



Salmon Recovery Requires Functional Flows

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Central Valley Chinook Salmon are in Decline

Despite decades of habitat restoration work and other management efforts, salmon have not met doubling goals

Natural production increases with more seasonal flow of cold water

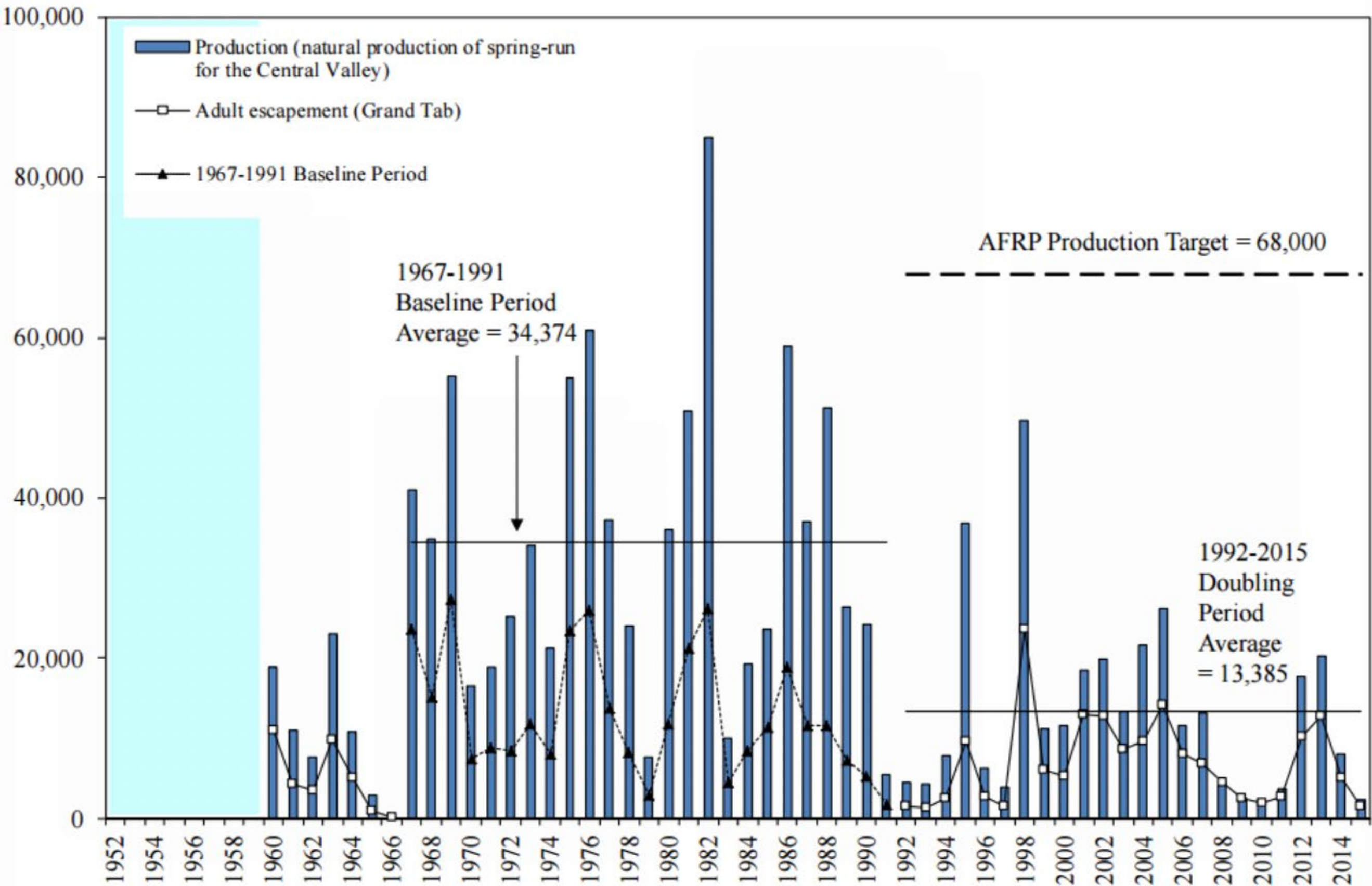


Figure 3. Estimated yearly adult natural production, and in-river adult escapement, of spring-run Chinook salmon in Central Valley rivers and streams, 1952-2015. Based on CDFW’s Grandtab escapement estimates. From USFWS Anadromous Fish Restoration Program 2017, Fig. 5, pg. 5.

