Pacific Threadfin Fingerling Transport Technology Development, Year 1

General Information

Reporting Period January 1, 2004–September 30, 2004

Funding Level

Year	Amount
1	**$35,000**

Participants

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Cates International, Inc.

Objectives

The goal of this project is to develop a reliable and cost-effective protocol for handling and transport of Pacific threadfin fingerlings at the appropriate age (D50 to 60) and size (~3 g) for stocking in offshore cages. This research will have direct application for the commercial movement of fingerlings from hatchery/nursery sites to the location of commercial grow-out (both onshore and offshore) operations. This project is a component of a long-term effort by the Oceanic Institute (OI) to establish commercial production technologies for marine food fish aquaculture and transfer these technologies to local industry in Hawaii and the Pacific region.

1. Compare standard bucket transfer versus the gravity-feed method for moving fingerlings from nursery to transport tanks.

2. Set up a replicated small-scale experimental tank system to study and optimize transport conditions for small marine finfish fingerlings.

3. Establish the effects of stocking density on survival time and quantitative changes in water quality parameters over time during simulated transport of Pacific threadfin fingerlings.

4. Examine effects of adjusting water temperature, salinity, and use of anesthetics during handling for purpose of increasing maximal transport density.

Anticipated Benefits

This project is anticipated to benefit all of the commercial marine finfish operations, allowing maximization of available facilities for fish movement and providing operators critical insights into the most likely concerns for operational success. Scaled-up hatchery and grow-out operations provide new opportunities to achieve economies of scale in commercial operations. Large numbers of fingerlings can be moved at very high densities, given adequate attention to handling protocols, stress reduction, and water quality. However, overstocking of fingerlings, or inattention to protocol can quickly lead to high mortality rates, especially after unanticipated delays or equipment failure. In contrast, packing fish at low density may ensure transport success, but it greatly increases equipment and staffing requirements. It is therefore important that the physiological tolerance limits to transport conditions be determined for the specific species (in this case Pacific threadfin) and life-stage of the fish being shipped. Identification of "critical" parameters provides valuable information on areas of possible improvement in the transport process and can reduce the number of parameters that should be followed when shipping fish for commercial operations.

Work Progress and Principal Accomplishments

Project initiation was delayed with the extensive storm damage to the Doherty Research Hatchery Facility that was encountered in December 2003 and January 2004. The necessary repairs were completed in October 2004 allowing for the initiation of the Year 1 work plan. A preliminary "shake-down" trial was success-

fully completed with results present under progress for Objective 2, and the necessary equipment and supplies have been ordered for large-scale experimental trials.

Fingerling Transfer Between Tanks

Objective 1: Compare standard bucket transfer versus the gravity-feed method for moving fingerlings from nursery to transport tanks.

This project work is planned for early in 2005 dependent upon fingerling availability.

Design Transport Test System

Objective 2: Set up a replicated small-scale experiment tank system to study and optimize transport conditions for small marine finfish fingerlings.

Under this objective, we have begun to test and optimize a small-scale experimental test system as a means to develop and optimize fish movement protocols for application to larger-scale commercial operations and to conduct laboratory-type monitoring of parameters that cannot be easily measured under actual working conditions. Preliminary trials saw the successful use of standard plastic insulated 48-quart "picnic" coolers equipped with air stones for delivering metered oxygen to treatment animals (Figure 1). The system is currently being scaled up and materials are being ordered to initiate large-scale experimentation as outlined in the project work plan.

FIGURE 1. *Photograph showing "shake-down" transport trial examining the effect of transport density on survival of Pacific threadfin fingerlings.*

Effect of Transport Density

Objective 3: Establish the effects of stocking density on survival time and quantitative changes in water quality parameters over time during simulated transport of Pacific threadfin fingerlings.

Large-scale "simulated" transport trials are currently scheduled to be initated, dependent upon fingerling availability, late in 2004 and early in 2005. Based on the results of preliminary "shake-down" trials conducted earlier, the proposed experimental test system appears appropriate for examining the relationships between fingerling densities, changes in water chemistry, and fish survival (Figure 2). Early results clearly indicate the importance of not overstocking transport tanks in ensuring low mortality rates during fish transport.

