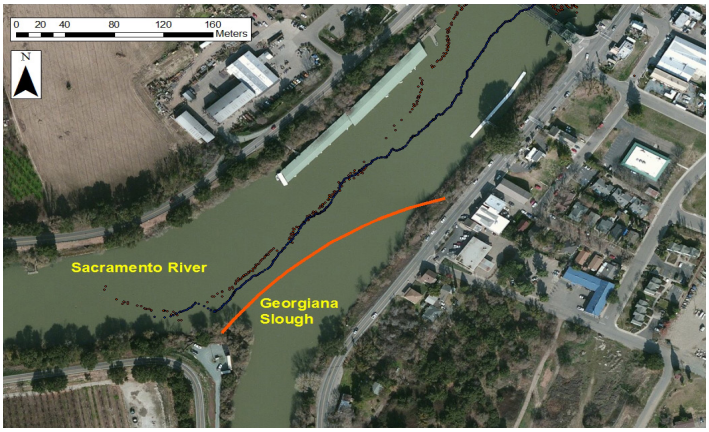
USGS
science for a changing world
May 2015 | Issue 3.5

Western Fisheries Research Center (WFRC)

Western Fisheries Science News



Aerial view junction of the Sacramento River with Georgiana Slough showing the location of the BAFF in orange, and two-dimensional movement paths of two acoustic-tagged juvenile Chinook salmon.. Source: Esri, DigitalGlobe, GeoEye, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IP, and GIS User Community.

The Delta – Developing Models to Understand Fish Passage and Survival In a Complex System

Below Sacramento, California the Sacramento River and the San Joaquin River merge to form the Sacramento-San Joaquin Delta. The Delta is an important water system that supports a population of approximately 24 million people, and provides water for millions of acres of the richest farmland in the U.S. The Delta is a playground for fishermen, hunters, boaters, and other recreationists. The Delta is home to around 750 distinct species of plants and wildlife (ACWA; accessed 06/01/2015). One of these species, Chinook salmon, is being studied by the U.S. Geological Survey's Western Fisheries Research Center and California Water Science Center; University of California, University of Washington, the Washington Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service because of its status as an endangered species.

Chinook salmon (*Oncorhynchus tshawytscha*) emigrating from tributaries of the Sacramento River negotiate a complex network of channels, both natural and man-made to make their way to the San Francisco Bay. The two major channels are the Delta Cross Channel (DCC) and the Georgiana Slough. The DCC is a man-made, gated channel that is used to divert water into the interior Delta to reduce salinity at the pumping stations. Fish that do not move into the DCC and remain in the Sacramento River may move into a natural channel below the (Continued on page 2)

Research

Acoustic Noise and Pacific Lamprey: During May, the WFRC, Confederated Tribes of the Umatilla Indian Reservation, and NOAA collaborated with a PhD candidate from the University of Southampton (GB) to study the effects of acoustic noise on Pacific lamprey. The University is renowned for their studies on the interaction of sound and vibration on the environment. Biologists suspect that acoustic noise caused by passage structures in streams may delay or deter fish during their upstream migration in the Umatilla River (OR). Throughout May, acoustic noise that occurs at passage sites will be measured and replicated during tests to measure how it affects fish behavior and the information collected may be used in the future to improve the passage of adult fish. For more information, contact Mike Hayes at mhayes@usgs.gov or 206-526-2537.

Events

USGS Participates in Washington Sea Grant (WSG) Site Review: As part of a National SeaGrant site review, WFRC Director Jill Rolland participated in a panel on restoration. The panel focused on restoration projects done in partnership with Washington Sea Grant or that are funded by Sea Grant and ranged from graduate students who received Sea Grant scholarships to city planners working on shoreline restoration. Rolland focused on the multi-disciplinary and multi-partner projects specifically the Elwha River restoration project and the Salish Sea Restoration project that is coordinated through Long Live the Kings. For more information, contact Jill Rolland at jrolland@usgs.gov or 206-526-6291.

USGS Presents at Regional Forest Service Fish and Watershed Program Managers Meeting: On May 14, 2015, Pathways Intern Rachel Reagan presented at the USDA Forest Service 2015 Fish and Watershed Program Managers meeting in Hood River, OR. Reagan presented a talk titled "Fish, funding, and floods - an integrated approach for designing and prioritizing passage restoration", describing recent work in Siuslaw National Forest. For more information, contact Rachel Reagan at rreagan@usgs.gov or 509-538-2299 x354.

