New paper examines dams' effects on California salmon

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Spring-run Chinook salmon and other fish in the rivers of California's Central Valley could be harmed by more water-storage dams, according to researchers at Duke University and the National Oceanic and Atmospheric Administration.

The findings of a recent paper may serve as a cautionary tale to policymakers, scientists and resource managers currently embroiled in a debate about the construction of new dams in the region.

The paper, "Directed Connectivity Among Fish Populations in a Riverine Network," was published in the September 3 online issue of *Journal of Applied Ecology*.

Robert S. Schick, of the University Program in Ecology at Duke's Nicholas School of the Environment and Earth Sciences, used analytical techniques from network science to study the relative importance of individual populations of salmon within the valley and examined how the addition of large water-storage dams blocked access to habitat and fragmented these populations over time.

"We found that fragmented populations became increasingly vulnerable to disturbance and extinction," said Schick, who co-wrote the paper with Steven T. Lindley of NOAA's Southwest Fisheries Science Center in Santa Cruz, Calif.

The paper has become topical thanks to a recent $9 billion bond proposal

by California Gov. Arnold Schwarzenegger to construct two new dams and expand a third in the environmentally fragile Sacramento-San Joaquin River Delta.

Schwarzenegger says the new dams could help alleviate water-shortage problems associated with frequent droughts in the region. Some money from the bond would be used to pay for conservation improvements such as increased seasonal river flows to aid Delta Smelt, salmon and other species of fish that live in the delta area or swim upriver to spawn.

After first establishing the historical structure of the San Joaquin and Sacramento River systems, Schick and Lindley studied the progressive impact of dams on spatial connectivity among Chinook populations. In addition, they established the spatial structure of the current surviving populations in the Central Valley.

“We were able to document reduced spatial and demographic connectivity between salmon populations in the rivers as a result of the dams, and we identified several populations that had become vulnerable to, and dependent upon, production in fish hatcheries,” Schick said.

In addition to identifying problems linked to the dam, their network analysis identified potential solutions.

“By highlighting the demographic impact of individual populations of fish, network science allowed us to propose a recovery pathway for spring-run Chinook salmon in the Central Valley,” Schick noted. “This pathway highlights dams whose removal would have the greatest positive impact on the species.”

The methods he and Lindley employed to do their analysis can be applied broadly across taxa and systems, he added, and would be useful tools for scientists, policymakers and environmental managers in

California who want a better understanding of the structure and function of impaired ecosystems.

“We feel our work documents the harmful role of dams on spring-run Chinook salmon and can be used as a cautionary tale,” he said.

Source: Duke University