Sustaining Oklahoma Fishes Under Increasing Water Demands

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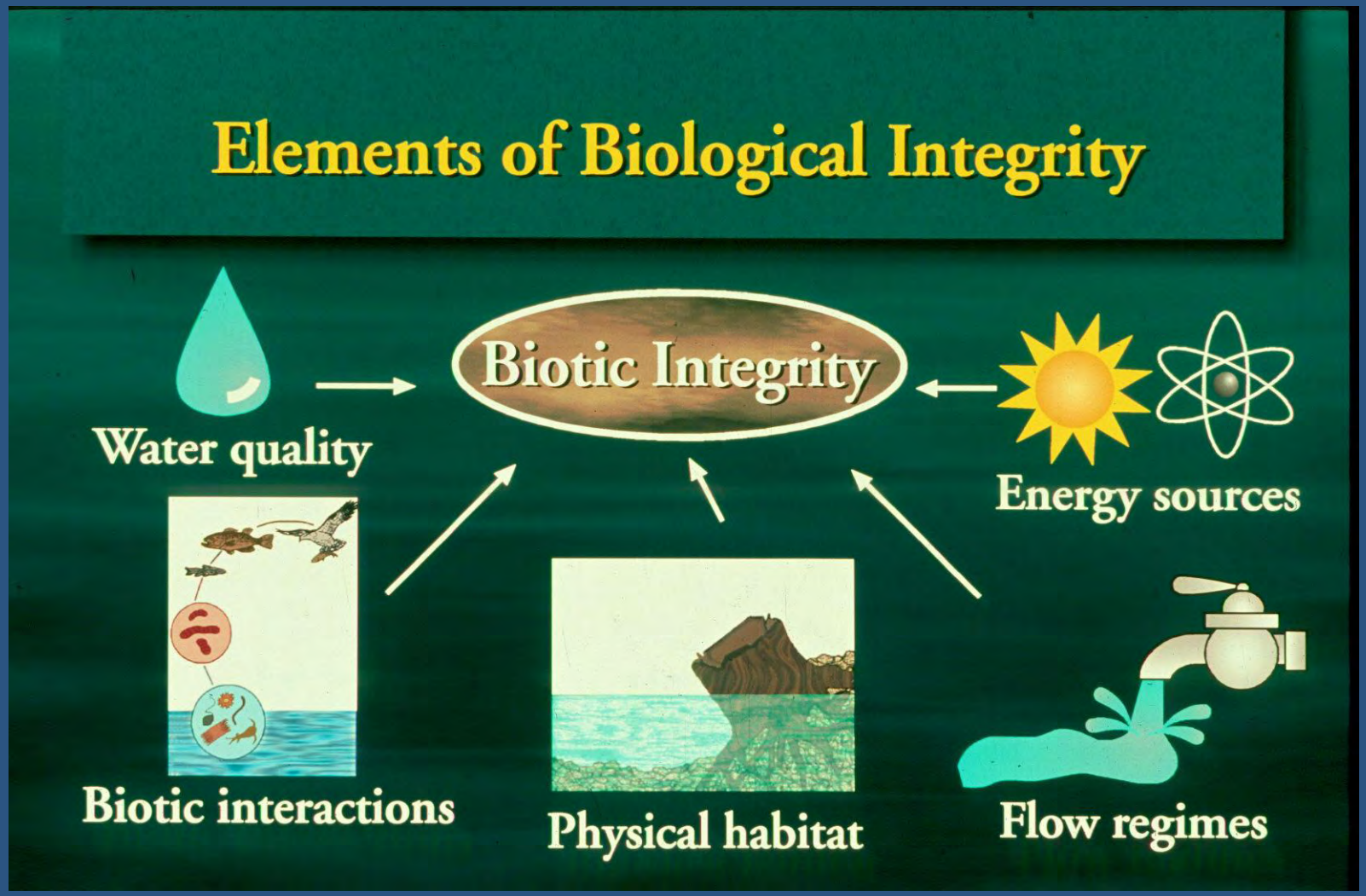
A central theme in aquatic ecology



