Oregon salmon forecasts

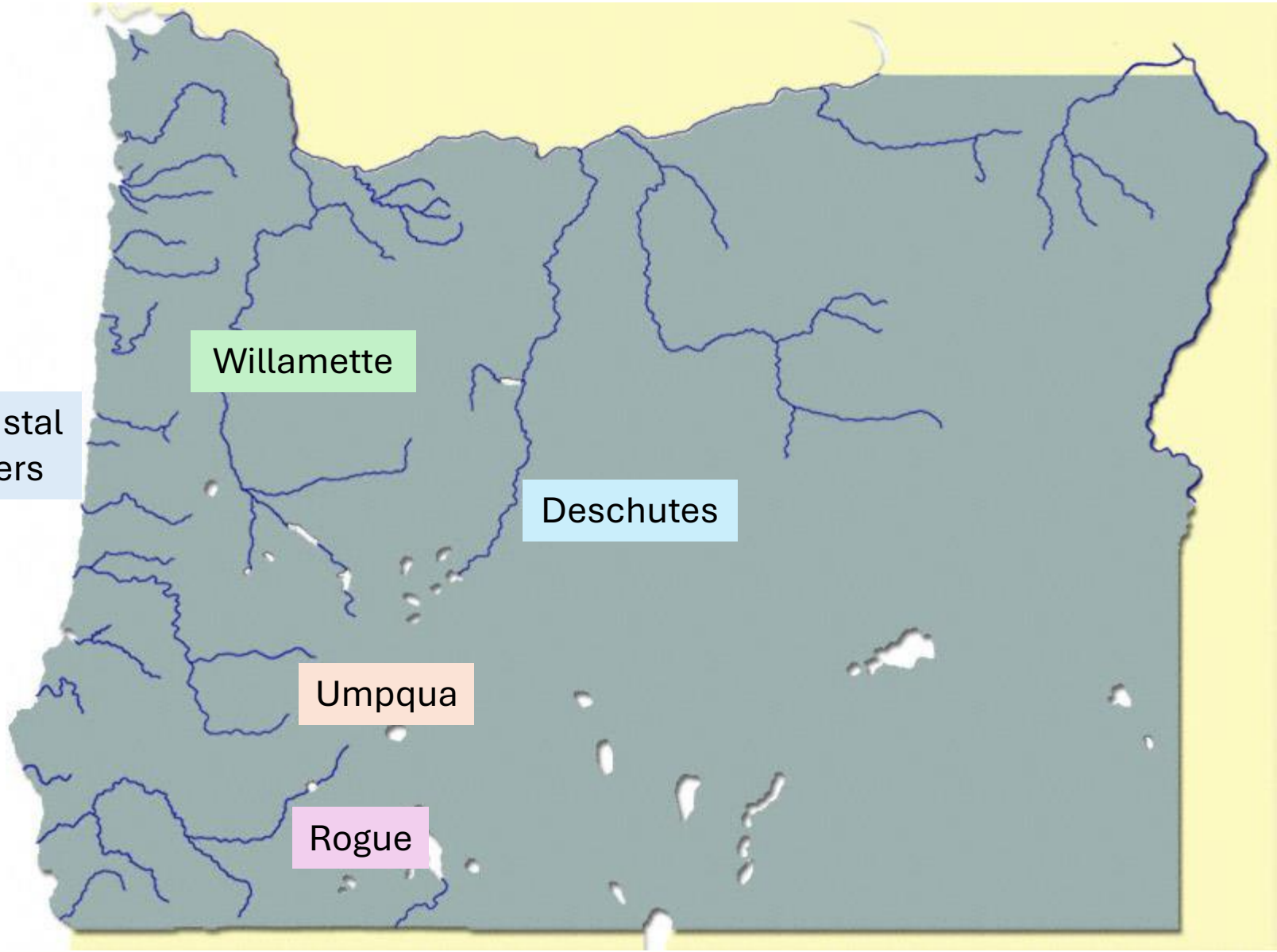
Megan Sabal

ODFW

9/11/2024

Forecasting Workshop

10 total forecasts!



