

**Project Nominee:** Texas Parks and Wildlife Department (TPWD)

**Project Title:** Collaboration to Maintain Quality Fisheries in Brazos River Reservoirs: using new technology to relate reservoir water levels, littoral habitat and recreational access.

**Category:** SFR - Category I – Sport Fishery Development and Management

**Need:** Texas' population is growing rapidly, as is demand for water. The state's population is expected to double by 2060 and three of the fastest growing areas are in the Brazos River Basin. With few opportunities for construction of new reservoirs, increased water demand puts pressure on existing reservoirs. To address expected shortfalls, the Brazos River Authority (BRA) sought to amend its 1964 System Operation Order and in 2004, submitted a water right permit application that would allow them to use additional water supply made available through operational flexibility into the System Operation Order. For the application, BRA needed to develop a comprehensive Water Management Plan (WMP). The BRA and TPWD worked together to develop operating guidelines for the WMP to minimize the frequency and magnitude of reservoir water level fluctuations. These operating guidelines will reduce negative impacts to fisheries and public access in all 11 reservoirs located within the Brazos River basin.

Texas' reservoirs provide recreational opportunities and significant economic impact. In 2012, an estimated 1.85 million anglers produced at least \$2.38 billion in trip and equipment expenditures throughout the state. Abrupt changes in reservoir water levels can hinder access, and fish recruitment, and reduce fishing participation and other forms of water recreation.

Minimizing impacts of future reservoir fluctuations requires objective quantification of littoral habitat quantity and quality as well as angler access in all 11 reservoirs.

**Objectives:** 1) Quantify changes in vegetative and woody habitat, substrate type, and recreational access with decreasing water levels, and 2) Recommend operational threshold elevations for each reservoir based on littoral habitat availability and quality, angler access, river/reservoir connectivity, and the specific fish community to minimize the effects of drawdown.

**Procedures:** Because the study reservoirs were at or near conservation pool and time was limited, new and innovative methods for collecting and assessing reservoir specific habitat and access data using side-scan sonar and GIS were developed. The littoral zone for each reservoir was determined a-priori and it varied by reservoir, ranging from 2' - 14'. This value was used to develop elevation-specific littoral zone contour polygons for each reservoir.

Side imaging systems were used to capture high-resolution sonar recordings of submerged habitat at 75 points in each reservoir, 25 within each of 3 strata. Geo-referenced substrate and structural habitat data were collected along a 50 m section of shoreline, followed by a scan perpendicular to the shoreline for 200 meters or to the water depth associated with 30% reservoir capacity, whichever occurred first. Habitat and substrate were verified by physical inspections.

Sonar recording files were transformed into map images, and areas of coarse or fine substrate, aquatic vegetation, and woody habitat were delineated within a GIS. Percentage of littoral habitat was determined by overlaying the elevation-specific littoral zone contour polygons onto the delineated habitat layers. Public boat launch sites were also recorded, and the terminus of each ramp was identified from sonar imagery. The contour polygons were used to estimate the elevation

at each boat launch terminus. The number of usable boat ramps at reservoir elevations between conservation pool and 30% capacity were then determined for each reservoir. The elevation at which connectivity between the reservoir and river was lost was also determined. Using this information, reservoir specific threshold elevations were developed where habitat, access and fisheries were believed to be negatively impacted.

**Results:** Littoral area was reduced up to 81% with 2 to 4 m reductions in water level. Coarse substrate and aquatic vegetation was reduced by more than 50% at 2 to 3 m reductions. Woody habitat availability varied widely among reservoir and water levels. Minimum water level for public access was determined for 84 public boat ramps in the 11 reservoirs. Access was reduced by 50% with 2 to 3 m water level reductions, and total loss of recreational access was realized from additional declines of 1 to 5 m for all reservoirs.

Threshold elevations were selected from points of inflection in the slope of the relationships between water level and high quality habitat availability for each reservoir. These thresholds were used by the BRA to develop a systems operating plan that recognized the impacts of drawdowns and included language to address those impacts when they became severe and long-term.

**Benefits:** Recommended threshold elevations were incorporated into the BRA's WMP on November 28, 2012. The incorporation of these threshold elevations allows TPWD to have input into how the BRA operates the 11 reservoirs and helps ensure the viability of those fisheries. Quantification of drawdown impacts for each reservoir enables the BRA to preferentially release water from reservoirs where littoral habitat impacts are minimal, while conserving water levels in reservoirs where habitat impacts are more severe.

This unique study, demonstrated how developing technologies can be used to improve and expedite habitat assessments. Results of this study 1) Influenced TPWD Inland Fisheries to adopt new methodology for evaluating recreational access facilities throughout the state; 2) Demonstrated that fisheries, habitat, and recreational access differ from reservoir to reservoir and water management plans need to be specifically tailored for each reservoir; and 3) Provided the BRA and TPWD the ability to prioritize future habitat and access enhancement efforts.

Moreover, this effort demonstrated the value of TPWD having a "seat at the table" in water management planning and serves as a model for future work with other water authorities across our state. Similar methodologies, or processes, could be applied in other areas of the country where competing interests for water have potential for impact on fisheries, reservoir habitats, or public access.

This study was a collaborative effort between the BRA and multiple divisions and branches within TPWD; including the Legal Division, Water Resources, River Studies, Heart of the Hills Fisheries Science Center, and the three Inland Fisheries Management Regions.

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