Evaluating water level management to satisfy competing management objectives for fish, fishery, and birds in a reservoir

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Reservoirs provide multiple uses including fish habitat, fisheries, and habitat for waterfowl and shorebirds. Bluff Lake water levels are managed by the USFWS to achieve management objectives related to aquatic species, fishing, endangered species, and birds. Achieving bird objectives requires releasing water during the summer to expose mudflats and provide shallow water foraging habitats. However, reservoir drawdowns negatively influence aquatic species and fishery yield. Water releases used to promote downstream passage of paddlefish are constrained by lake level management for bird species. Lake level management with competing objectives and water constraints and uncertainty in future water availability is a challenge. We developed a stochastic hydrodynamic model relating water inflow to climatic conditions and lake morphology so changes in lake volume due to water inflow and releases modified exposed area. Exposed lake bed area and amount of shallow water was function of a lake volume and related to the likelihood of achieving bird management objectives. Water volume influenced the likelihood of achieving fishery objectives and releases influenced paddlefish passage. A decision model was developed from the hydrodynamic lake model and used to identify optimal water levels given competing management objectives and water availability uncertainty providing a way to solve this problem.

* Reservoir water levels are manipulated to achieve management objectives which can at times can compete for finite water stored in the reservoir.
* Additionally, annual reservoir drawdowns can negatively influence the fish assemblage and the fishery of Bluff Lake.
* Water level management is a trade off of releasing or holding back water to achieve management objective while maintaining sufficient water in the reservoir to minimize the risk of not achieving management objectives in the future because of extreme drought or rain events.