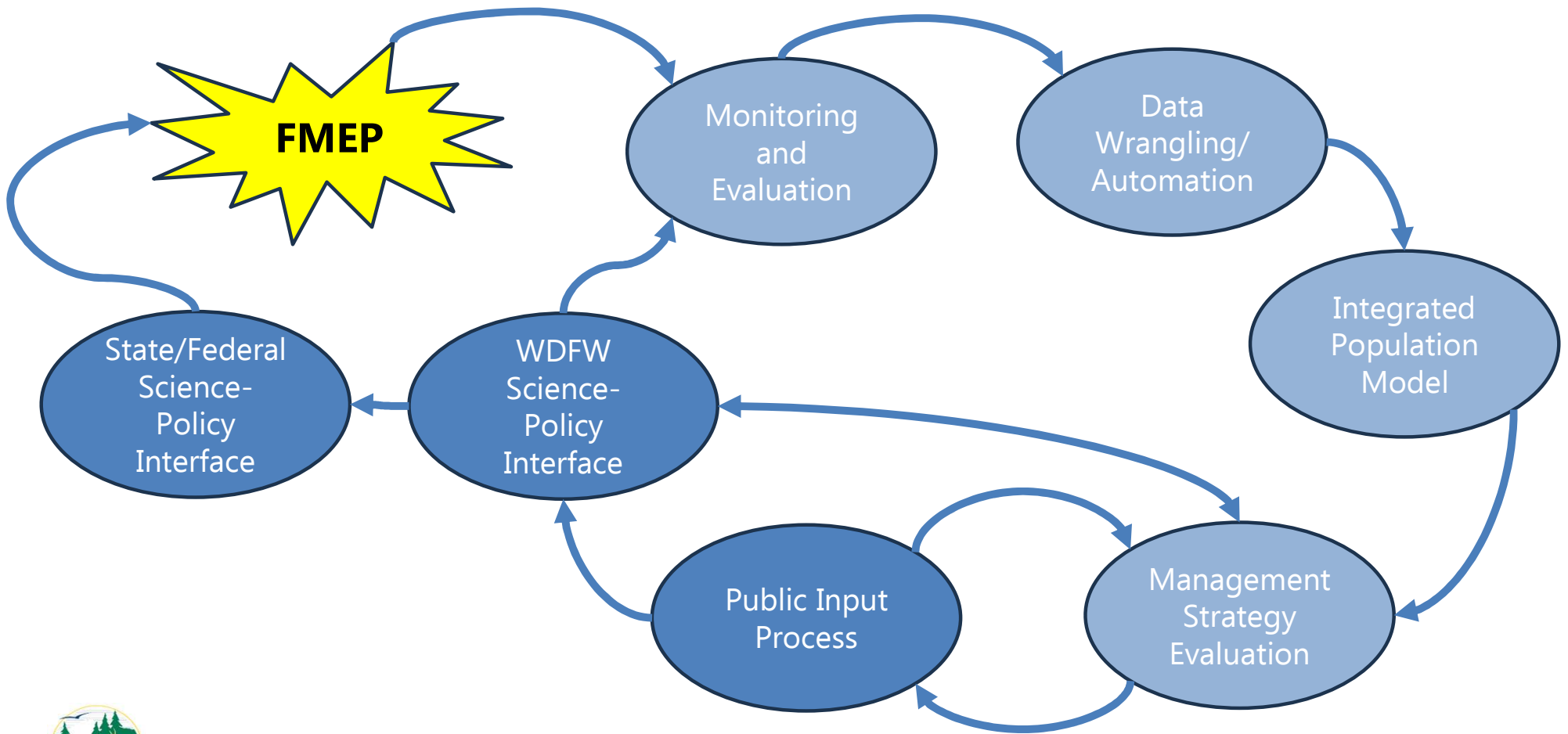
Management Strategy Evaluation



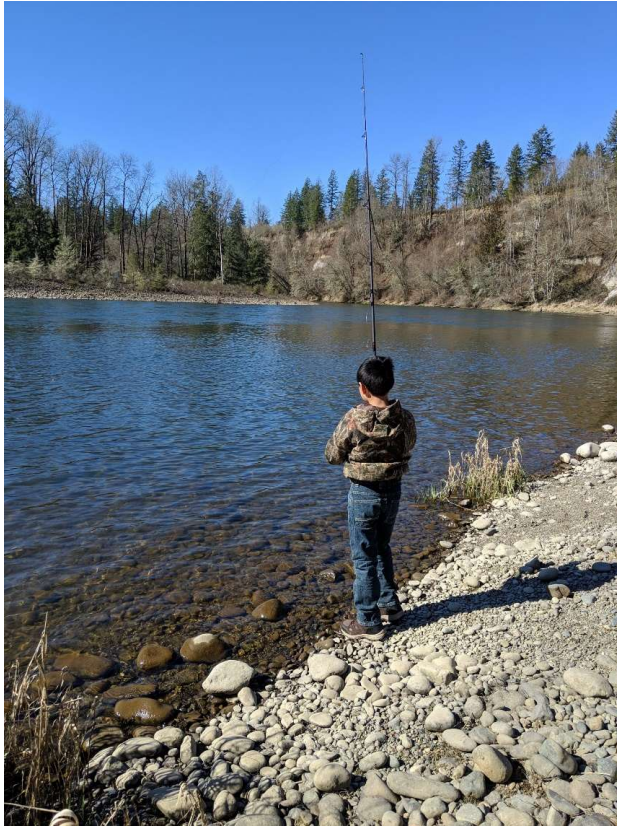
- Contained within the salmonMSE R package
- Project populations forward using parameters from IPM
- Apply alternative harvest control rules during forward projections
- Assume hatchery influences and mainstem plus ocean harvest rates as in recent past
- Measure performance metrics associated with each HCR option



Structured Decision-Making Framework



Public Input Process



- Public engagement can reduce conflict and increase resource stewardship
- Structured, repeatable survey produces data
- NOT a vote
- Policy and legal sideboards for HCRs
- Received 4,000 responses

