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FLOODPLAINS: LESSONS FROM THE COSUMNES RIVER AND YOLO BYPASS

Management CUES

OCTOBER 2003

FLOODPLAIN RESEARCH SITES – COSUMNES RIVER AND YOLO BYPASS

BACKGROUND

Mounting evidence indicates that floodplain habitat is important for species of concern. However, very little floodplain habitat remains in the Bay-Delta region. Recent floodplain research comes from two sites where water has been allowed to flow outside channels previously constrained by levees: the Cosumnes River and the Yolo Bypass on the Sacramento River.

The Yolo Bypass was constructed in the 1930's for flood control. It routes excess floodwaters though land that when dry is used for agriculture and wildlife habitat, inundating up to 24,000 hectares in wet years. Here, CALFED-funded science is revealing that one of the West's largest flood control projects may also be one of its most significant ecosystem restoration opportunities.

The Cosumnes is unique because it has no large dams, making it the only river in the Bay-Delta region with a nearly unregulated hydrograph. Here, smaller floodplains were re-created in the 1990's by breaching agricultural levees, reconnecting areas of historical floodplain to the unregulated seasonal flows to produce a more hydrologically natural system. Native fish, birds, bats, and insects have all been shown to thrive on the newly restored floodplain habitat.

The applicability of lessons from these areas to other sites in the region has not yet been established, and should be studied. Other promising sites for study include the Sutter Bypass and other lowland floodplains of the Sacramento and San Joaquin Rivers.

MULTI-OBJECTIVE FLOODPLAIN PROJECTS CAN WORK

The experiments in the Yolo Bypass seem to be working: floodplain habitat can be compatible with seasonal agriculture and flood protection. The Yolo bypass diverts peak flows to protect Sacramento from flooding, and is farmed when dry. Recent science has shown that winter inundation of the farmland provides high quality spawning and rearing habitat for native fish species. These results demonstrate that land can be managed simultaneously for floods, farms and fish.

QUESTIONS ABOUT THE SCIENCE?

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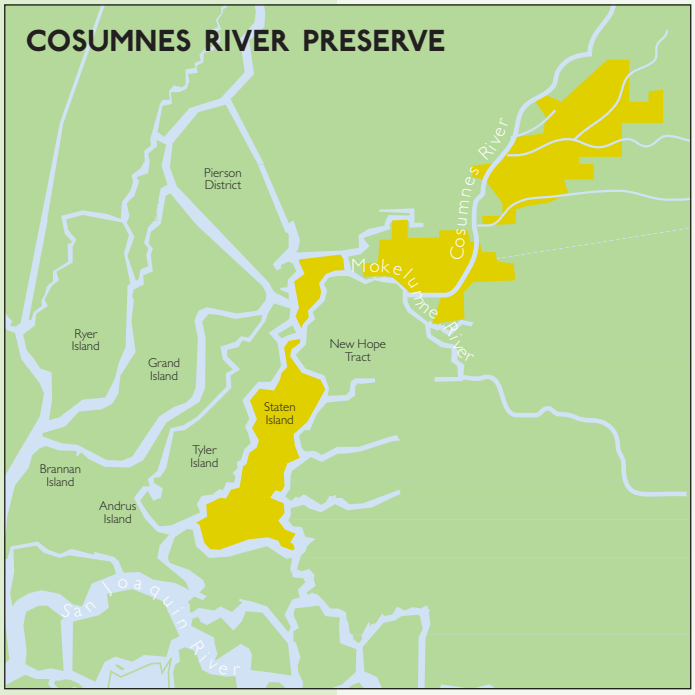
Photo: Gavin O'Leary



Lower Consumnes River from Michigan Bar in the confluence with the Mokelumne River showing the Consumnes River Preserve study area.

FLOODPLAINS CAN BE RESTORED

There is hope for floodplain restoration, even in a system with few remaining natural floodplains. On the Cosumnes River, levees that confined floodwaters to river channels have been breached in order to restore natural floodplain topography and hydrology. The resulting habitat benefits populations of native birds, bats, plants and fish.

QUESTIONS ABOUT THE SCIENCE ?