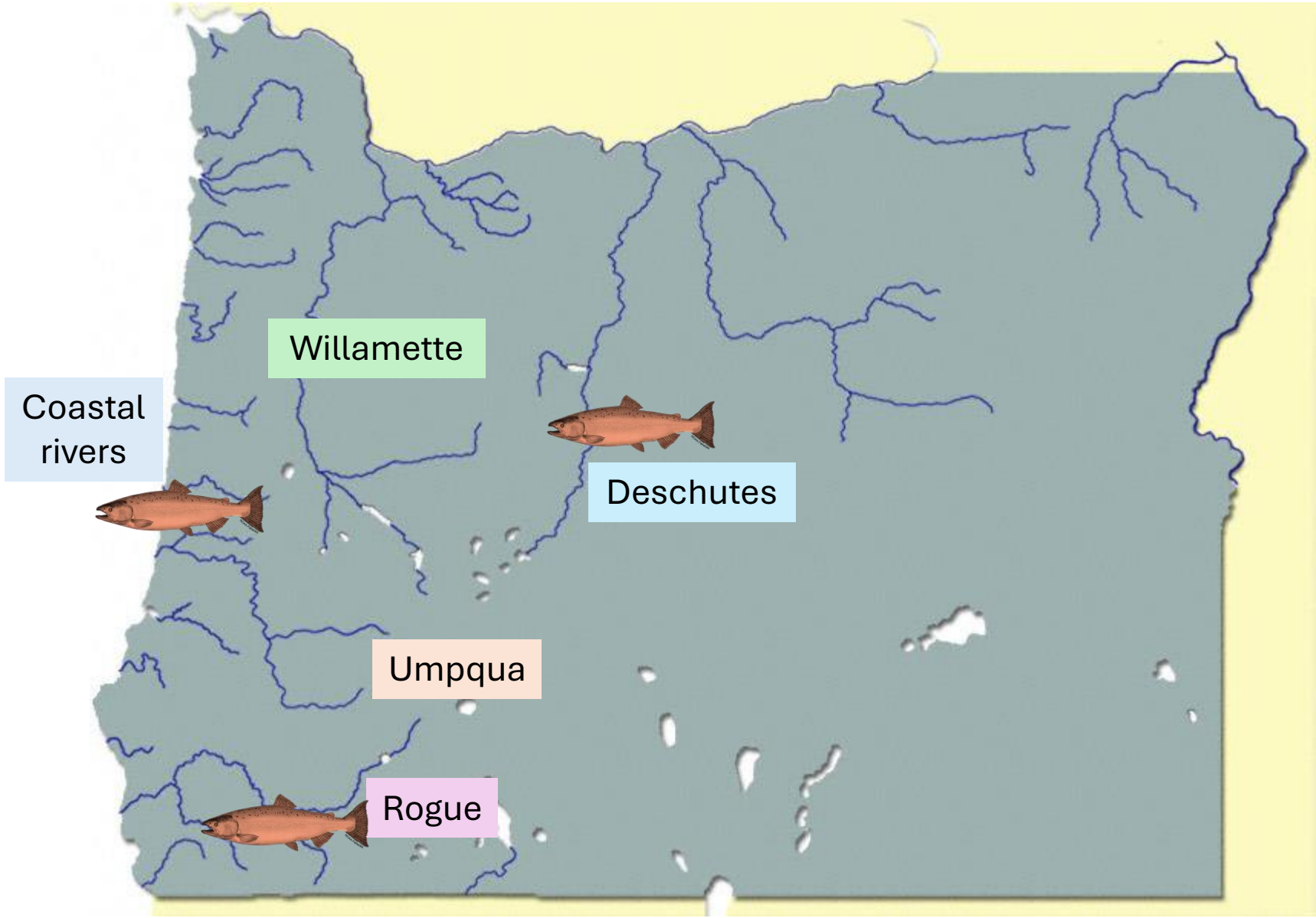
Data In – I mostly didn’t do this!