DCC called the Georgiana Slough. Up to 50 percent of juvenile Chinook salmon encountering these two channels may be carried by the current into the interior Delta, exposing a substantial fraction of the population to low survival probabilities (Perry et al., 2010). To estimate the proportion of fish migrating through the interior of the Delta, which is critical to understanding the effect of water management, researchers used acoustic telemetry. Acoustic telemetry enabled individual fish to be detected repeatedly by telemetry stations as they moved through the Delta. Researchers then developed a mark-recapture model for the Delta explicitly to estimate the migration routes of the fish. In Perry et al., 2010 researchers showed that route-specific survival and movement among migration routes interact to influence population-level survival. However, their next challenge was to quantify the mechanisms causing variation in route-specific survival.

In a manuscript published in 2014, Perry et al., discuss the use of a non-physical behavioral barrier to alter migration routing of juvenile Chinook salmon in the Delta. A bio-acoustic fish fence (BAFF) was placed at the mouth of the Georgiana Slough to detour fish away from the channel and into the Sacramento River where survival is higher. Non-physical barriers, such as the BAFF use behavioral stimuli; sound, bubble curtains and lights to deter fish from entering into a channel. Researchers released fish that were surgically implanted with acoustic tags into the channel at various intervals. Fish were then tracked with hydrophones. Receivers linked to a personal computer, were used to collect and store the acoustic data. During the experiment researchers found that less fish were (Continued column 2)

Press Inquiries/Media

Invasive Asian Carps: On May 28, WFRC scientist Jason Romine was interviewed by Jeff Gillies at FishSens magazine regarding a recent publication on invasive Asian Carps. For more information, contact Jason Romine at jromine@usgs.gov, or 509-538-2299 x262.

Tracking Suckers in Drought Proves Tricky: On May 21, 2015, WFRC scientists Dave Hewitt and Amari Dolan-Caret were featured in an article in the Herald and News, about how USGS is using biotelemetry to monitor how threatened shortnose and Lost River suckers are responding to drought. For more information, contact David Hewitt at dhewitt@usgs.gov, or 541-273-8689 x215.

USGS Scientist on Oregon Public Broadcasting: On April 30, 2015, WFRC research ecologist Jeff Duda was mentioned on Oregon Public Broadcasting's EarthFix about a perspectives paper "1000 dams down and counting" published in Science on May 1, 2015. The article is a product from the Dam Removal Synthesis working group at the USGS John Wesley Powell Center. For more information, contact Jeff Duda at jduda@usgs.gov, or 206-526-2532.

entrained in the Georgiana Slough when the BAFF was on. This suggested that operation of the BAFF reduced entrainment (Perry et al., 2014). However, researchers did find that variation in environmental conditions and complex physical settings could alter the results of the using the BAFF.

In the Delta, water diversions can route juvenile salmon from the Sacramento River to the Interior Delta, where survival rates are low. Understanding when fish migrate and how they are influenced by water diversion is critical for improving fish survival. In an article published in 2015, (Perry et al.) researchers from the WFRC, along with USGS colleagues from the Great Lakes Science Center and California Water Science Center, compared diel behavior and entrainment probabilities in relation to water diversion operations. Modelling results suggest that opening the water diversion (the Delta Cross Channel) during daytime and keeping it closed during night time may allow for water diversions that minimize fish entrainment and mortality.

Researchers continue to study the movement of water through the Delta. The information learned from the studies will help water managers understand the mechanisms that affect fish distribution in association with water diversions from the Sacramento River. Further, models developed from research done in the Delta can be used in other systems such as the Columbia River where dam operations influence routing probabilities, and total dam passage survival.

For more information, contact Russell Perry rperry@usgs.gov or 509-538-2299, x242.

Publications

Elliott, D.G., C.L. McKibben, C.M. Conway, M.K. Purcell, D.M. Chase, and L.J. Applegate. 2015. Testing of candidate non-lethal sampling methods for detection of *Renibacterium salmoninarum* in juvenile Chinook salmon *Oncorhynchus tshawytscha*. Dis. Aquat. Org. 114:21-43. DOI: 10.3354/dao02846.

Hardiman, J.M., and M.B. Allen. 2015. Salmon habitat assessment for conservation planning in the lower White Salmon River, Washington: US Geological Survey Open-File Report 2015-1100, 24 p. DOI: 10.3133/ofr20151100.

Beeman, J.W. and N.S. Adams. 2015. In-reservoir behavior, dam passage, and downstream migration of juvenile Chinook salmon and juvenile steelhead from Detroit Reservoir and dam to Portland, Oregon, February 2013-February 2014: U.S. Geological Survey Open-File Report 2015-1090, 92 p. DOI: 10.3133/ofr20151090.

Pre-Publication Notice: New research links water levels to endangered fish spawning activity. Results will be published in the N. Am. J. Fish. Manage. on May 18, 2015. For more information contact Summer Burdick at sburdick@usgs.gov, or 541-273-8689 x209.

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