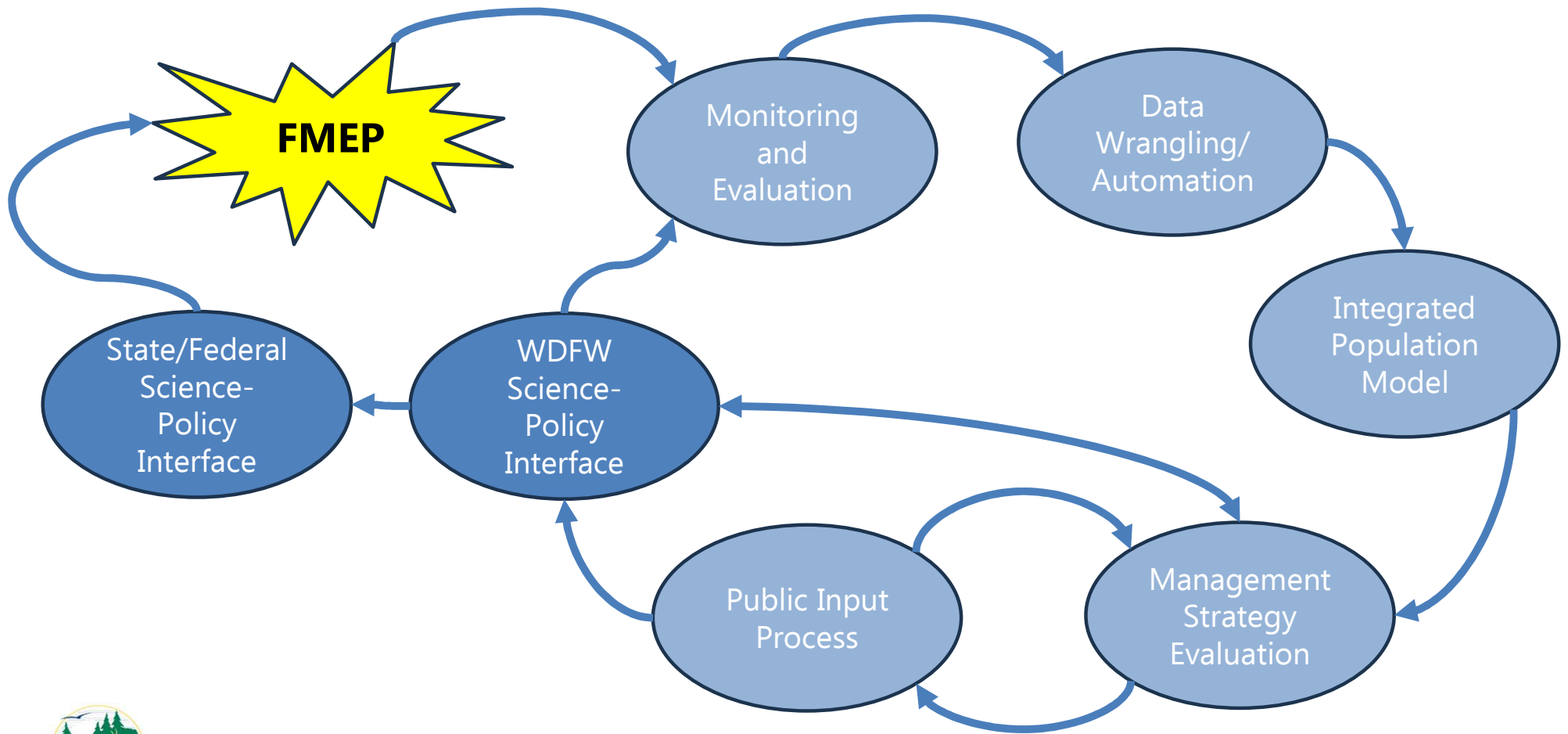


Public Input Survey – Analysis Ongoing

- Conducted Exploratory Factor Analysis (EFA) and Latent Class Analysis (LCA) to explore how public values and preferences influence risk tolerance for HCRs
- Risk tolerance is driven by key values including attitudes towards conservation, harvest on hatchery production, and fishing regulation
- General preference for moderate HCRs across anglers and non-anglers across all species
- More in this later! (At 4:05pm)



