

HENRY

Hydraulic Engineering Repository

Ein Service der Bundesanstalt für Wasserbau

Article, Published Version

Durand, John; Moyle, Peter B.

San Francisco estuary: Time for a reconciliation approach to species conservation

HydroLink

Verfügbar unter/Available at: <https://hdl.handle.net/20.500.11970/109263>

Vorgeschlagene Zitierweise/Suggested citation:

Durand, John; Moyle, Peter B. (2015): San Francisco estuary: Time for a reconciliation approach to species conservation. In: HydroLink 2015/1. Madrid: International Association for Hydro-Environment Engineering and Research (IAHR). S. 16-17. https://iahr.oss-accelerate.aliyun.com/library/HydroLink/HydroLink2015_01_Sacramento_San_Joaquin_River_Delta.pdf.

Standardnutzungsbedingungen/Terms of Use:

Die Dokumente in HENRY stehen unter der Creative Commons Lizenz CC BY 4.0, sofern keine abweichenden Nutzungsbedingungen getroffen wurden. Damit ist sowohl die kommerzielle Nutzung als auch das Teilen, die Weiterbearbeitung und Speicherung erlaubt. Das Verwenden und das Bearbeiten stehen unter der Bedingung der Namensnennung. Im Einzelfall kann eine restriktivere Lizenz gelten; dann gelten abweichend von den obigen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Documents in HENRY are made available under the Creative Commons License CC BY 4.0, if no other license is applicable. Under CC BY 4.0 commercial use and sharing, remixing, transforming, and building upon the material of the work is permitted. In some cases a different, more restrictive license may apply; if applicable the terms of the restrictive license will be binding.





SAN FRANCISCO ESTUARY: TIME FOR A RECONCILIATION APPROACH TO SPECIES CONSERVATION

BY JOHN DURAND & PETER B. MOYLE

California is a hotspot of physical and biological diversity. At its center lies the Sacramento-San Joaquin watershed, a network of rivers that converge in the Sacramento-San Joaquin Delta. The rivers course through an ever-changing landscape, from Sierra Nevada canyons to Central Valley floodplains and marshes. From there, water flows through the Coast Range and mixes with seawater in a gradient of freshwater to marine habitats within 100 kilometers. This transitional region is the Bay-Delta estuary, home to a variety of habitats and native and alien (often naturalized) species that manage to coexist in a constantly changing ecosystem.

Managing the estuary for endangered and valuable species has become increasingly important, difficult and controversial. The estuary hosts four overlapping runs of salmon, each timed to capitalize on seasonal resources. These runs once were among the most productive on the west coast of North America; today two runs are endangered and others are in serious decline. The estuary is also a refuge for many rare and threatened species, such as the endemic delta smelt and Suisun song sparrow, and is the wintering grounds for one of the highest concentrations of migratory birds in North America.

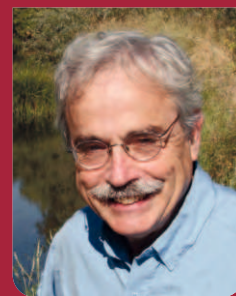
The native species in the estuary have declined from the combined effects of development, especially water exports, but also levee construction, deposition of mining sediment, reclamation of intertidal regions and land subsidence. As changing conditions have led to the decline in natives, alien species have flourished. Some non-natives such as the invasive Brazilian

waterweed have altered physical habitat to the benefit of other non-natives. Still other alien species, such as two species of small clams, have changed the food web to favor alien fishes and invertebrates.

Conflicting environmental and economic goals, combined with irreversible physical changes and species invasions, have ruled out traditional restoration approaches in the estuary, especially the Delta. A reconciliation approach, however, offers promise. It seeks to improve conditions for desirable species (native species are usually deemed preferable by resource agencies and environmental NGOs to invasive species whose influence on the ecosystem is difficult to predict in the short term) while acknowledging that many of the human-caused alterations to estuary are impossible to surmount. Thus, improving ecosystem performance must occur as humans continue using the land and water and as the estuary continues to change biologically and physically.



John Durand is a researcher at the Center for Watershed Sciences, U.C. Davis. He specializes in the ecology and conservation of estuaries, and has actively been involved in Delta research for over ten years.



Peter Moyle is Professor and former Chair of the Department of Wildlife, Fish and Conservation Biology. His research interests include conservation of aquatic species, habitats, and ecosystems, including salmon; ecology of fishes of the San Francisco Estuary; ecology of California stream fishes; impact of introduced aquatic organisms; use of flood plains by fish.