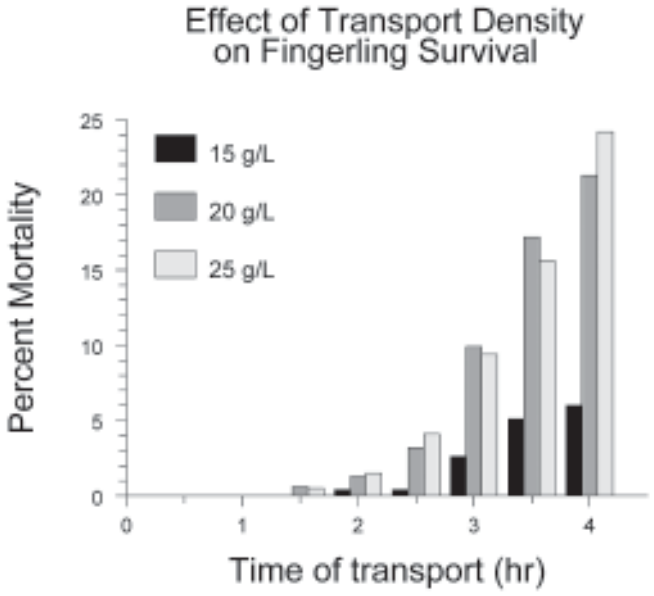

FIGURE 2. *Preliminary data from "shake-down" fingerling transport trials conducted with Pacific threadfin fingerlings.*

Alterations to Increase "Safe" Density

Objective 4: Examine effects of adjusting water temperature, salinity, and use of anesthetics during handling for purpose of increasing maximal transport density.

Experimental trials aimed at improving transport techniques and increasing "safe" transport density will be initiated upon completion of studies outlined under Objective 3.

Work Planned

1. Compare the current "bucket-based" transfer of fingerlings from nursery to truck-based transport tanks with that of a gravity-fed system through the tank drain. Under this objective, we will compare the manual fingerling transfer with that of gravity-fed tank transfer from nursery tanks to truck-based transport tanks. Although manual transfer by way of buckets has been a relatively simple and straightforward approach during early stages of industry startup, the high volume of fingerlings now being moved in support of the growing offshore cage industry make this approach antiquated and labor intensive. However, Pacific threadfin fingerlings have proven to be highly susceptible to handling stress. Therefore it is important to experimentally evaluate alternate procedures prior to subjecting large numbers of valuable fingerlings to potentially dangerous transport procedures. Detailed records of labor requirements and time required for fish transfer will be maintained on separate production runs to obtain a cost benefit analysis of alternative fingerling transfer methodology.

2. Complete installation of the small-scale experimental test system for examining and optimizing fish transport techniques.

3. Complete large-scale replicated fish transport density studies.

4. Complete studies examining potential methods to increase fingerling transport density. Under this objective, Pacific threadfin fingerlings will be stocked into experimental simulated transport tanks at previously determined densities to result in 50% survival at four hours (i.e., LD_{50}). Fingerlings will then be randomly divided into one of five treatment protocols including: control, reduced transport temperature, lowered salinity, light anesthesia during handling, and a combination of the above treatments toward improving transport survival and maximizing safe stocking densities during fish transport.

Impacts

The findings of this project will greatly benefit the development of the growing marine finfish industry by facilitating the safe and cost-effective movement of marine finfish fingerlings between hatchery and grow-out facilities across Hawaii and the Pacific Islands. In particular, the offshore cage industry is expanding rapidly in light of the successful demonstration of large-scale production of Pacific threadfin in submersible cages. The rapid expansion of the marine finfish industry has already outstripped the available supply of hatchery-reared fingerlings. A single operation (Cates International, Inc.) is currently targeting production of over two million

fingerlings per year, and at least two other commercial operations are expected to start production within the year. Scaled-up hatchery and grow-out operations provide new opportunities to achieve economies of scale in commercial operations. However, current handling and transport methods were developed for movement at the research or pilot scale, and are mostly limited to transfers within the research facility. Even stock enhancement efforts within the state have been relatively small and experimental in nature.Therefore, this project will ensure the successful movement of large numbers of fish between facilities, over roads and open ocean, and facilitate scale-up of production to levels to achieve the necessary economies of scale to become competitive in the world seafood trade.

Publications in Print, Manuscripts, and Papers Presented

None to date.