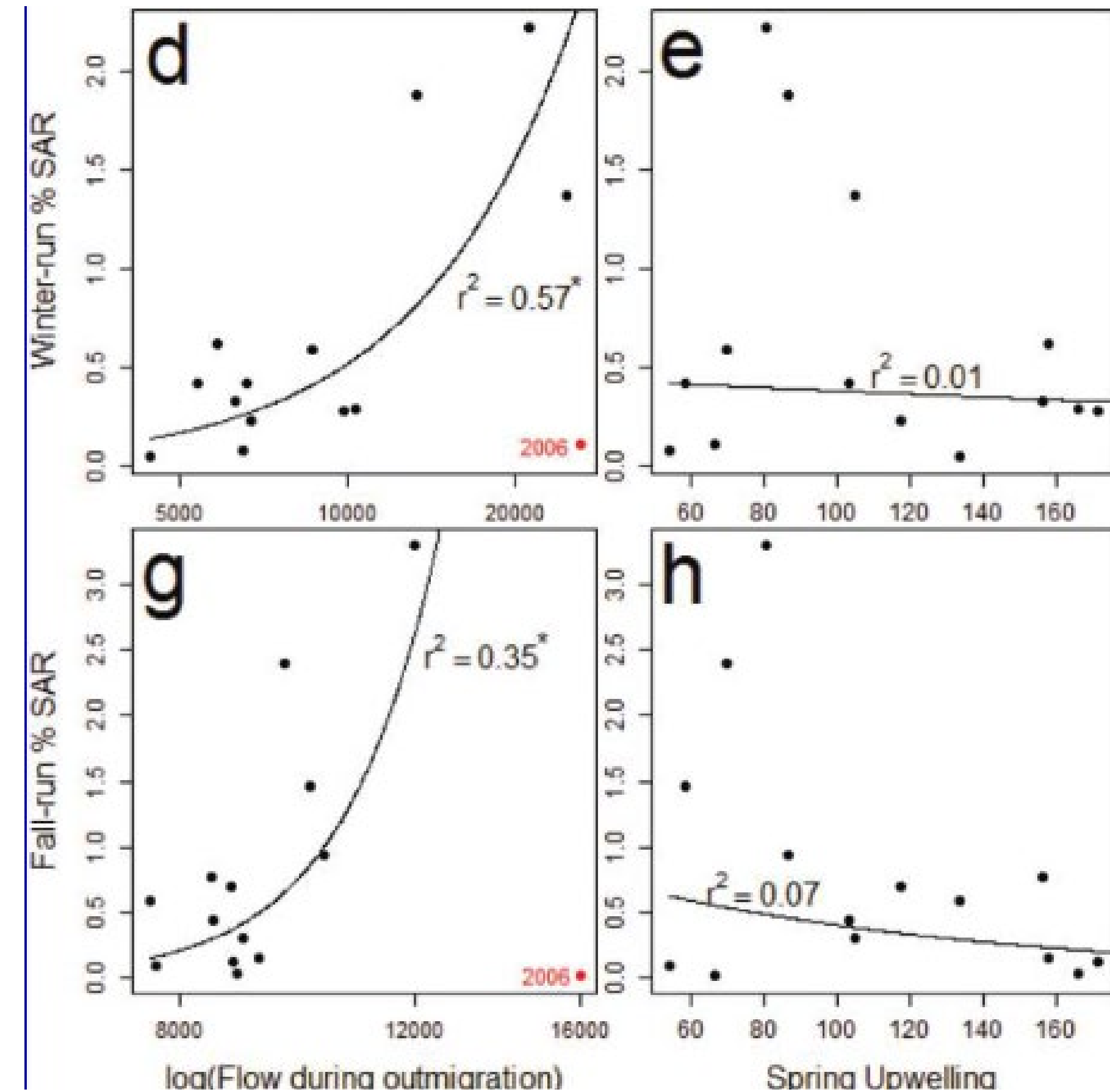


Flow Creates Habitat

Salmon Respond Strongly to Flow

Flow is the only action that improves habitat across the entire basin

- Flow predicts smolt-to-adult ratio better than ocean conditions (Michel 2019)
- Lower flows delay juvenile migration timing and survival (Sturrock et al. 2020; Hassrick et al. 2022)
- Increased flow benefits all migrant size-classes (Sturrock et al. 2019)