- Escapement:
  - Spawning ground surveys
  - M-R experiments
  - Dam counts
- By Age
- Environmental covariates
- Survival indices

Species	Run	System	Output	Forecast approach(es)	Best, ensemble, static	New model(s) each year?	Contact
Chinook	fall	16 coastal rivers in 4 strata					**Clemons**
Chinook	fall	Rogue River					Mazur
Chinook	fall	Deschutes River					**Clemons**
Chinook	fall	Salmon and Elk Rivers					**Riggers**
Chinook	spring	Umpqua River (North and South)					**Sabal** (**Falcy** developed)
Chinook	spring	Willamette River					**Storch**
Chinook	spring	Rogue River					Samarin (**Falcy** developed)
Coho	OCN	Coastal OR rivers (natural)					**Suring**
Coho	OPI-H	Klamath to WA (hatchery) & CR (natural)					Leeman; **Suring; Sorel**
Steelhead	winter	Rogue River					Anthony

Names in bold are here at the workshop!


Fall Chinook


Willamette
Coastal rivers
Deschutes
Umpqua
Rogue

Fall Chinook

Species	Run	System	Output	Forecast approach(es)	Best, ensemble, static	New model(s) each year?	Contact
Chinook	fall	16 coastal rivers in 4 strata	Age-specific abundance	Naïve, ARIMA, Sibling w and w/o covariates, Kalman filter (ForecastR)	Best	Yes	**Clemons**
Chinook	fall	Rogue River	Age-specific abundance	Sibling	Static	No	Mazur
Chinook	fall	Deschutes River	Age-specific abundance	Naïve, ARIMA, Sibling w/o covariates, Kalman filter (ForecastR)	Best	Yes	**Clemons**
Chinook	fall	Salmon and Elk Rivers	Age-specific abundance	Survival model; Cohort analysis	Static	No	**Riggers**

Coastal

- Population forecasts rolled up to strata for PST management.
- Strata forecasts don't perform as well.
- Challenge: turn-around time.

Rogue

- Developed 10 years ago.
- Recently running high.
- Works well for purposes: to capture dramatic downturn.