Flow as the Master Variable –

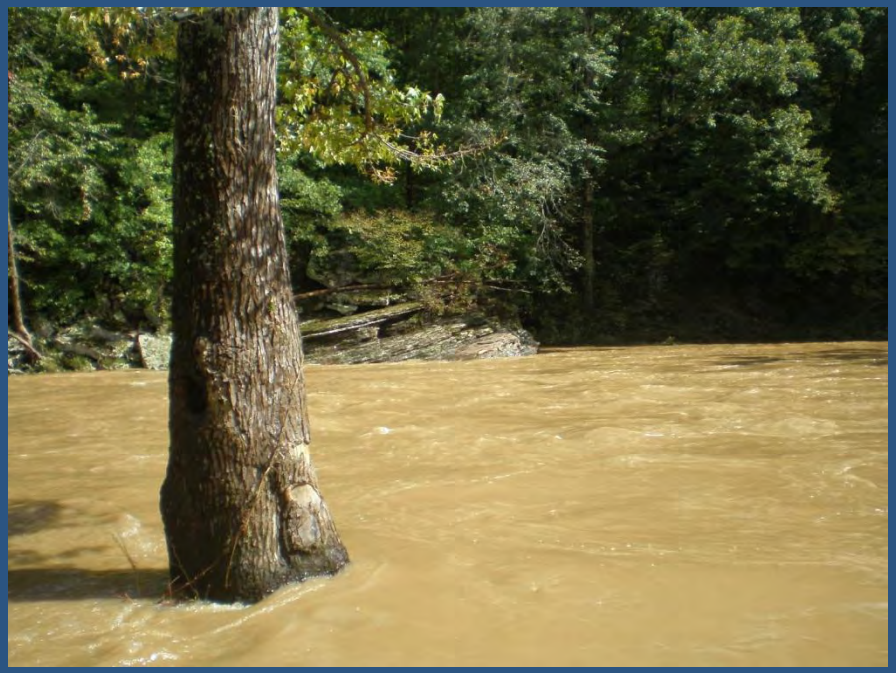
Historically, our focus was WQ and minimum flows

- Duration (time for specific flow)
- Rate of change
- Magnitude (Q)
- Frequency
- Timing (regularity of predictable Q)

Organisms have evolved in response to these factors- e.g., reproduction

What is a disturbance?

- Relates to adaptation of fishes
- Within a natural range of events and timeline ≠ disturbance
- Unpredictable events with biological responses = disturbance