Structured Decision-Making Framework



WDFW Science-Policy Interface

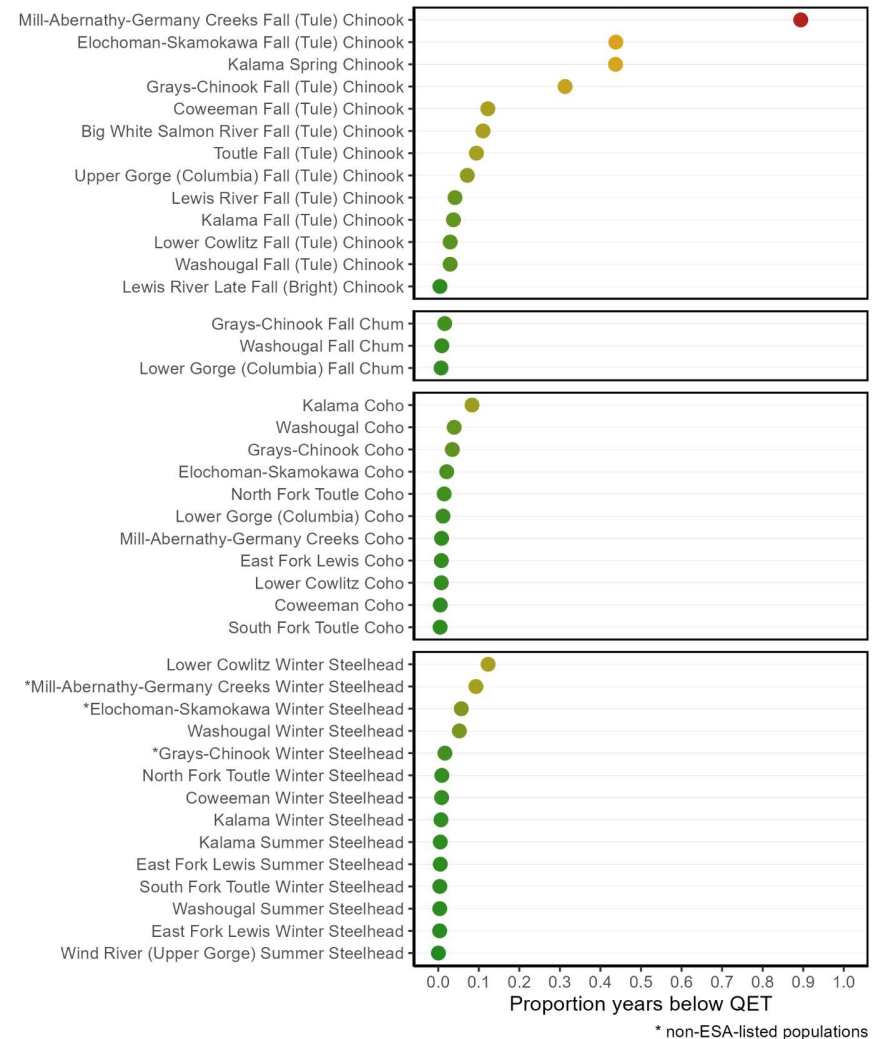
- Iterative process involving WDFW fisheries managers and scientists
- Tributary-specific total impact rates
 - Harvest, C&R mortality, hatchery removals
- Performance metrics in MSE model
 - Recruitment potential
 - Quasi-extinction risk
- Additional considerations
 - Mean harvest or C&R encounters
 - ESA delisting goals



WDFW Science-Policy Interface

- Risk tolerance strategy
- If quasi-extinction risk without tributary fisheries is >25%, propose 2.5% maximum non-target tributary impact rate
- Risk thresholds
 - 3% increase in quasi-extinction risk
 - 10% decrease in recruitment potential

Quasi-extinction risk (no tributary fishing)



Unmodeled Populations/Exceptions

- HCRs selected based on
 - Population recovery designations (primary, contributing, stabilizing)
 - Passage barriers
 - Hatchery mitigation programs
 - Listing status (i.e., SW Washington DPS steelhead are not ESA listed)
 - Additional conservation considerations



Selected Total Impact Rates

- Population specific
- Chinook salmon: 2.5-15%
- Chum salmon: 2.5-10%
- Coho salmon: 5-15%
- Steelhead: 2.5-15%