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NEW IDEAS ABOUT FLOODPLAIN VEGETATION

A decade ago, the goal of riparian habitat restoration was often to produce mature forest. Research has since shown that diverse habitats are necessary for meeting the needs of multiple species. Recent science provides a simple example. Some native fish species seem to prefer open areas instead of forested floodplains. They appear to associate with the sunlight and structure provided by low, stubbly vegetation. Adjacent forested areas can provide nutrient-rich litter to support insect populations. These insects in turn provide high-quality food for the fish living on open areas. Historically, natural disturbances produced such a mosaic of habitat types. Perhaps restoration projects could work more towards dynamic, diverse collections of habitat types, rather than any single endpoint.

QUESTIONS ABOUT THE SCIENCE?

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MORE WATER FOR THE YOLO BYPASS

The Yolo Bypass provides flood control, seasonal agricultural land, and aquatic habitat, while the parallel reach of the Sacramento River provides limited value to native species. But science suggests opportunities for improvement. Recent modeling suggests that a small amount of increased flooding or floodplain restoration in the Yolo Bypass could have dramatic effects on increased habitat for juvenile salmon and splittail. Rerouting some Sacramento River water might increase the habitat value of this land, with the water returning to the River below the Bypass.

QUESTIONS ABOUT THE SCIENCE?

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UNDERSTANDING SPECIES HABITS ALLOWS FLEXIBILITY FOR MANAGERS

Knowing the life history traits of individual species is important for designing successful restoration efforts. Splittail rapidly produce offspring when they can access floodplain habitat to spawn. The specific timing of floods is not as important to these fish as is the existence of an inundation at some point in the late winter or early spring. This may allow water managers flexibility in timing releases of water to inundate restored floodplains.

QUESTIONS ABOUT THE SCIENCE?

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SALMON AND FLOODPLAINS

For many years, the large rivers of the Central Valley were viewed simply as corridors for salmon migration. Management focused on moving adults upstream and juveniles downstream to the estuary as rapidly as possible. However, research has shown that juveniles can spend many months rearing in these rivers and on their floodplains. Studies of the Yolo Bypass and Cosumnes River show that juvenile salmon that rear on the floodplain grow much faster than their counterparts that rear in the rivers. Higher juvenile growth rates may translate into higher likelihood of survival to adulthood.

QUESTIONS ABOUT THE SCIENCE?

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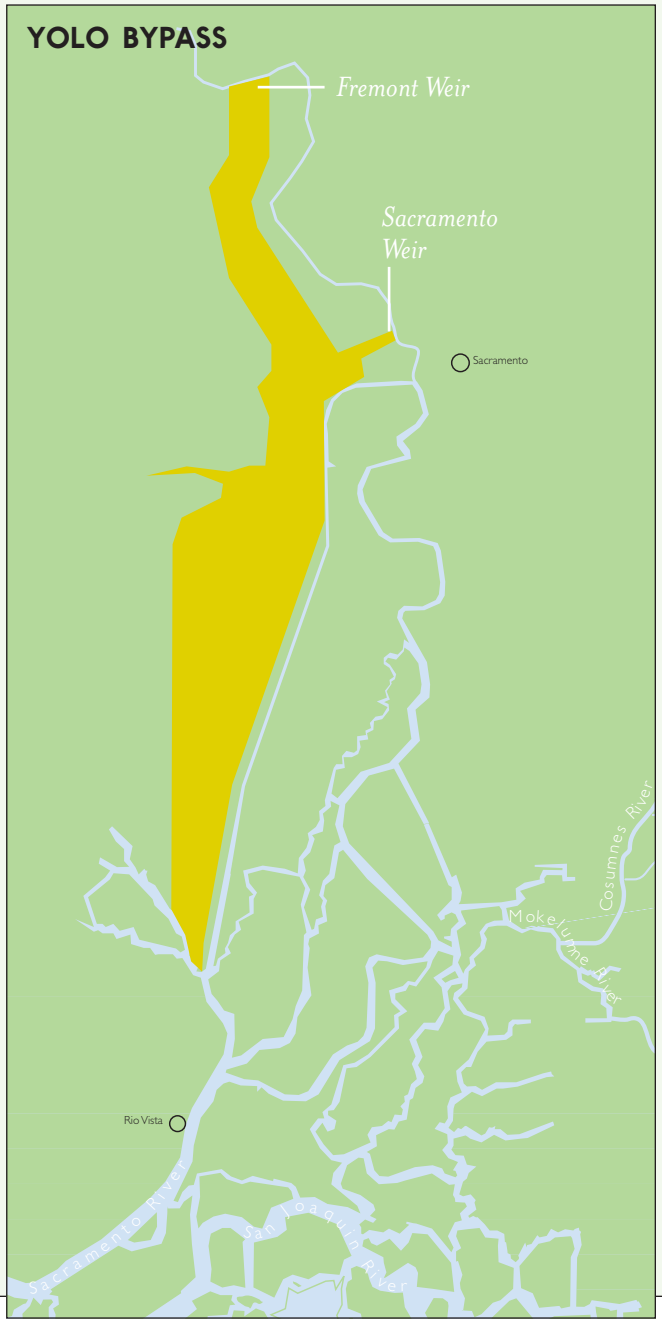

