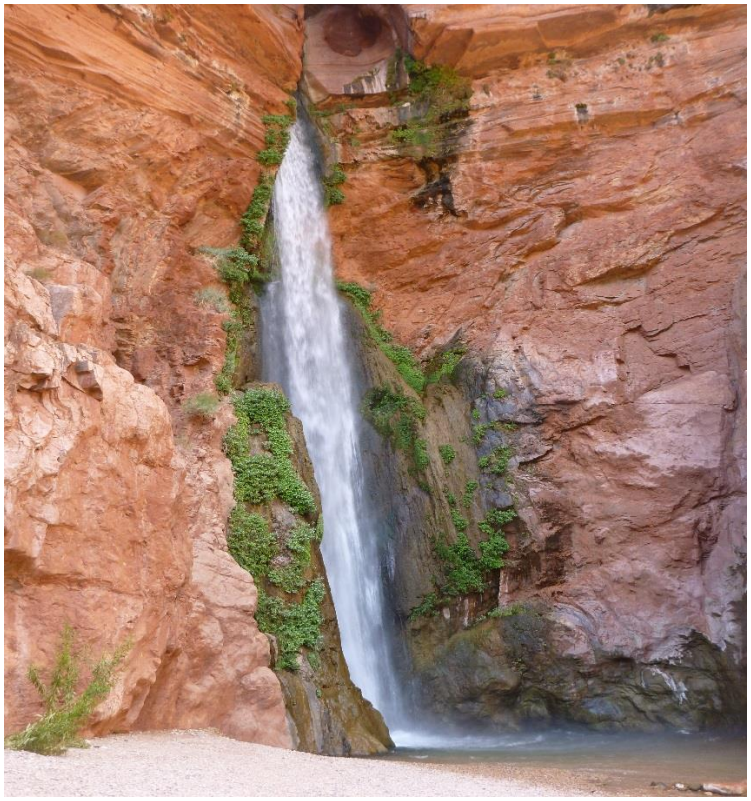
Southwest Biological Science Center Monthly Update

As a unit of the U.S. Geological Survey (USGS), the mission of the Southwest Biological Science Center (SBSC) is to provide quality scientific information needed to conserve and manage natural and biological resources, with an emphasis on the species and ecosystems of the southwestern United States. The SBSC has two research branches: Terrestrial Dryland Ecology and Rivers Ecosystem Science (which includes the Grand Canyon Monitoring and Research Center (GCMRC)). Both branches conduct research on the biology, ecology, and processes of the Southwest. SBSC has two field stations in Arizona (Flagstaff and Tucson) and one in Moab, Utah. You can find the SBSC online at: **https://usgs.gov/centers/sbsc**.

WELCOME

Below are recent products and activities coming from the SBSC. Underlined names indicate SBSC personnel. If you would like more information on anything in this month's update contact Todd Wojtowicz (twojtowicz@usgs.gov).

IMAGE OF THE MONTH



Waterfall and hanging gardens in Grand Canyon.
(photo credit: Kyrie Fry, USGS)

OUTREACH

Media, Broadcasts, and Films

SBSC's Ted Kennedy was quoted and his research was referenced in a recent piece in bioGraphic. The article, "**In Search of Suckers: An Endangered Fish Makes a Comeback in Grand Canyon's Depths – but will the Razerback Sucker Stick Around?**", is focused on the endangered razorback sucker in the Colorado River in Grand Canyon. Ted Kennedy's findings on the effects of hydropeaking on the aquatic foodbase in the Colorado River in the Grand Canyon are discussed in the article. The link to the article is here: *http://biographic.com/posts/sto/in-search-of-suckers*. The link to the hydropeaking and aquatic foodbase paper is here: *https://academic.oup.com/bioscience/article/66/7/561/2463266/Flow-Management-for-Hydropower-Extirpates-Aquatic*.

Anya Metcalfe's work on angel lichen moths in Grand Canyon was the topic of a recent Earth Notes episode produced by KNAU, a local affiliate of NPR. The link to the piece is here: *http://knau.org/post/earth-notes-angel-lichen-moths*.