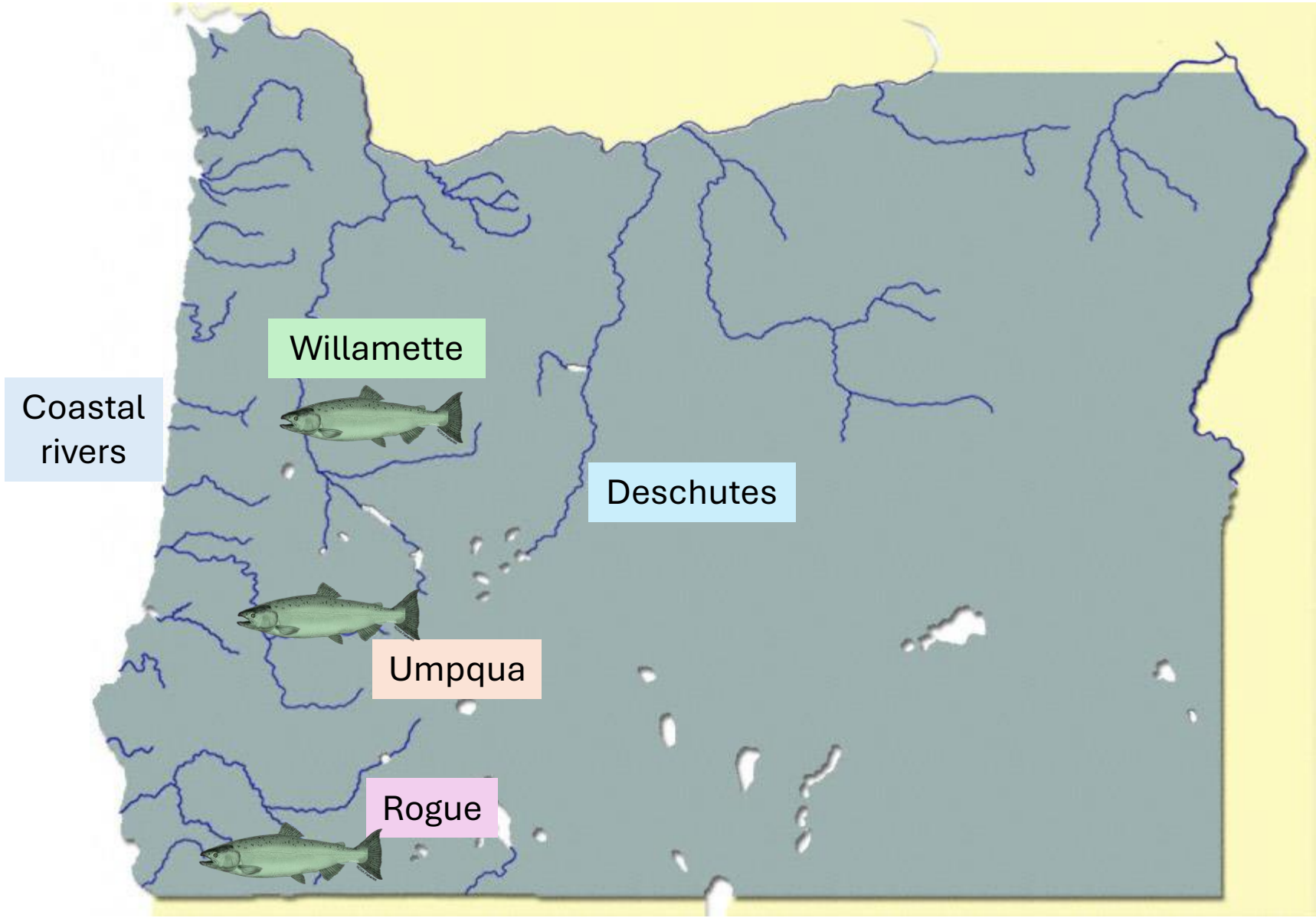
Deschutes

- Was particularly bad at forecasting!
- Currently not used anymore.

Salmon and Elk

- Applies relevant CWT age-specific survivals to hatchery release #s. Sum across ages for total abundance.
- In progress: apply to natural fish.


Spring Chinook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Spring Chinook

Species	Run	System	Output	Forecast approach(es)	Best, ensemble, static	New model(s) each year?	Contact
Chinook	spring	Umpqua River (North and South)	Abundance	ARIMA, NNAR, Sibling regressions; each with and without minimum summer flow covariate	Ensemble	No	**Sabal** (**Falcy** developed)
Chinook	spring	Willamette River	Age-specific abundance	Sibling w and w/o covariates (state-space w/ sometimes time-varying parameters)	Best	Sometimes	**Storch**
Chinook	spring	Rogue River	Age-specific & total abundance	Sibling regression (age-specific) and ARIMA with covariates (total)	Ensemble	No	Samarin (**Falcy** developed)

Umpqua

- No age data available.
- Used to set bag limits.
- Hasn't performed great – interest in updating.

