2023 NORTHEAST AQUATIC BIOLOGISTS CONFERENCE

WINTER LAKE DRAWDOWNS: PREVALENCE, HYDROLOGIC CHARACTERISTICS, AND ABILITY TO MEET MANAGEMENT GUIDELINES

Winter water level drawdown (WD) is a common lake management strategy in the northeast United States to protect shorelines from ice damage, control nuisance macrophytes, and support recreation. Most WD lakes undergo small magnitude (<3 ft) drawdowns without a special permit; thus, there is no database for where, when, and how lakes are drawn down. In Massachusetts (MA), there are general guidelines for drawdowns and refill timing, but there is little information on whether lakes meet these guidelines and how adherence varies among different years. We developed novel methods that use satellite-derived lake surface area and water level to assess the prevalence and hydrologic characteristics (timing, magnitude, duration) of lakes that undergo WDs in New England. We used multi-sensor satellite data from 2014–2021 to develop a Google Earth Engine-based framework to generate lake surface area, which was combined with digital elevation models to derive water level. Both satellite-derived surface area and water level showed consistent trends with in-situ water level for medium-to-large lakes (lake size > 1 km2). Additionally, we developed a hydrologic modeling framework based on the Cemaneige-GR4J rainfall-runoff model to simulate water levels in WD lakes with in-situ data (n=18). We evaluated the ability of each lake to meet the state WD guideline requirement (refilled by April 1st) under different drawdown magnitudes and refill initiation timing, and determined the latest refill date and deepest magnitude while still refilling by April 1st. Basin characteristics and lake morphometry explained most variation in timing and magnitude among lakes, such that lake management to optimize duration of the drawdown varied among lakes. The results from this study will be used to understand current regional variation in WD management and inform future decisions under different climate change scenarios.

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