SCIENCE

Presentations, Posters, Lectures, Workshops, and Panels

Bair, L., 2017, **Is rainbow trout control necessary, and if so, what is the most cost-effective approach?** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Bair, L., and Duffield, J., and Neher, C., 2017, **How do Colorado River flows impact Glen Canyon anglers' and Grand Canyon whitewater floaters' recreational experiences?** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Caster, J., Kasprak, A., and Sankey, J.B., 2017, **Geomorphic processes from topographic form: automating the interpretation of repeat survey data for monitoring fluvial-aeolian sediment connectivity** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Chapman, K., Parnell, R., Grams, P., Smith, M., and Mueller, E., 2017, **Evaluating the sustainability of controlled floods as a sandbar maintenance practice with sediment fingerprinting** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Daubert, M., and Muehlbauer, J., and Kennedy, T., 2017, **Aquatic invertebrate response to brown trout removal in Bright Angel Creek: study design and preliminary results** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Dean, D., 2017, **Hydrologic change and the geomorphic transformation of the Little Colorado River: implications for sediment delivery to Grand Canyon** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Dean, D., and Topping, D., 2017, **The Little Colorado River Revisited: analysis of nearly a century of hydrologic and geomorphic data** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Deemer, B.R., Yackulic, C.B., Hall, R.O., Kennedy, T.A., and Muehlauer, J.D., 2017, **Lake Powell nutrient dynamics are a lever on food webs near the Lower Colorado River** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Dodrill, M., Yackulic, C., Kennedy, T., and Yard, M., 2017, **Patterns of invertebrate prey selection by rainbow trout in the Colorado River** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Duniway, M.C., Nauman, T.W., Johanson, J.K., Green, S., Miller, M.E., Williamson, J.C., and Bestelmeyer, B.T., 2017, **Generalizing ecological site concepts of the Colorado Plateau for landscape-level applications** [poster]: Society for Range Management 70th Annual Meeting.

Fairley, H., 2017, **Historical changes to culturally important riparian plants along the Colorado River: a progress report on Project 12** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Fairley, H., 2017, **Management implications of riparian and terrestrial resource monitoring and research** [moderator for stakeholder discussion]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Fairley, H., Sankey, J., East, A., Caster, J., and Kasprak, A., 2017, **Beyond compliance: evolution and design of a program to monitor downstream dam effects at archaeological sites in Glen and Grand Canyons, Arizona** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Grams, P., 2017, **Management implications of water quality, sediment transport, and geomorphology monitoring and research** [moderator for stakeholder discussion]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Hamill, D., Buscombe, D., Wheaton, J.M., and Wilcock, P.R., 2017, **Transforming a low-cost leisure gadget into a high resolution riverbed remote sensing tool** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Korman, J., and Yard, M., 2017, **On the catchability of fish populations and interpretation of catch per effort trends** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Kasprak, A., 2017, **Individual and additive effects of vegetation encroachment and hydrological alteration on fluvial-aeolian sediment connectivity in Grand Canyon** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Kennedy, T., 2017, **Floods, fluctuating flows, and the foodbase** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Lovich, J.E., 2017, **Desert tortoises and renewable energy development in the desert Southwest to the U.S. Geological Survey** [presentation]: Energy & Wildlife Community of Practice Group.

Lupoli, C.A., Kennedy, T.A., Muehlbauer, J.C., and Yackulic, C.B., 2017, **Terrestrial-aquatic linkages in Grand Canyon: preliminary results** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Metcalfe, A., Kennedy, T., and Muehlbauer, J., 2017, **Citizen science monitoring of aquatic insects in the upper Colorado River basin** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Muehlbauer, J., 2017, **Brown trout in Glen Canyon: insights from an expert elicitation survey** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Muehlbauer, J., 2017, **Fluvial aquatic ecology of the Colorado River** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Nauman, T.W., Duniway, M.C., Villarreal, M.L., and Poitras T.B., 2017, **Disturbance automated reference toolset (DART): assessing ecological recovery from energy development on the Colorado Plateau** [presentation]: Society for Range Management 70th Annual Meeting.

Palmquist, E., Ralston, B., Sarr, D., and Merrit, D., 2017, **Ground-based riparian vegetation monitoring and research** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Rossi, R.K., Buscombe, D.D., Grams, P.E., Schmidt, J.C., and Wheaton, J.M., 2017, **Efforts to establish a long-term protocol of alluvial sandbars using "structure-from-motion" photogrammetry** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Sankey, J., 2017, **Fluvial-aeolian sediment connectivity during the current HFE protocol: effects for dunefields and archaeological sites** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Thomas, K,B., Stuaffer, B.A., Jarchow, C.J., and Arundel, T.R., 2016, **Vulnerable plant communities across the Southwest: a view through two CCSM4 scenarios** [poster]: International Biogeographic Society 8th Biennial Conference.