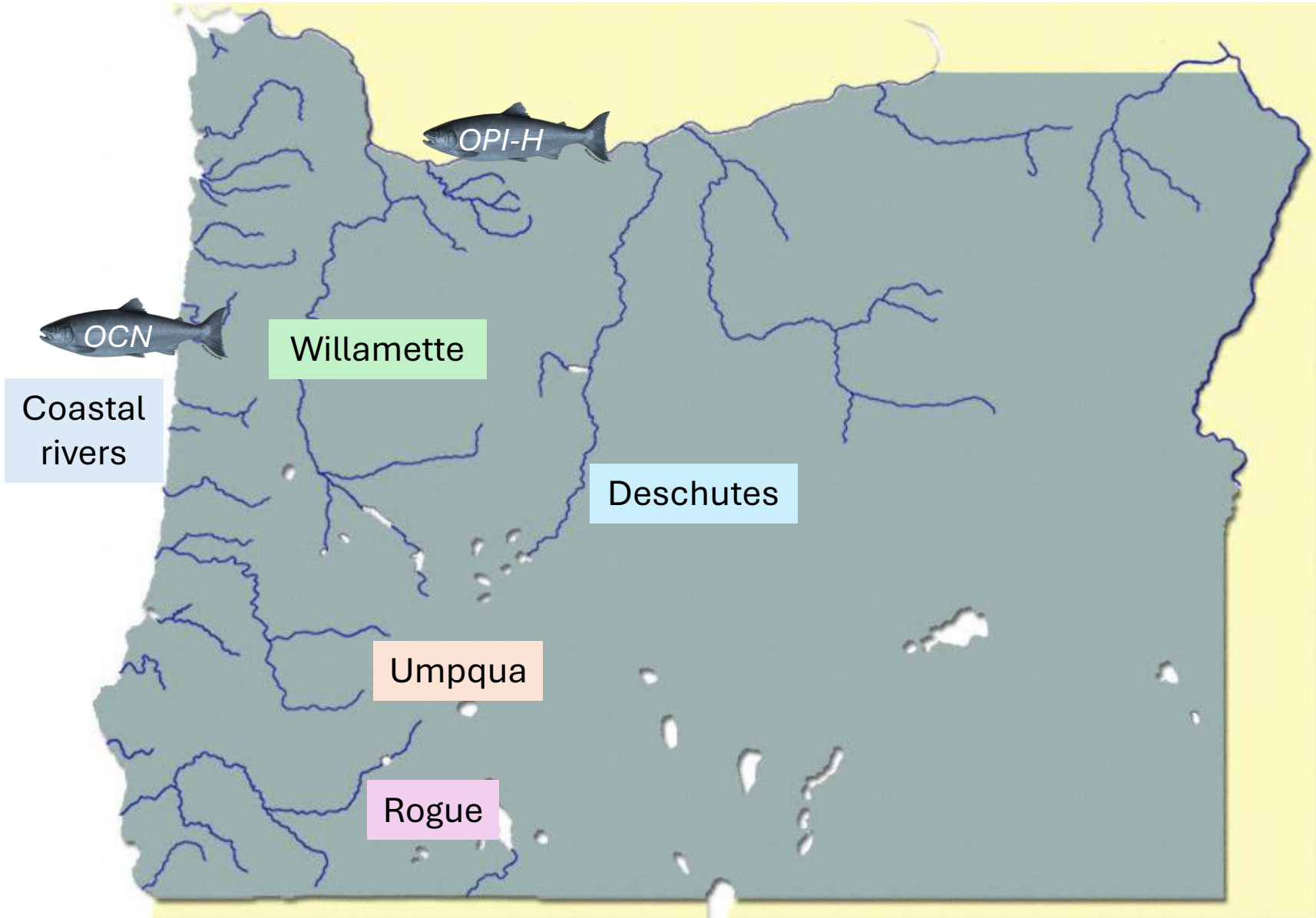
Willamette

- Formal evaluation in 2016.
- Now "best" models updated only when they appear to be performing poorly.
- Age-specific error propagated via MCMC for total run.
- With cool Shiny app!

Rogue

- Been used for recent 6 years.
- Typically done well but missed recent downturn.