Flow Alterations

PREDICTABLE
AVAILABILITY

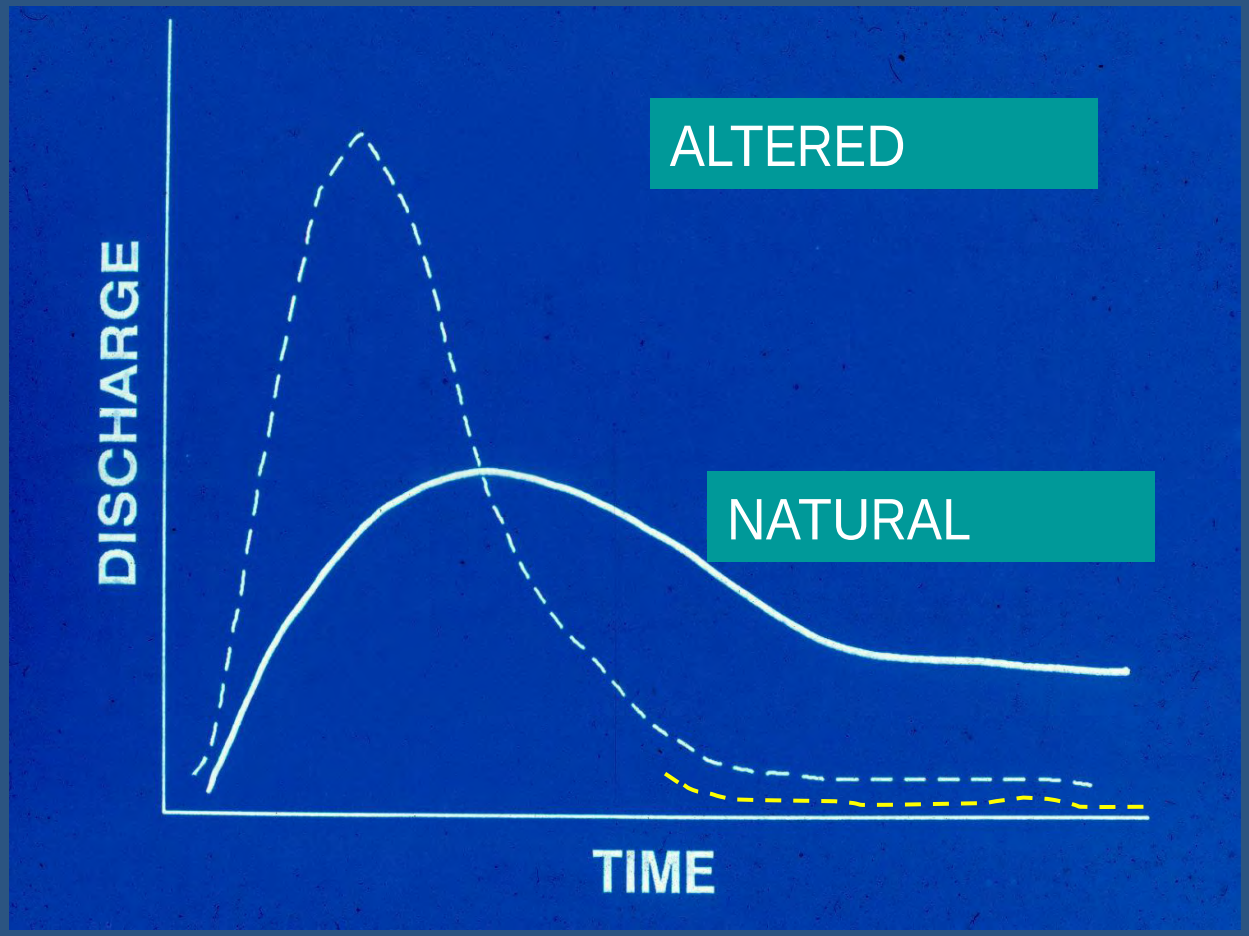
Evolution of species

occasional

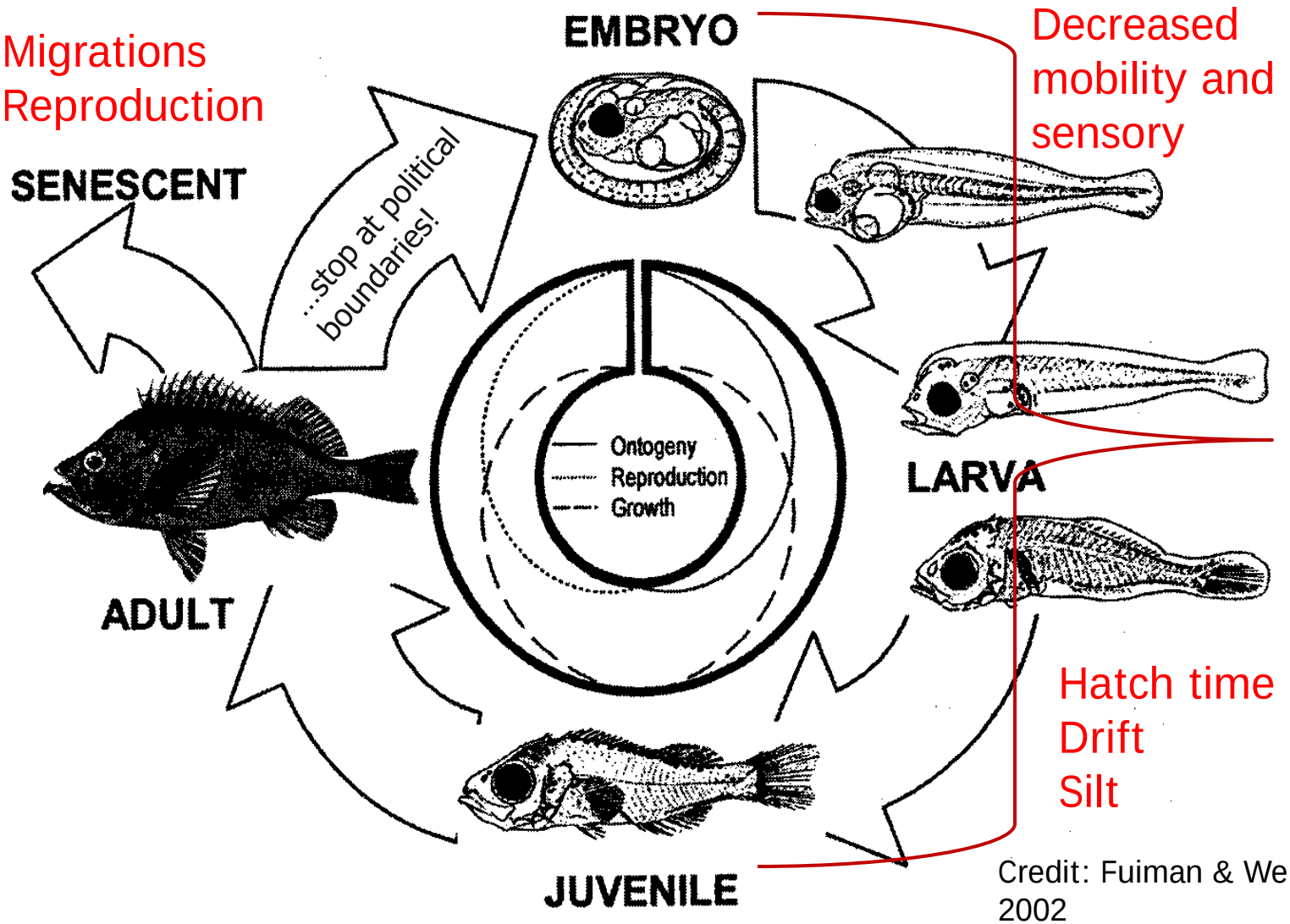
seasonal

persistent

yrs



Conceptual View of Fish Life Stages

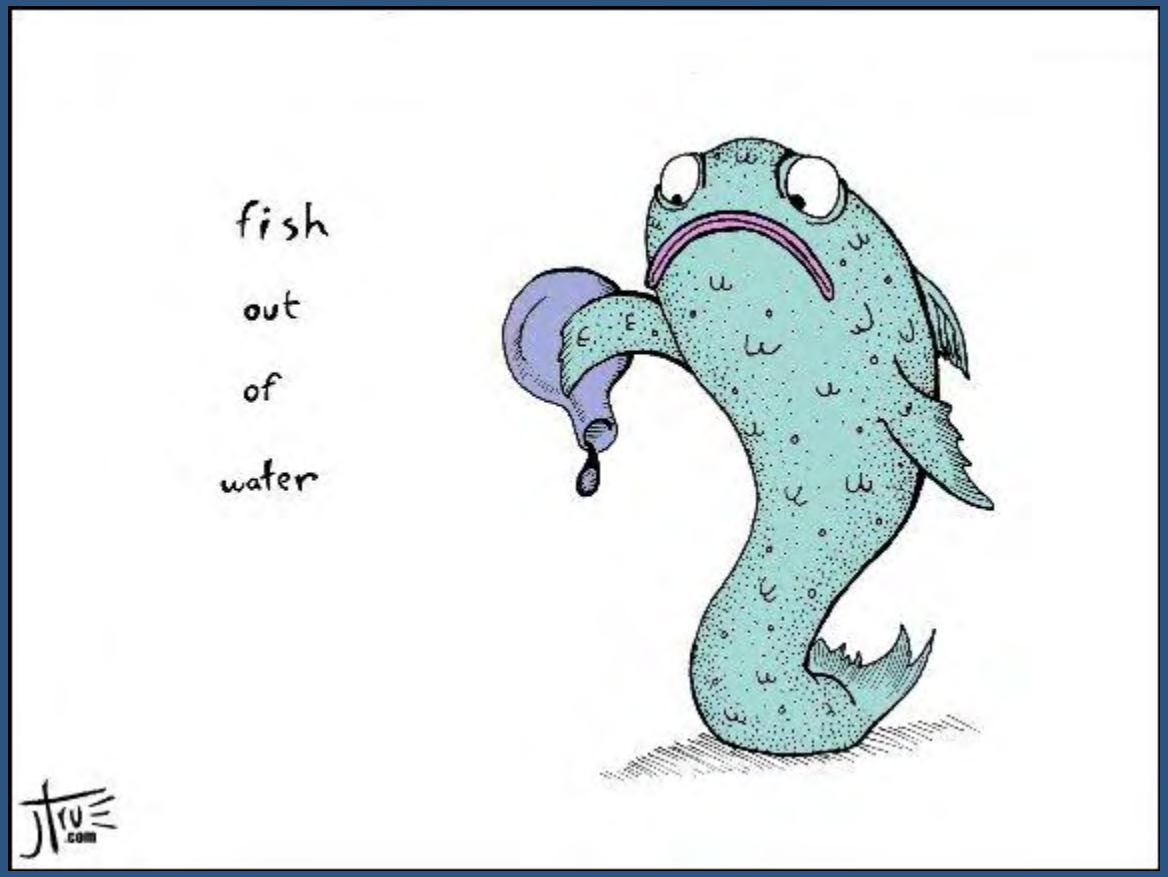


Credit: Fuiman & Werner 2002

Altering flow - the balance between water and sediment

