USDA-CSREES 2006 National Water Quality Conference

Dissolved oxygen modulates effluent partitioning of P in fish culture and should be considered in management practices designed to reduce effluent P

Phosphorus (P) is the nutrient limiting freshwater primary production, and excessive levels cause premature eutrophication of nearby lakes and rivers. Failure by fish farms to meet stringent guidelines limiting P levels in the effluent may become a bottleneck in production of aquacultured fish. Hence, studies increasing our understanding of waste P partitioning into soluble, particulate (10 – 200 um), and settleable (> 200 um) fractions should provide information relevant to design of practices that reduce effluent P. Dissolved oxygen (DO) is one of the most important abiotic factors determining growth and survival of fish because it increases feed consumption, feed efficiency, metabolism, and growth. The effects of DO on P metabolism by fish and on P partitioning in the effluent waste have not been studied. Dietary P is a well characterized but equally important biotic factor because intracellular P plays a pivotal role in virtually all metabolic pathways. During the late summer months when water supply is often restricted and fish require more DO to support higher metabolic rates, supplemental oxygen must be used in raceways to maintain DO levels above the recommended minimum concentration of 6 mg/L. Therefore, we studied effects of DO (6 and 10 mg/L) and dietary P (0.7 and 1.0% P) on rainbow trout growth, P utilization, and effluent P partitioning. Biomass increased by 40% after three weeks. As expected, % P in the body increased with dietary P. Fish maintained at low DO had significantly higher hematocrit values indicative of an adaptive response to increase blood oxygen carrying capacity. DO at 10 mg/L significantly increased fish growth, feed efficiency, and the amount of P in the soluble fraction of the effluent. Soluble effluent P was also greater in fish fed 1.0% P. Hence, DO increases fish growth and modulates P partitioning in aquaculture effluents. Factors regulating P metabolism must be considered in formulating feeding and management practices designed to meet guidelines regulating effluent P from fish culture.

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