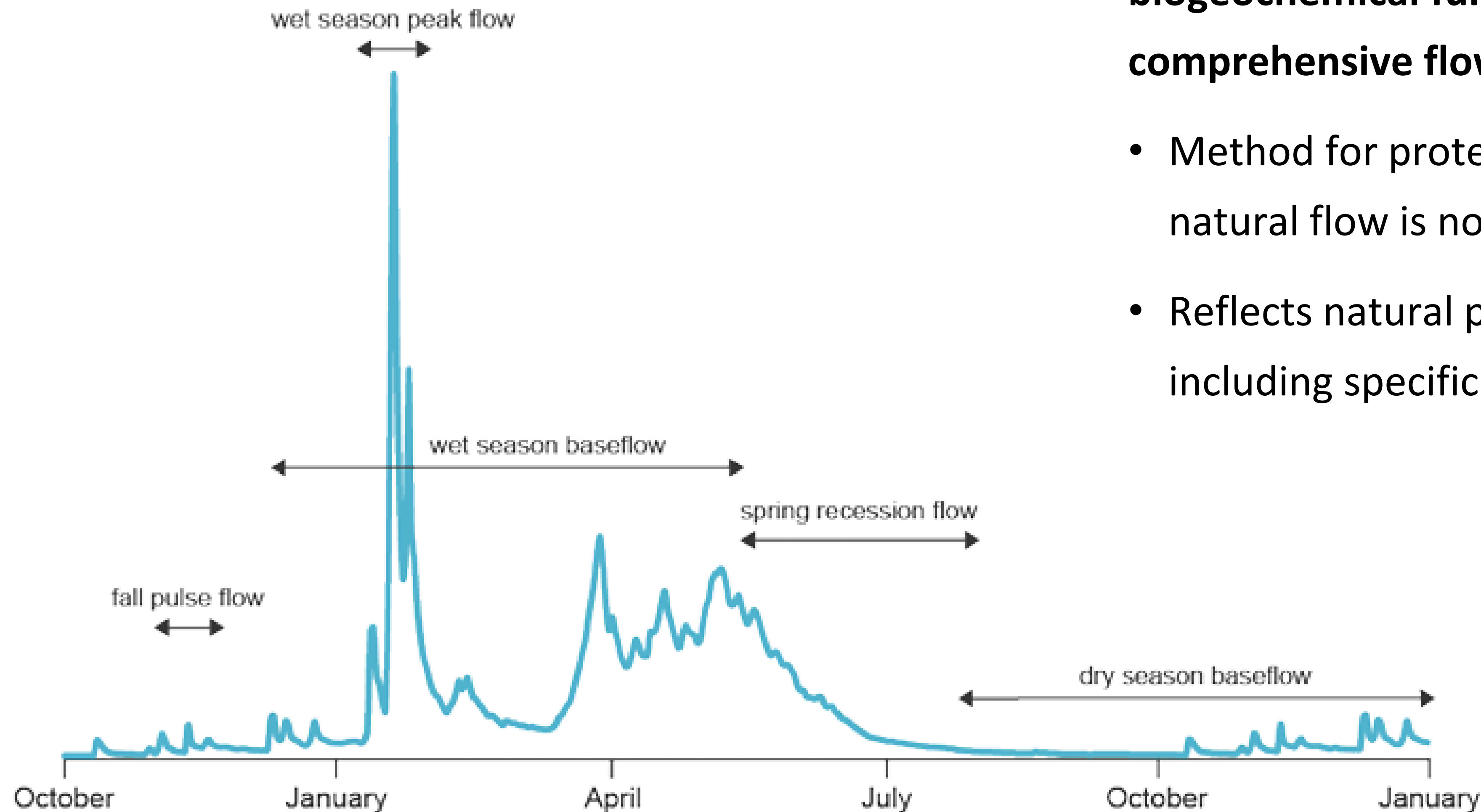


Michel 2019

Functional Flows Approach

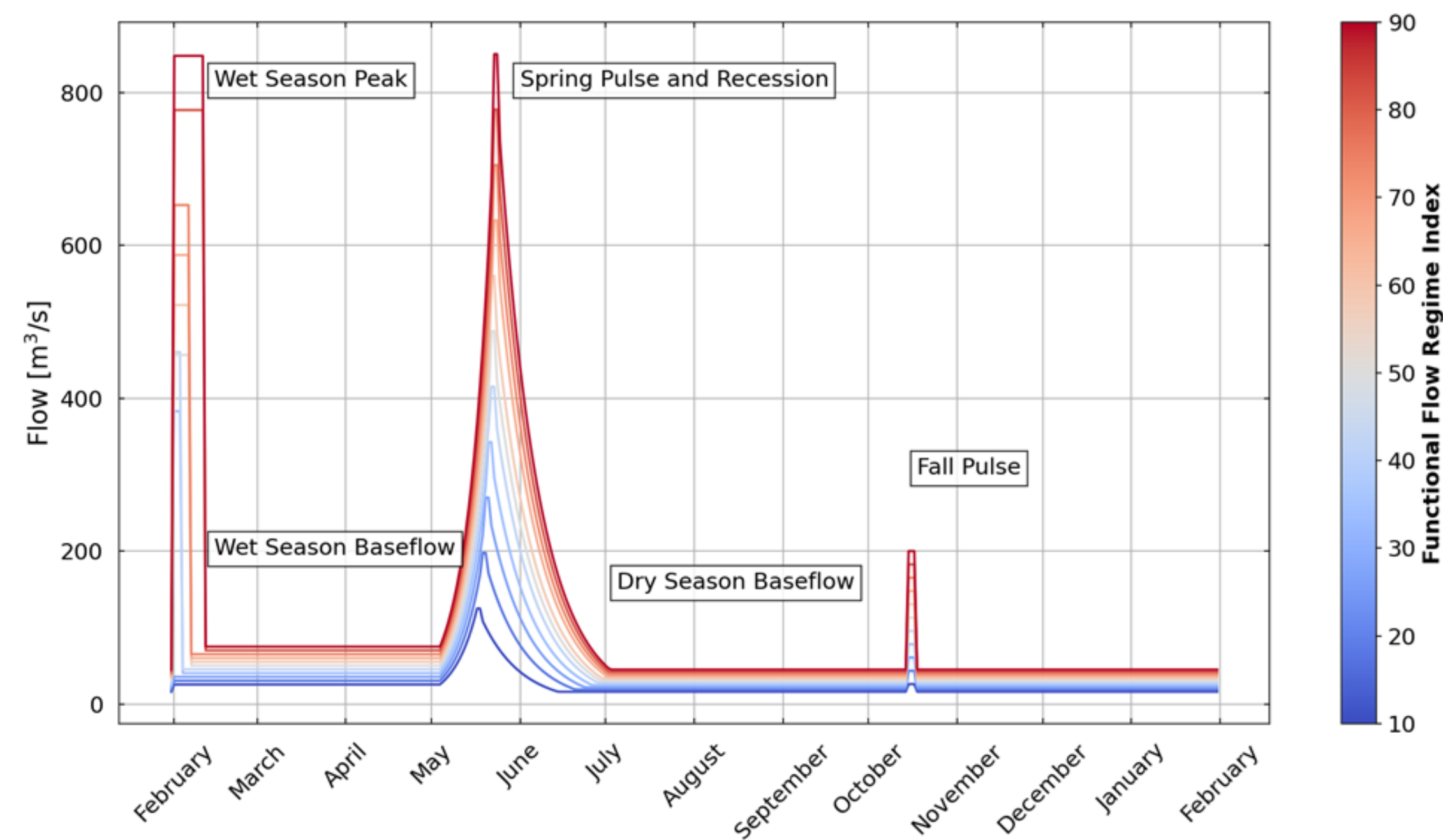
"Functional flow" = hydrograph component that provides a distinct **geomorphic, ecologic, or biogeochemical function** as part of a **comprehensive flow regime**