Example of juvenile chinook salmon raised in rice ponds on the Yolo Bypass (upper) compared to a salmon reared in the Sacramento River (lower). Photo credit: Carson Jeffres



For example, much of the Delta is too deeply subsided to restore the estimated 95 percent loss of tidal wetland. These sunken areas are vulnerable to flooding and permanent inundation. Once flooded, they will slow tidal action, burdening the restoration effort. Given these constraints, the optimal reconciliation approach would be to tailor the different regions of the Delta for different ecological functions. The northern Delta, for example, offers the most promise for establishing intertidal marsh and floodplain habitat to support native species; the region has a remnant arc of this habitat that extends from Suisun Marsh to the Yolo Bypass, tied together by the Sacramento River. The eastern and southern Delta may support riparian and seasonal floodplains fed by the San Joaquin, Cosumnes, and other rivers – habitat for many native migratory fish and bird species. The central Delta will continue to support ship traffic and sport fishing for bass and other alien fishes as some of its most deeply subsided islands permanently fill with water, creating lake-like habitat. Under a reconciliation approach, conservation dollars would be invested at sites promising the biggest “bang for the buck” while investments in less promising sites would be minimal. The tools used to manage the Delta for agriculture, water export and flood control will continue to be essential for managing fish and wildlife – though operations will need to be re-considered to mimic historic conditions that support valued species.

Ponds, managed wetlands, flooded islands and other restoring sites can be gated and their flows controlled to imitate the flow patterns of historic long, meandering sloughs, which were nearly all straightened and shortened for farming and shipping. The longer residence times of tidal water in the historic, natural sloughs resulted in a high abundance of plankton – food for fish. Managing flows through gated ponds could restore this food supply even if the sloughs themselves remain unchanged.

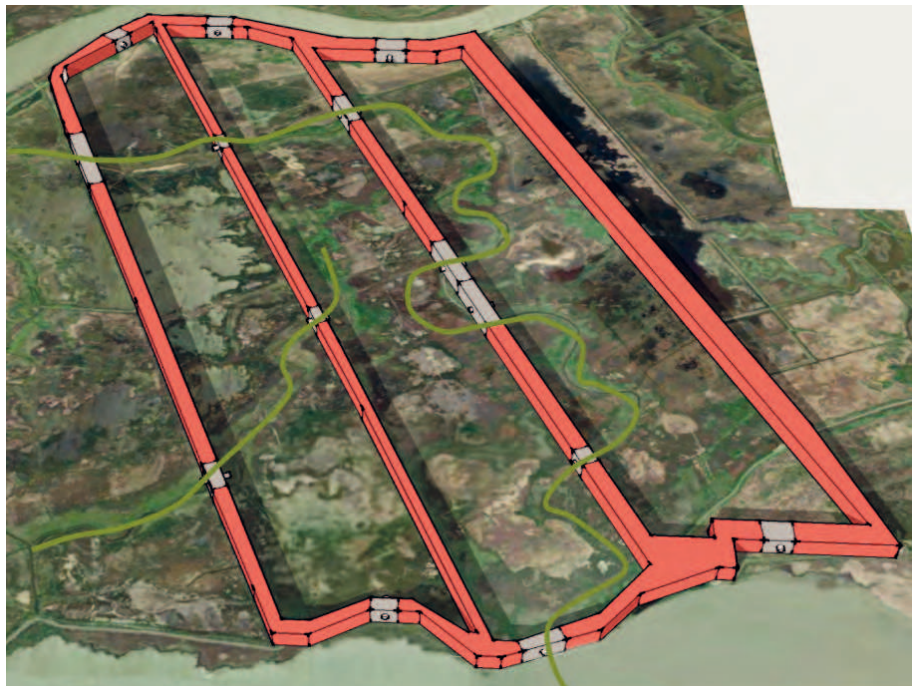
Tidal marshes and seasonal floodplains will continue to need directed flows controlled by levees, channels and barriers. Levees and gates can be operated so that Delta waterways can once again support delta smelt and other fishes. They also can work to drain and “re-set” restoration sites overrun with detrimental species such as Brazilian waterweed. Our prescription for the estuary acknowledges a revolutionary change emerging in our relationship with the environment, from one of total domination to reconciliation. Reconciliation



Subsided pasture lands on Twitchell Island, bordered by elevated Delta channel. Many levees throughout the Delta have a high probability of failure

means accepting that the Delta is a novel ecosystem in an irreversibly changed landscape that supports an interacting mix of native and alien species. Such an ecosystem can be managed to favor species and services desired by humans. Managing novel ecosystems, especially in a changing climate, is necessarily experimental; an iterative approach will be needed to reach desired results. Traditional water management and conservation goals have historically been at odds. A reconciled approach to water management offers the best possibility for achieving the “co-equal

goals” of providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem – as mandated by the state’s 2009 Delta Reform Act. The Delta ecosystem cannot be restored to look or function as it did at some idyllic point in the past. We cannot bring back the sinuous sloughs and tule-filled marshes as they were 150 years ago. Too much has changed for that to happen. But we can change our approach to species conservation. We can create and maintain new habitats to conserve species diversity – even in an environment as unnatural as the Delta.



Using a reconciliation approach to landscape restoration, shallow water habitat could be restored as experimental replicates, with configurable gates to change flows and residence time. Gates would allow restorations to mimic the hydrodynamic functions that are otherwise lost because of irreversible landscape-level changes to the estuary. Graphic: John Durand