Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
August 27th and 28th, 2014

Agenda Item

Science Updates: Recent Research on Sand, Bugs, and Fish

Action Requested

None

Presenters

Dan Buscombe, Ted Kennedy, and Charles Yackulic
USGS Grand Canyon Monitoring and Research Center

Previous Action Taken

Relevant Science

Background Information

Measuring bed sediments for improved sediment budgets and physical habitat assessment: The success of the HFE protocol EA - that is, high flow releases timed to coincide with periods of fine-sediment supply from tributaries - is predicated on the maintenance of a sufficient supply of sand from within the channel for rebuilding sandbars. Periodic comprehensive mapping of long reaches is necessary to constrain estimates of changes in sediment storage within an acceptable level of uncertainty, because flux-based sediment budgets become indeterminate at long (3-10 years) timescales. Changes in sediment storage are calculated by differencing high-resolution elevation maps from repeat surveys. However, for these calculations to be accurate it is necessary to distinguish between fine and coarse sediment. In addition to calculating sediment budgets, maps of bed sediment are also valuable for quantification of aquatic primary productivity and characterization of fish habitat.

Given the heterogeneity of the riverbed, identification of bed texture is difficult to achieve with sufficient coverage using conventional methods such as physical sampling and underwater video, which are also prohibitively expensive and time-consuming. Therefore, we have developed methods to work with existing data and data-collection protocols using signals recorded by multibeam echosounder, in order to map bed sediment types at unprecedented resolution and coverage. So far, an almost continuous map of bed sediments has been constructed for Lower Marble Canyon (RM 30 - 60) in May 2012. By the end of the year, we aim to have completed maps of Upper Marble Canyon (RM 0 - 30) in May 2013 and Eastern Grand Canyon (RM 60 - 87) in May 2014. Additional ongoing work focuses on relating signals recorded by singlebeam echosounder and low-cost sidescan sonar with sediment types, for the purposes of mapping shallow water physical habitats. The aim is to develop a suite of techniques with which to accurately map sediment type in any water depth, and from any vessel.

Citizen science monitoring of insect emergence: Recent food web studies demonstrated that aquatic insects are key prey items for native and desired non-native fishes in the Colorado River. Aquatic insects emerge from rivers when they reach maturity, and the timing of this critical life stage change is often triggered by environmental cues, including discharge and temperature thresholds. Glen Canyon Dam has greatly altered discharge and temperature regimes of the Colorado River in Grand Canyon, which may explain why only two aquatic insects—midges and blackflies—are common in this river segment. In 2012, we initiated a citizen science project in collaboration with professional river guides, Grand Canyon Youth, and private boaters to quantify insect emergence for the 240 mile Grand Canyon segment of the Colorado River. Citizens conduct standardized light trapping each night in camp, yielding an unprecedented insect emergence dataset (750+ samples each year). This dataset has elucidated insect emergence patterns related to dam operations including pronounced decreases in midge emergence coincident with abrupt increases in regulated discharge. Our findings suggest that the diversity and productivity of aquatic insects in the Colorado River could potentially be enhanced through changes in flow management alone, even without more natural temperature regimes.

Factors influencing humpback chub population dynamics: Since 2009, GCMRC biologists and their collaborators have regularly sampled a fixed reference reach in the Colorado River just below its confluence with the Little Colorado River. Mark-recapture data from this reach have dramatically improved our understanding of humpback chub survival and growth in the mainstem Colorado River, particularly with respect to juvenile fish. When these data are analyzed together with long-term system wide sampling in the Little Colorado River led by USFWS, a holistic understanding of humpback chub population dynamics emerges. Whereas mainstem temperatures and salmonid abundances play important roles in driving long-term population trends, interannual variation in juvenile chub production in the Little Colorado River and outmigration rates to the Colorado River heavily impact juvenile chub abundances over shorter time scales. This short-term variation, if not accounted for, can confound interpretation of short-term flow management treatments.