- Geomorphic features- Habitat– more uniform; isolated floodplain; loss of riparian habitat
- Fewer species – fluvial specialists
- Alters timing and composition of energy (invertebrates ↓)
- Fine sediments (dams, headcutting – reproduction)
- Temperature/oxygen/toxins

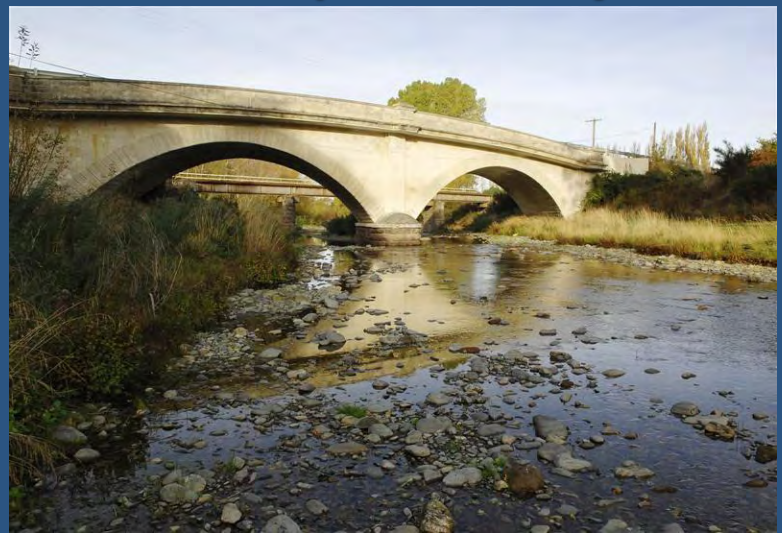
At the most basic level, fish need *some* water!



Didn't streams go dry historically?? …recall disturbance