Topping, D., 2017, **Streamflow, water quality, sediment transport, and sand budgets in the Colorado River ecosystem** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Ward, D., 2017, **CO_2 dynamics and implications for fish in the Little Colorado River** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Ward, D., 2017, **Green sunfish eradication at Lees Ferry** [poster]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Yackulic, C., 2017, **Humpback chub that span in the LCR: status, trends, and potential drivers** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Yackulic, C., 2017, **It's not just about temperature and flow: the potential role of nutrients as a driver of Colorado River dynamics** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Yard, M., 2017, **A synthesis of what we have learned about rainbow trout movement, growth, and survival over the study period that has implications to management** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017.

Young, K., VanHaverbeke, R., and Dodrill, M., 2017, **Humpback chub aggregations** [presentation]: Glen Canyon Dam Adaptive Management Program Annual Reporting Meeting 2017

Published Papers, Reports, and Data Releases

Alvarez, L.A., Schmeeckle, M.W., and Grams, P.E., 2017, **A detached eddy simulation model for the study of lateral separation zones along a large canyon-bound river**: Journal of Geophysical Research: Earth Surface. Online link: *http://onlinelibrary.wiley.com/doi/10.1002/2016JF003895/full*.

Buscombe, D., 2016, **Shallow water benthic imaging and substrate characterization using recreational-grade sidescan-sonar**: Environmental Modeling & Software, no. 89, p. 1-18. Online link: *http://www.sciencedirect.com/science/article/pii/S1364815216303899*.

Cuttler, M. V., Lowe, R.J., Falter, J.L., and Buscombe, D., 2016, **Estimating the settling velocity of bioclastic sediment using common grain-size analysis techniques**: Sedimentology. Online link: *http://onlinelibrary.wiley.com/doi/10.1111/sed.12338/abstract?campaign=wolacceptedarticle*.

Deemer, B.R., 2017, **Lakes of the world with Google Earth: understanding our environment** [book review]: Limnology and Oceanography Bulletin. Online link: *http://onlinelibrary.wiley.com/doi/10.1002/lob.10161/full.*

Gibbons, J.S., Lovich, J., and Bowden, R.M., 2017, **Turtles: Freshwater**, *In* Reference Module in Life Sciences, Elsevier. Online link to abstract: *http://dx.doi.org/10.1016/B978-0-12-809633-8.01218-8*.

Hamideh, N., Anderson, S., Sutton, P., Beecham, S., Nagler, P., Jarchow, C.J., and Roberts, D.A., 2017, **NDVI, scale invariance and the modifiable areal unit problem: an assessment of vegetation in the Adelaide Parklands**: Science of The Total Environment, v. 584–585, p.1–18. Online link: *http://www.sciencedirect.com/science/article/pii/S0048969717301407*.

Persons, W.R., Van Haverbeke, D.R., and Dodrill, M.J., 2017, **Colorado River fish monitoring in Grand Canyon, Arizona**; 2002–14 humpback chub aggregations: U.S. Geological Survey Open-File Report 2016–1177, 43 p., *https://doi.org/10.3133/ofr20161177*.

Reed, S.C., 2017, **Disentangling the complexities of how legumes and their symbionts regulate plant nitrogen access and storage**: New Phytologist, v. 213, p. 478–480, DOI:10.1111/nph.14390. Online link: *http://onlinelibrary.wiley.com/doi/10.1111/nph.14390/full*.

Reed, S.C., and Wood, T.E., 2016. **Soil phosphorus cycling in tropical soils: an Ultisol and Oxisol perspective**, *In* Lal, R., and Stewart, B.A., eds., Soil Phosphorus: New York, USA, CRC Press, p. 247-283. Link to book: *http://www.crcnetbase.com/doi/book/10.1201/9781315372327*.