Steelhead

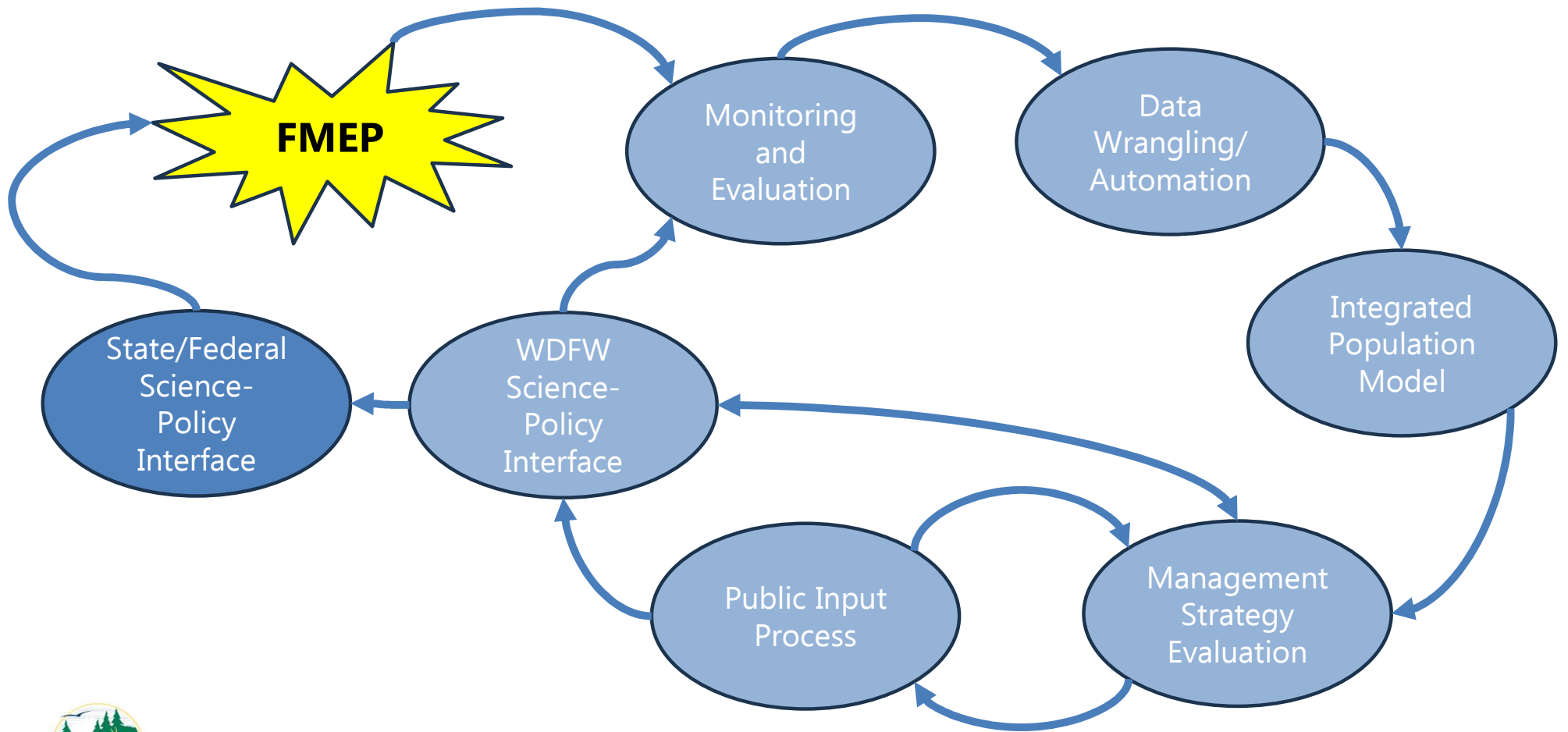
Increase in extinction risk due to ocean+mainstem vs tributary fisheries – NOT exploitation rates

Population	Percent increase in QET Risk		
	Ocean and Mainstem	Tributaries (3% Cap)	Total
Coweeman Winter Steelhead	0.1%	0.7%	0.8%
East Fork Lewis Summer Steelhead	0.0%	0.2%	0.2%
East Fork Lewis Winter Steelhead	0.0%	0.8%	0.8%
Elochoman-Skamokawa Winter Steelhead	0.2%	2.6%	2.8%
Grays-Chinook Winter Steelhead	0.0%	0.6%	0.6%
Kalama Summer Steelhead	0.0%	0.4%	0.4%
Kalama Winter Steelhead	0.2%	0.3%	0.5%
Lower Cowlitz Winter Steelhead	0.5%	4.9%	5.4%
Mill-Abernathy-Germany Creeks Winter Steelhead	0.0%	4.0%	4.0%
North Fork Toutle Winter Steelhead	0.0%	1.0%	1.0%
South Fork Toutle Winter Steelhead	0.0%	0.1%	0.1%
Washougal Summer Steelhead	0.0%	0.6%	0.6%
Washougal Winter Steelhead	0.0%	3.4%	3.4%
Wind River (Upper Gorge) Summer Steelhead	0.0%	0.0%	0.0%

* Differences among impacts of less than 1% are considered comparable due to the finite number of stochastic simulations



Structured Decision-Making Framework



Cyclical Adaptive Management Process

- 1—year cycle:
 - Produce tributary specific estimates of total impact rates for each population, report to NOAA
 - Evaluate success in meeting HCR targets, alter regulations as needed
- 5-10—year cycle:
 - Re-run MSE using updated data
 - Propose new HCRs as appropriate