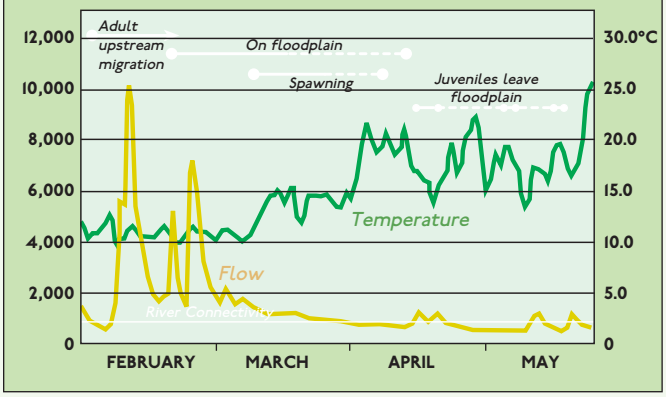

On the Cosumnes River, Splittail adults use floodplains for spawning during winter floods, and their young leave the floodplains during intermittent early-spring high flows. Figure courtesy of Jeff Mount.

STRANDING MAY NOT BE AS IMPORTANT AS WE THOUGHT

Managers sometimes prevent floodplain inundation out of concern for stranding of fish. Recent work indicates that native species may not be as susceptible to seasonal stranding as some fear. Research on Cosumnes River native fish, for example, shows that these fish move from the river to spawn or rear on the floodplain in the winter, and successfully return to the main channel in early spring. Stranding that does occur is concentrated in unnatural features like ponds built for waterfowl. Even then, 80-90% of stranded individuals on Cosumnes River floodplains are non-native species. This knowledge might lead to opportunities for greater flood control capacity on floodplains while moving towards restoration goals.

QUESTIONS ABOUT THE SCIENCE?

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MANAGING FLOODPLAINS FOR FISH

Designing restoration projects to include a wide range of habitat types may be necessary to maximize benefits for fish. Although agricultural land can support floodplain habitat, natural floodplains are not uniform, level surfaces. Although the frequency of floodplain inundation is the main variable that enables splittail to spawn, these fish utilize different micro-habitats over their lifespan. The ideal floodplain surfaces for these fish would include connections between floodplains and river channels to allow fish migration, and varied habitats within the floodplain to accommodate the needs of adults and juveniles. This is how natural floodplains work, and restored floodplains should imitate nature in this way.

QUESTIONS ABOUT THE SCIENCE?

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Sacramento Splittail, (Pogonictys macrolepidotus). *Photo: Bill Harrell*

USING FLOODING TO CHANGE THE NATIVE/ALIEN SPECIES BALANCE

Native fish species have adapted to use floodplains during winter and early spring. Many alien fish species use floodplains if water is available later in the spring. By inundating floodplains early in the year, then allowing them to dry out, managers may be able to promote native fish production. This might offer a rare large-scale tool for reducing the success of undesirable non-natives.

QUESTIONS ABOUT THE SCIENCE?

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FLOODPLAINS COULD HELP INCREASE HIGH-QUALITY FOOD RESOURCES

The Estuary is a food-limited system, with some species of concern affected by lack of specific food sources. CALFED-funded science suggests that the quality rather than the quantity of food may be a limiting factor for some species of concern. Phytoplankton (algae) fuels productivity more effectively than other, more common sources of organic matter by supporting zooplankton and other high-quality invertebrate food sources. Floodplain restoration has the potential to increase productivity in the Estuary. The shallower, warmer waters of floodplains have significantly higher algae and zooplankton production than rivers. As they drain, they are flushed into the Estuary, benefiting species that do not directly use floodplains.

QUESTIONS ABOUT THE SCIENCE?