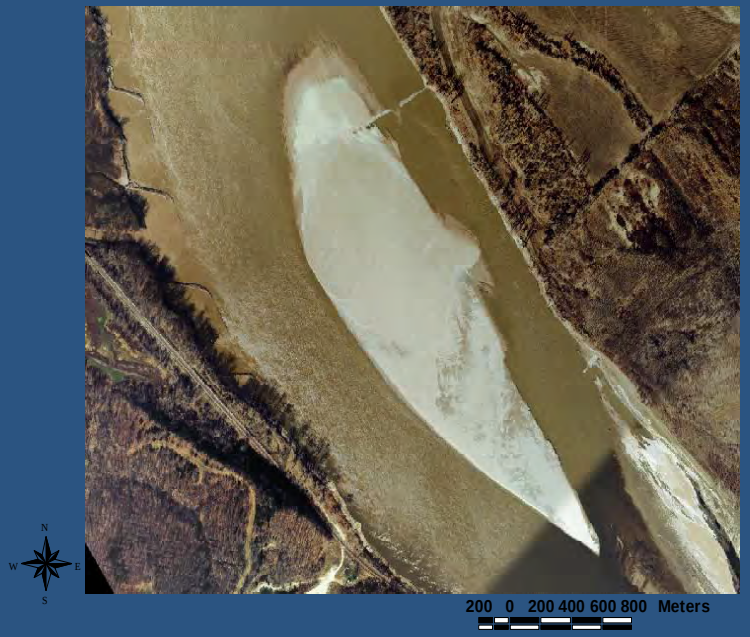
Minimum Flows- a compromise between water users

- Increase species richness (AL- doubled)
- 100-fold increase in invertebrate densities
- Prevent dewatering of mussels and other relatively sedentary organisms
- Prevent passage barriers
- Maintain minimal water quality (oxygen and temperature)



Higher flows are also necessary!