Benefits of MSE-Based SDM Process

- Direct quantification of conservation and fishing opportunity implications of HCRs
- Promotes efficient workflows (data pipeline)
- Transparent, repeatable, empirical
- Facilitates participation from scientists, managers, stakeholders, and the public
- Application of best available science



Next Steps

- Complete internal policy review
- Submit FMEP to NOAA for consultation
- Adaptive management process moving forward
- Ongoing M&E to support re-evaluation
- Communicate survey results to the public



Acknowledgements

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Primary collaborators: Dr. Jan Ohlberger and Dr. Thomas Buehrens; Chris Donley, Chad Jackson, and Trevor Hutton; Mike Tonseth; Dr. Mark Sorel and Dr. Charlene Hurst; Jim Scott

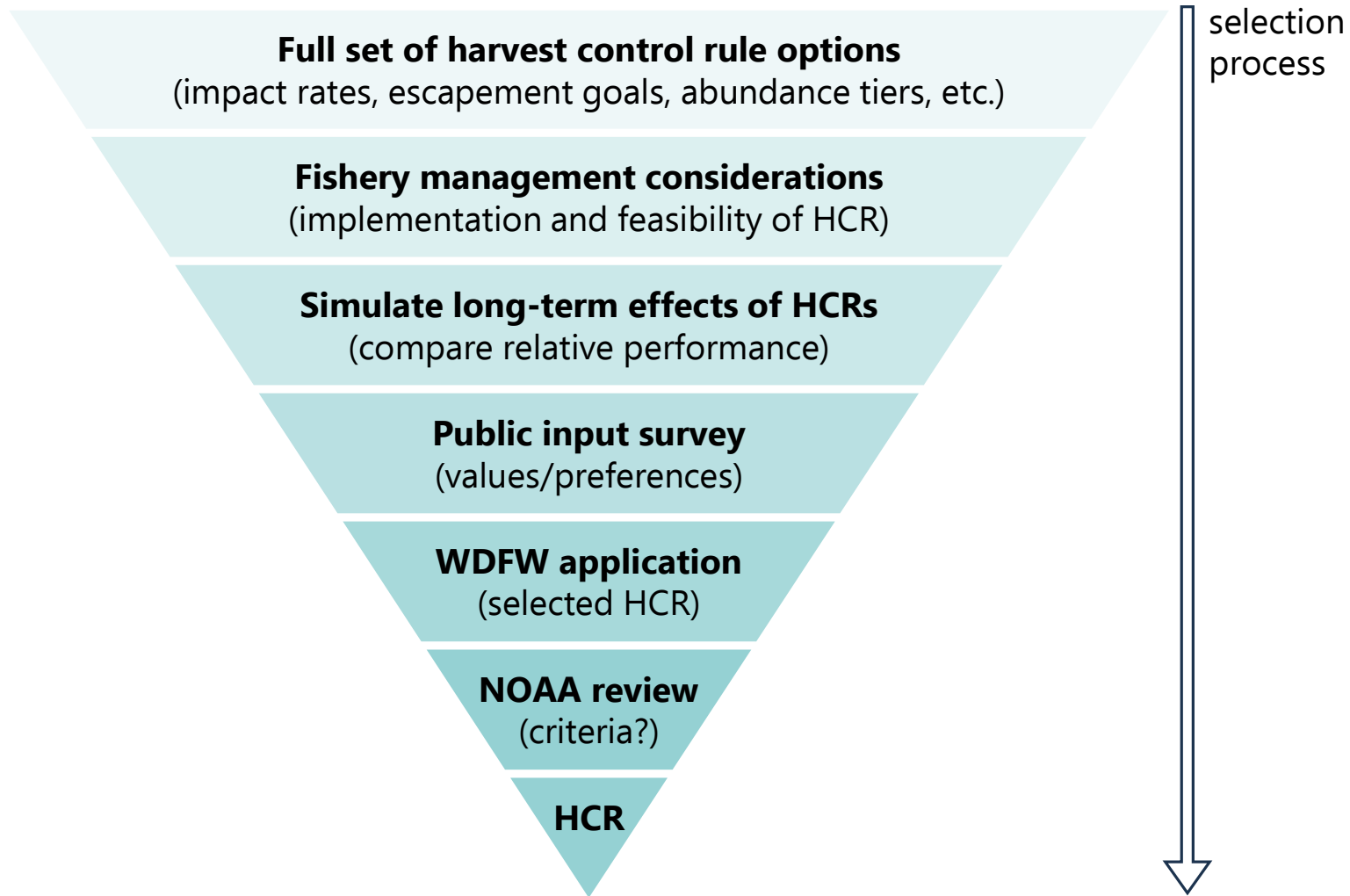




Questions?

MSE

HCR selection



LCR Tributary FMEP