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FLOODPLAIN DESIGN: CONVEYANCE FLOODPLAINS

Both the Yolo Bypass and the Cosumnes River floodplains are conveyance floodplains. Water enters at the upstream end, and moves across them before reentering the river. Research indicates that water flowing across floodplains, rather than simply being stored on floodplains, is important to the health of floodplain

ecosystems. Such flows also increase the ability of the floodplain to provide key nutrients and food sources to the river.

QUESTIONS ABOUT THE SCIENCE?

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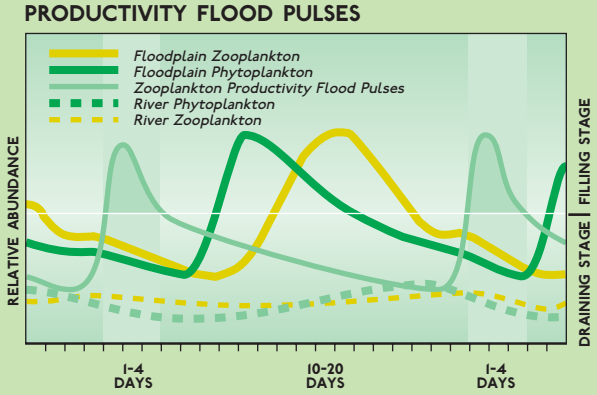
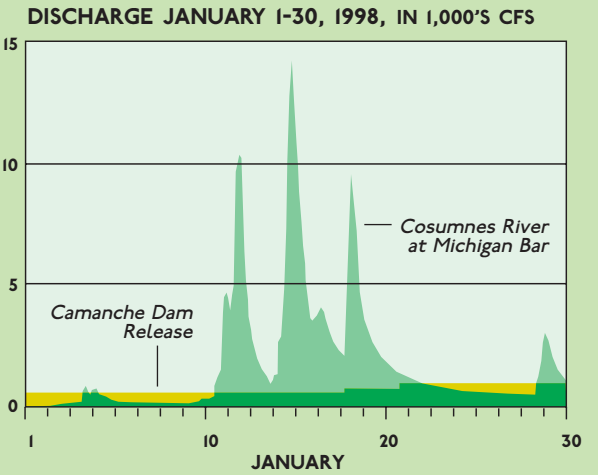


Floodplains can produce high-quality food for ecosystems when they are connected to the river. Productivity of phytoplankton and zooplankton each increase in the days following flows that inundate Cosumnes River floodplains. Figure courtesy of Jeff Mount.



The unregulated Cosumnes River has higher flow peaks and a more complex hydrograph than the Mokelumne River below Comanche Dam. These flow peaks allow inundation of floodplains (connectivity between the river and floodplain happens above about 900 cubic feet per second on the Cosumnes). Figure courtesy of Jeff Mount.

COMPLEX HYDROGRAPHS INCREASE FLOODPLAIN FOOD PRODUCTION

Comparison between the Yolo Bypass and the Cosumnes River shows that the more natural Cosumnes system has higher production of high-quality food sources for native fish. The more natural hydrograph of the Cosumnes appears to be a principal cause of this difference. Multiple, short-lived flood pulses followed by long draining periods may produce more phytoplankton than the simpler hydrograph of the Yolo Bypass. To restore ecosystem attributes of floodplains, managers may need to operate dams and flood control structures to vary the timing and duration of floodplain flows.

QUESTIONS ABOUT THE SCIENCE?

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LIMITS ON OUR ABILITY TO RESTORE FLOODPLAINS?

Opportunities exist for further floodplain restoration in the rivers that feed the Estuary, but there are some caveats. While restoring some floodplain processes will lead to benefits for species of concern, it will not be possible to completely restore natural processes within these projects. Regulated hydrographs limit the size of restored floodplains below their historical extent. Also, without large periodic flushing flows, restored floodplains will require careful maintenance and continuous management to ensure that they favor native plants and fish. Sediment supply may also limit some types of floodplain restoration, such as levee breaches that rely on sediment deposition to restore topography. Local sediment supply should be assessed as part of floodplain restoration planning.

QUESTIONS ABOUT THE SCIENCE?

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These Cues are intended to increase communication between resource managers and CALFED-funded scientists, not as an exhaustive technical review. Source material is published reports as well as preliminary results and working hypotheses from conferences and public workshops — please contact those listed above if you would like supporting documents, or are interested in exploring the primary literature. These Cues have been reviewed for accuracy in our reporting. Other Management Cues are available at http://science.calwater.ca.gov

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