RETROSPECTIVE ANALYSIS TO QUANTIFY MIGRATION OF AMERICAN SHAD IN AN IMPOUNDMENT ON THE LOWER SUSQUEHANNA RIVER

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Abstract. We integrated several existing data sources (migration timing/behavioral, hydrological, variable power station operations, and a 3-D time-varying hydrothermal model) to quantify the migration of American shad, Alosa sapidissima, in Conowingo Pond, a 9,000 acre impoundment on the lower Susquehanna River relative to the potential individual and synergistic effects of thermal discharge from Peach Bottom Atomic Power Station (PBAPS) and Muddy Run Pumped Storage Station (MRPSS) operations. The two power stations are approximately 5 mi apart with PBAPS on the west western shore and MRPSS on the eastern shore. Our approach isolated factors contributing to the failure of a large proportion of American shad to reach upstream spawning areas. American shad has been targeted for restoration to the Susquehanna River.

The PBAPS thermal plume shifts downstream, narrows in width upstream of discharge structure during MRPSS generation and moves upstream when MRPSS has been pumping for at least 12 hours (7 hours typical) primarily in summer at river flows = 12,500 cfs. Modeled maximum surface velocity of the upstream shifting plume is < 0.3ft/s and its ?T = 4.0F; changes in velocity and temperature rise are negligible at depths > 5ft. Most of the Pond remains within the temperature and velocity tolerance range of migrating American shad allowing a wide passage zone.

The maximum recorded MRPSS discharge velocity was < 6ft/s and restricted to a small area leaving substantial area of low velocity (< 2.0 ft/s) for migration passage. Almost the entire population (80-91%) of radio-tagged pre-spawned American shad successfully migrated past the two stations with minimal delay; the release location distance from MRPSS also did not influence travel speed. Estimated travel speed (4.0 to 6.7 mi/d) was similar to that reported by others.

High natural river flows (= 55,000 cfs) with their attendant turbulence and turbidity and inefficiency of fishways pose significantly greater impedance to American shad upstream migration than the operation of either power station individually or synergistically.