ADVANCES IN FISH HARVEST TECHNOLOGIES FOR CIRCULAR TANKS

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Improved equipment and husbandry practices are required to effectively grade and harvest fish in large land-based culture tanks. The objective of our work was to develop and evaluate several types of relatively inexpensive, portable, and efficient fish handling equipment to reduce the labor requirement for grading and harvesting fish from large circular culture tanks. This equipment and husbandry practices also had to provide for worker safety and minimize the stress or damage to the fish. Two techniques were developed and evaluated to remove the entire population from a large and deep circular tank, i.e., (a) purse seine and (b) carbon dioxide avoidance response. Two other techniques were developed and evaluated to remove the fish from a large (150 m^3) and deep (2.44 m) circular culture tank after they had been top-graded *in situ* using a 3-panel clam-shell grader: (c) an airlift fish pump and hand sorting/dewatering box and (d) a sidewall drain box for hand sorting/dewatering. Some of these technologies are new, while others (such as the purse seine) have been used in other applications. Our commercial-scale evaluation of these technologies provided insight into the advantages and disadvantages of each option. With use of the clam-shell grader, the majority of the fish in the culture tank were never lifted from the water during the self-sorting process, which minimized stress, perhaps enhancing final product quality. In contrast, harvesting the tank using the purse seine and hand brailing was much more labor intensive and increased the stress on the fish, as indicated by a nearly 10-fold increase in fish mortality compared to the mortality observed when the clam-shell type crowder/grader system and an air-lift fish pump or sidewall drain box were used during fish harvest. The combination of the clam-shell crowder/grader with the sidewall drain harvest box was our preferred harvest method, because of its low labor requirement, relatively low fish mortality, and rapid harvest rate. We also think that the carbon dioxide avoidance harvest technique can be used effectively, with little labor input and practically zero mortality when the entire fish population must be removed from a fish culture tank, but not during a selective harvest using *in-situ* grading. Ultimately, the more effective technologies and practices should help fish farmers overcome scale-up issues and improve land-based fish farm profitability.

This work is more completely described in a manuscript that has been submitted to the journal *Aquacultural Engineering*.