Investigation of Habitat Formation and Fish Use during a Range of Flows in a Sand-bed Stream, the Pecos River, New Mexico

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Abstract. The Pecos River between Fort Sumner Dam and Bartlett Reservoir provides habitat for the federally and state-listed threatened fish, the Pecos bluntnose shiner (PBNS). Since 1937 when Fort Sumner Dam was built, periodic block flow releases (1,200 cfs) have been used to convey most of the flow between the reservoirs, and as a result the flows in the river are generally low (< 80 cfs) for the remainder of the year. The wide, braided, sand-bed river ($D_{50} = 0.32$ mm), which has cohesive ($D_{50} = 0.04$ mm) vegetated banks, occasionally experiences flow intermittency, which may affect the population demographics, and habitat availability and use of the threatened fish. A collaborative investigation of fish habitat formation and use was conducted to identify flow requirements to support the listed fish species.

Topographic, geomorphic and fish habitat and use data were collected at six flows (2 to 80 cfs) in 2002 and 2003 at four study sites (Yeso Creek gage, Cedar Creek confluence, Fivemile Draw confluence, and the Carl Madison Ranch) that are located between Fort Sumner and Roswell. At each of the sites that are about 1,600 feet long and 200-300 feet wide, GPS and conventional surveys were used to develop detailed topographic maps (0.5- to 1-ft contour interval) for each flow, and the locations of braid channels, subaqueous linguoid bars and bank-edge scour holes were mapped. Simultaneously, habitat types (10) were mapped, chemical and physical parameters were measured, and fish numbers in randomly selected locations of the individual habitat types were determined by netting.

Analysis of the fish capture data showed that the PBNS preferentially used the parallel and perpendicular plunge habitat types which are created by flow divergence and scour at the lateral margins and the noses, respectively of the channel-width spanning linguoid bars in the individual braid channels. Other habitat types such as runs (deeper channel areas between the linguoid bars) and flats (shallow upstream portions of the linguoid bars) were not consistently selected by the fish. Additionally, volumetric analysis showed that while the volume of habitats such as flats and runs increase with discharge,

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the volumes of parallel and perpendicular plunges remain constant and are preferentially used by the fish.