Coho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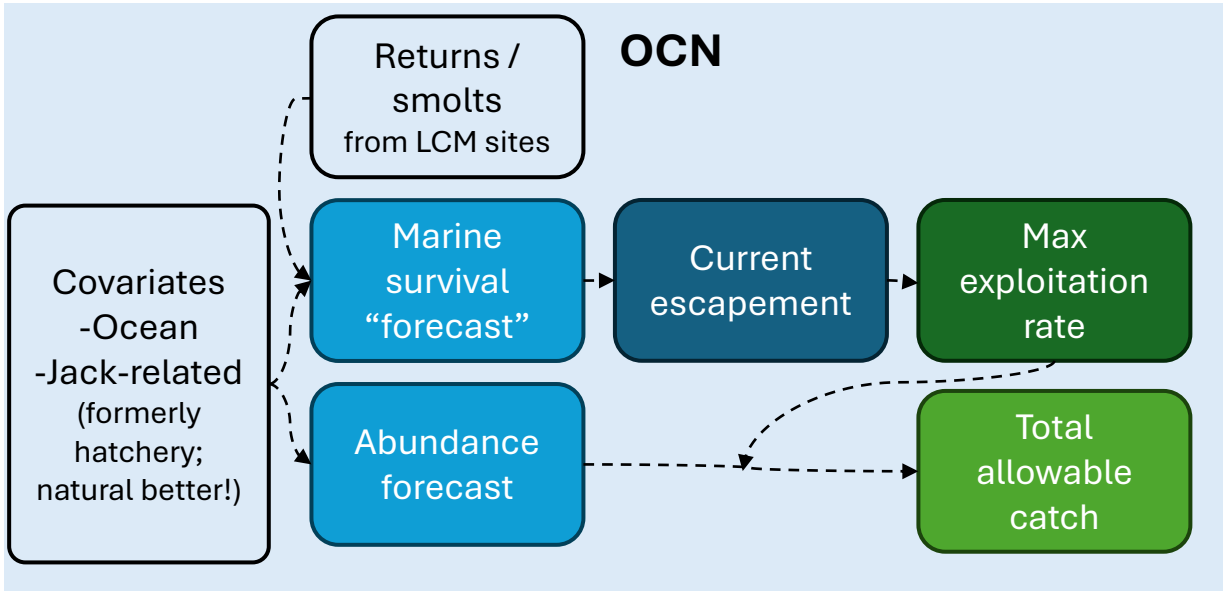
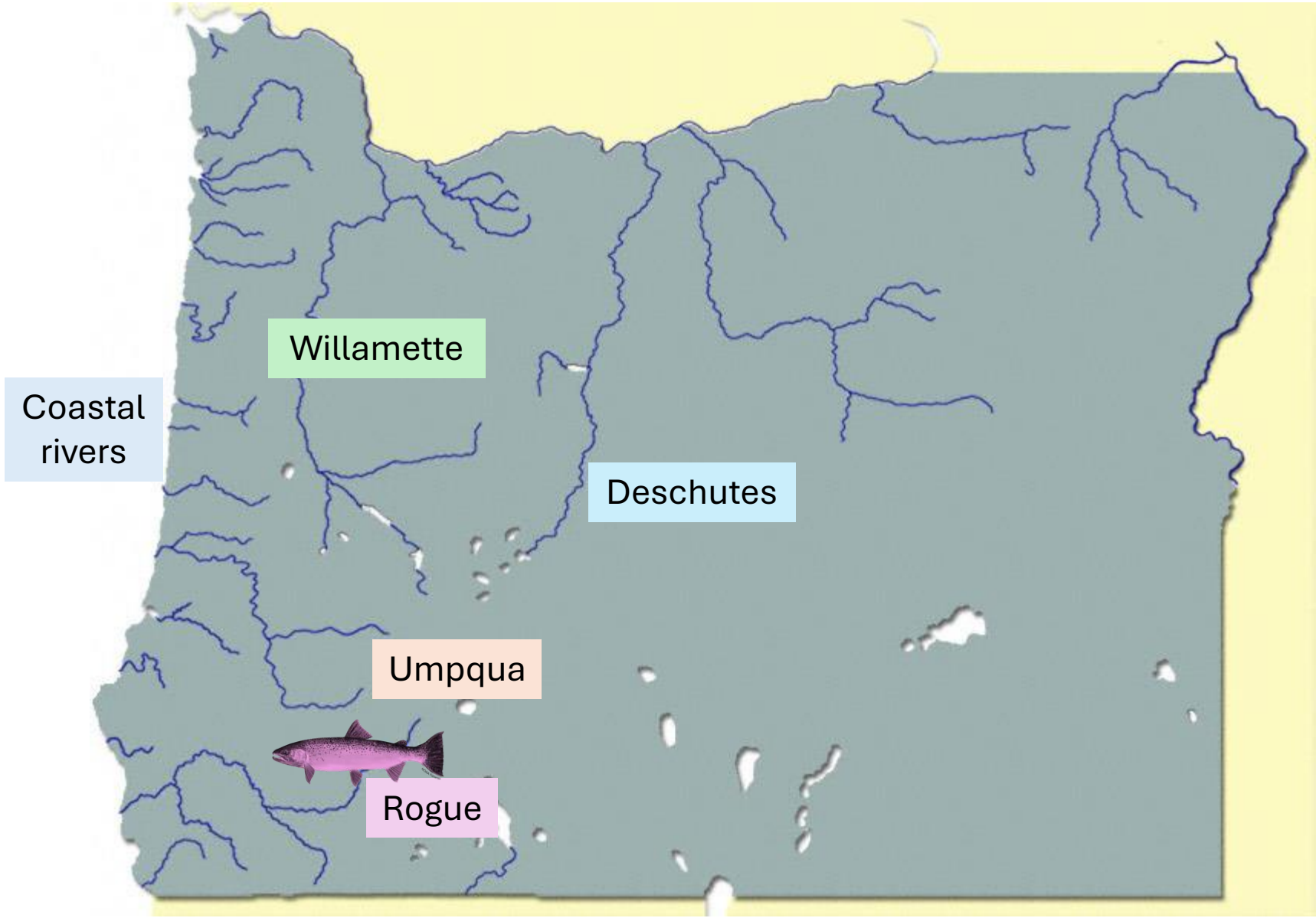