Smith, A.L., Puffer, S.R., Lovich, J.E., Tennant, L.A., Arundel, T.R., Vamstad, M.S., and Brundige, K.D., 2016, **A potential predator-prey interaction of an American badger and an Agassiz's desert tortoise with a review of badger predation on turtles**: California Fish and Game, v. 102, p. 131-144. Online link: *https://www.wildlife.ca.gov/Publications/Journal/Contents*.

Taniguchi, M., Lovich, J.E., Mine, K., Ueno, S. and Kamezaki, S., 2017, **Unusual population attributes of invasive red-eared slider turtles (*Trachemys scripta elegans*) in Japan: do they have a performance advantage?**: Aquatic Invasions. Online link: *http://www.aquaticinvasions.net/2016/ACCEPTED/AI_2017_Taniguchi_etal_correctedproof.pdf*.

Tietjen, B., Schlaepfer, D.R., Bradford, J.B., Lauenroth, W.K., Hall, S.A., Duniway, M.C., Hochstrasser, T., Jian, G., Munson, S.M., Pyke, D.A., and Wilson, S.D., 2016, C**limate change-induced vegetation shifts lead to more ecological droughts despite projected rainfall increases in many global temperate drylands**: Global Change Biology. Online link: *http://onlinelibrary.wiley.com/doi/10.1111/gcb.13598/full*. Note: This work was supported by the USGS John Wesley Powell Center for Analysis and Synthesis.

OTHER NOTABLES

January 4-5th 2017, SBSC scientist Sasha Reed met with the other four scientific co-leads of the second State of the Carbon Cycle Report (SOCCR-2) in Boulder, CO. It has been 10 years since the first Report, and these efforts are designed to provide accurate, unbiased, and policy-relevant scientific information concerning the carbon cycle to a broad range of stakeholders. In particular, goals are to summarize scientific knowledge about carbon cycle properties and changes for North America and to provide scientific information for decision support and policy formulation concerning carbon. For more information, please contact Sasha at *screed@usgs.gov*.

SBSC received word that all 22 of our proposals to the Youth and Education in Science (YES) Internship program were approved for funding in FY17.

Scott VanderKooi, Chief of the Grand Canyon Monitoring and Research Center (GCMRC), attended the 38th Annual Researchers Meeting for the Upper Colorado River Endangered Fish Recovery Program & San Juan River Basin Recovery Implementation Program held January 10-11, 2017 in Grand Junction, Colorado. He gave a presentation on rainbow trout abundance, distribution, and movement in Glen and Grand Canyons, Arizona.

SBSC's Terrestrial Dryland Ecology Branch, Tucson, AZ location, hosted an open house and information session on January 10, 2017 in association with NOAA's National Weather Service. SBSC's Brent Sigafus presented information on SBSC's mission and tools available for both partners and the public. Cecil Schwalbe and Brent Sigafus led the very popular herpetology stop on the tour. Shane Selleck and Brent

Sigafus were on the planning board for the event which hosted representatives from a variety of town, county, state, and military entities.

Brent Sigafus presented at the Collateral Duty Safety Program Coordinator's annual meeting at the BLM Training Center in Phoenix, AZ this week. Brent's presentation is titled, "**Implementing a Heat Stress Program at the Local Level**" and jointly presented with Fletcher Brinkerhoff from the New Mexico Water Science Center on "**Field Protection and Border Safety**". Additionally, Brent led a discussion/hands-on demo on the use of field vehicles.

On January 24-25, SBSC staff from the Grand Canyon Monitoring and Research Center (GCMRC) met with stakeholders from the Glen Canyon Dam Adaptive Management Program to update them on the results of numerous studies completed during FY2016. This information will set the stage for collaborative development of GCMRC's FY2016-2020 work plan. For more information, contact Scott VanderKooi, Chief of GCMRC, *svanderkooi@usgs.gov*.

Personnel from the Forest Service, Fish and Wildlife Service, National Park Service, Bureau of Land Management, and the Colorado Plateau Native Plant Program have inquired about the Restoration Assessment & Monitoring Program for the Southwest (RAMPS). RAMPS is a relatively new program to assist land management agencies develop successful restoration strategies for the water-limited ecosystems of the Southwest. For more information about RAMPS, contact Seth Munson (*smunson@ugsg.gov*) and visit: *https://www.usgs.gov/centers/sbsc/science/restoration-assessment-monitoring-program-southwest-ramps-0?qt-science_center_objects=0#qt-science_center_objects*.