Current/approved maximum tributary impact rates (LCR FMEP, Feb 2001, updated Oct 2003)

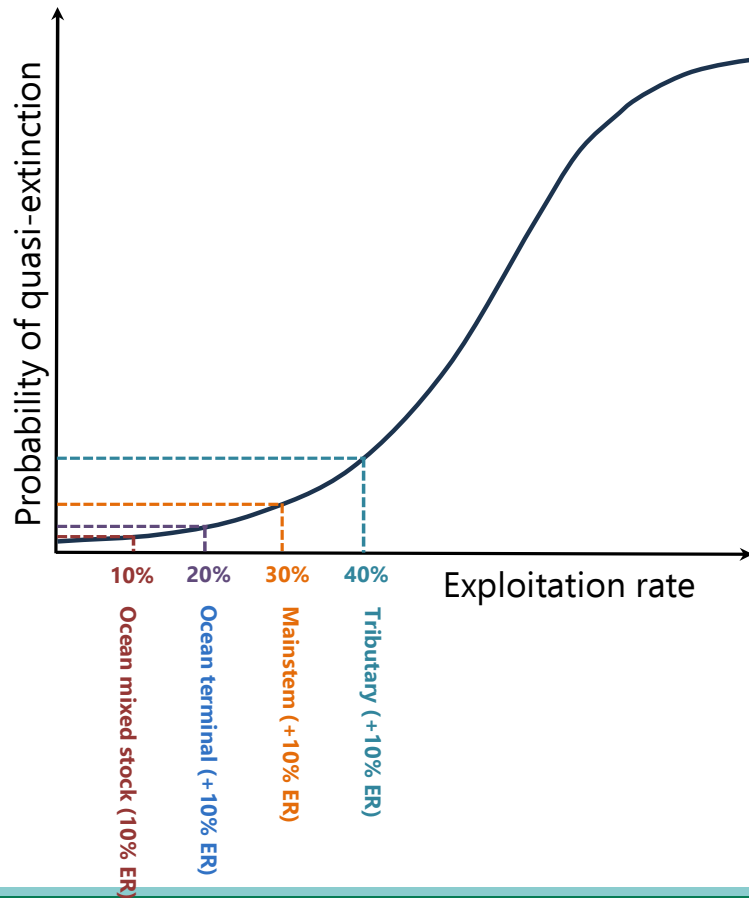
Species	Run	Impact rate
Chinook	Fall (Tule)	PFMC/NoF*
	Spring	≤10%
Steelhead	Winter	≤10%
	Summer	≤10%
	Summer above BON	≤4%
Chum		≤4%
Coho		None

* Tributary fishery impacts will not cause total Tule Fall exploitation to exceed level developed for PFMC/NoF fisheries



Supplement

Conceptual illustration of non-linearity in extinction risk increase as a function of sequential exploitation impacts



Bull Trout

- While Bull Trout are largely absent from lower Columbia tributaries, some small populations do exist
- WDFW's ESA Section 6 Cooperative Agreement with the United States Fish and Wildlife Service provides statewide coverage of incidental take of Bull Trout associated with recreational fisheries targeting resident and anadromous fish species