- Maintain complex channel features
- Deposited sediment removal
- Maintain riparian and floodplain features (groundwater pumping & channel detachment)
- Timing of life-history events



Stream Rehabilitation & Restoration –
What can we learn from other states?

Look to the West…

Trinity River Restoration •

1950's …approximately 700,000 af of water was **"wasting to the Pacific Ocean"** — could be diverted to the Central Valley **"without detrimental effect to the fishery resources"**.

1984- Trinity River Restoration to restore fish and wildlife to "pre-dam levels"

Since 2000, 12-15 million $ annually

San Joaquin Restoration •

Friant Dam- 1942

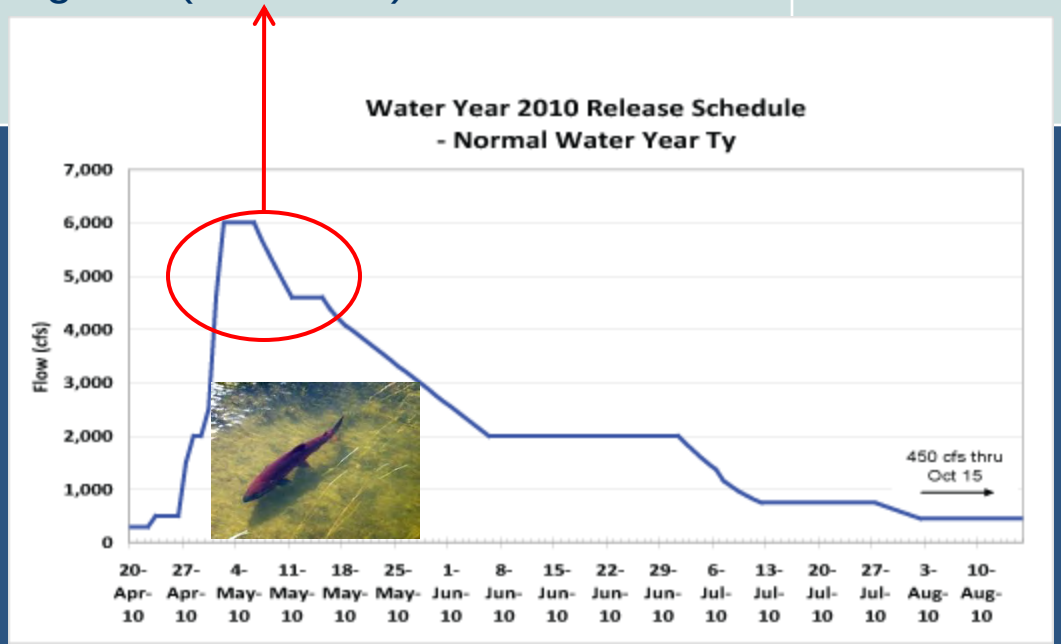
18 yrs of litigation prior to the settlement (2006)

300-800 million $ to complete settlement

Maintenance after completion of the settlement?

Methods for defining flows: history, life history, habitat

Exceedence Level (1922-2004) (natural water production in basin)	Water-Year Type
Wettest 20%	Wet
Next 30% (20-50%)	Normal-Wet
Next 30% (50-80%)	Normal-Dry
Next 15% (80-95%)	Dry
Remaining 5% (95-100%)	Critical



"Buffer Flows"??

What have they learned?

- Much higher flows to maintain habitats than required historically
- Variability is key
- Difficult to obtain viable stocks
- Cost for rehabilitation is higher than estimated, especially with required maintenance!

We can get protection for aquatic organisms without extensive sacrifices for alternative uses!

Aquatic Organisms

Financial Constraints

Social/Political Constraints

Questions?