OPI-H

- New method applied in 2024!
- Includes ocean covariates in top models.
- Models evaluated with 15 recent years of data (what is useful *now* vs *historic*)
- Covariates
  - Jack return data
  - Hatchery smolt releases (total and delayed)
  - Oceanographic indicators


Winter steelhead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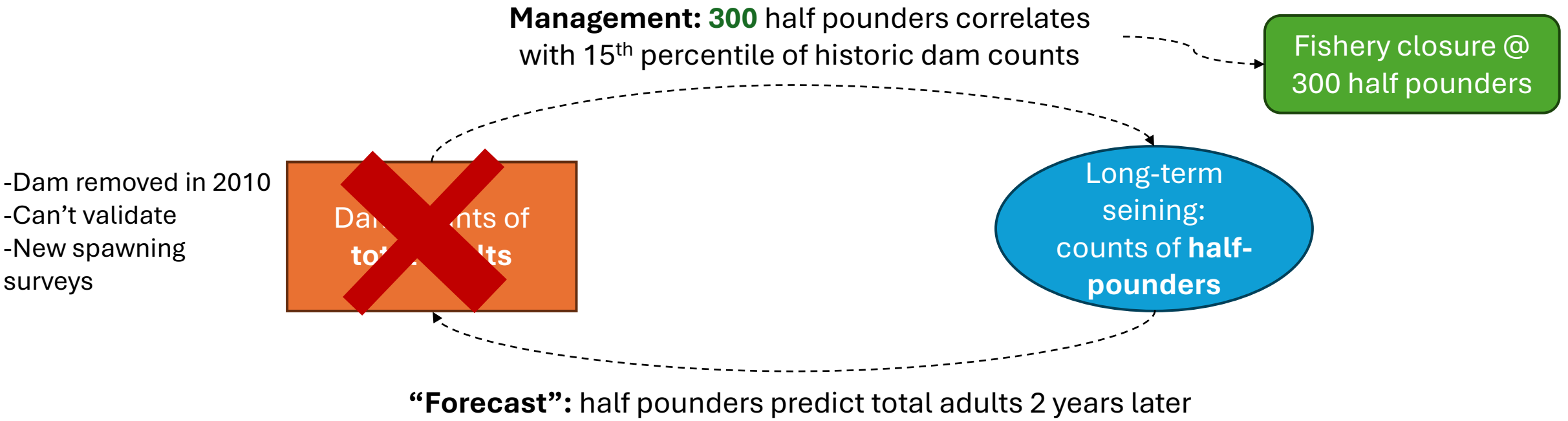
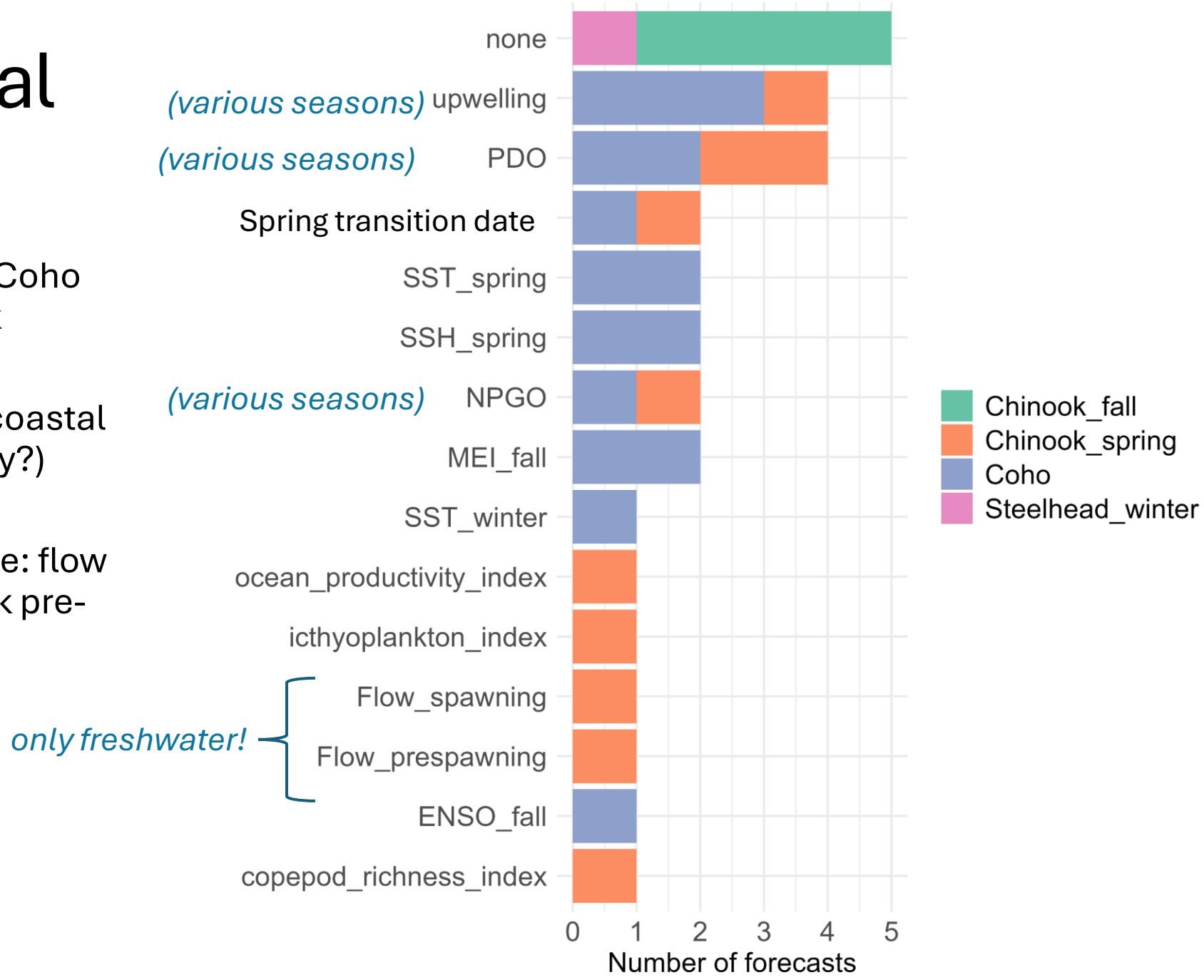


Environmental Covariates

- Currently considered in Coho and (2/3)spring Chinook forecasts.
- Formerly considered in coastal fall Chinook. Never(rarely?) ended up in best model.
- Only freshwater covariate: flow related to spring Chinook pre-spawning or spawning.



Shiny apps

Willamette spring Chinook (A. Storch)

https://oscrpapps.shinyapps.io/WillClackRunApp/

ForecastR

https://psc1.shinyapps.io/ForecastR/

Questions / Discussion

Possible topics

- “Best” model VS. ensemble VS. static
- Non-stationarity
  - Fit to recent 15 years instead of entire timeseries
  - Time-varying parameters
- Shiny apps
- Covariates: for which forecasts are they helpful; which ones; how to choose
- Changing/losing data
  - New methods
  - Closed Gold Ray Dam on Rogue, hatchery closure, etc.

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Sidebar: Covariate Selection

R packages

Climwin: tests many climate windows of single variable (van de Pol et al. 2016)

Boruta: finds all-relevant covariates to a response via machine learning (Kursa and Rudnicki 2010)