- Method for protecting key functions when full natural flow is not possible
- Reflects natural patterns in space and time, including specific flow magnitudes

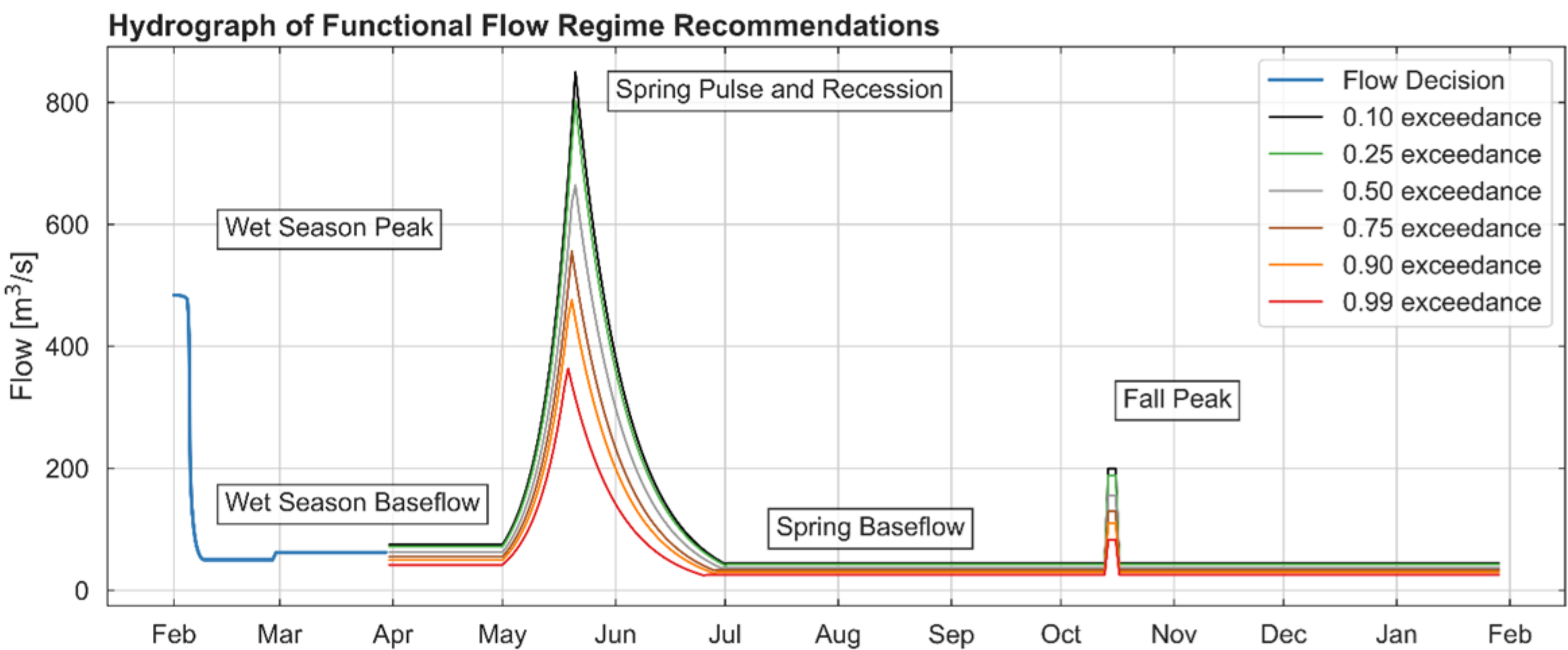


Environmental Flow Implementation

Functional Flows – Water Budget



- Use range of FF metrics to design FF regimes based on forecasted probabilities of annual water budget
- Optimize releases based on changing monthly forecasts



Functional Flows Adaptive Implementation Model (FFAIM)
(Yarnell et al. 2023; Murdoch et al. In Prep)



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