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AUTOMATED SOFT-SHELL CRAWFISH PRODUCTION

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Introduction

Since the introduction of the concept of automated separation of soft-shell crawfish (Malone and Culley, 1988), research efforts have been devoted to the development of the production unit and management procedures by the Civil Engineering Aquatic System Laboratory at LSU in the collaboration with Armant Aquaculture, Inc. of Vacherie, Louisiana and other collaborators. Successful implementation of the automated soft-shell crawfish separation process will reduce the labor requirements and increase productivity, thereby reducing the soft-shell crawfish price and stimulating a market expansion.

The automated separation system is based on the rationale that a freshly molted crawfish lacks the ability to resist a water current. When placed in a flow with a certain velocity, the soft-shell crawfish are swept away, while the intermolt (or hard-shell) crawfish are virtually unaffected. Based on this fact, a fiberglass separation tray was designed which optimized the hydraulic conditions for efficient separation of the soft-shell from the intermolt population. Crawfish are loaded and cultured in the tray consisting of four internal raceways, primary and secondary electrical inhibition gates and a crawl-out port. The inhibition gate applies a mild electric shock (or stimulation) with a low AC voltage to any crossing crawfish. As a results, the intermolt crawfish coming in contact with the inhibition gate are typically forced to move back into the tray. Conversely, a freshly molted soft-shell crawfish is so weak that it is unable to respond actively to the inhibition gate in the same way, and is pushed out of the tray by the water current. The separation tray remove the soft-shell crawfish from the hard-shell ones which are living the trays as the the primary separation step.

Ten to twenty of such separation trays can be stacked directly upon one another to form a "Stack separator" or simply called "stack" in which all trays are hydraulically linked. This arrangement makes it possible to hold larger number of crawfish in a relatively small space. Having the stack as a key unit, a typical automated soft-shell crawfish
production facility consists of a array components. All the components are linked together in a way which efficiently moves intermolt, soft and dead crawfish to their designated areas. The flow of the crawfish within the system is completely automated. The operation starts with loading sorted, immature crawfish into the stacks of the separation trays via a conveyor and a horizontal distribution trough. Once in the stack, the crawfish reside there until they are flushed out of the trays

and moved to components which separate them. Intermolt crawfish in the stack have three options: (1) remain in the trays, (2) crawl out into the underlying tray of the stack via the crawl-out port, or (3) escape the trays along with the soft and dead crawfish. Typically, the crawfish obtained through the primary separation in the trays are a mixture of soft-shell, hard-shell and dead crawfish. This mixture is sent to a secondary and a tertiary separation devices which remove the soft and dead for packing or disposal. The hard-shell crawfish which escape the from the separation trays are reloaded back into the stack. A detailed description of the separation process and the associated components can be also found elsewhere (Malone and Chen, 1991; Robin, 1992).

Research Progress

Laboratory

A series of laboratory studies provided detailed information for the design and operation of the separator. Emphasis has been given to the investigation of the behavioral response of crawfish to the inhibition gate and to the separation system, the movement of the crawfish through a stack, the design of the gate and the trap, and the impact of water flow rate and crawfish loading density. The laboratory research results defined the design criteria of each individual component and developed the management procedure for commercial implementations.

Commercial Implementation

A commercial scale facility has been set up in Armant Aquaculture, Inc. of Vacherie, Louisiana. This system consisted of 30 trays divided into three stacks which are interrelated by a crawfish distribution trough and transport pipe. This facility was evaluated for production performance from April 15, to June 14, 1991. The target loading density was 25 lb/tray. However, due to the lack of immature crawfish later in the experimental period, not all the 30 trays were operated at their full capacity.

During this operation period, the recorded soft-shell crawfish production was 136 lb which is a good production number given the one and half month period. The average mortality was 4% which is also higher than that in a typical operation. This higher mortality was partially due to the water quality at the starting period.

The experimental results indicate that as a means of reducing labor costs in the soft-shell crawfish industry, the automated separator showed promise. Although the facility needs fine tuning, production for the 1991 season was higher than expected under the loading regime and the observed mortality. However, structural and management modifications could help to increase the performance of the facility.

Problems and Future Research Directions

Problems have been experienced during the operation of the commercial facility. The first was the higher morality of which undesired water quality at the starting period was partially responsible. Secondly, controlling the crawfish distribution to each individual stack in the multi-stack system using a central conveyor and a distribution trough proved difficult.

Further research has been planned for the 1992 season with the commercial collaboration of Armant Aquaculture, Inc. of Vacherie, Louisiana. The Vacherie facility will be operated at the full loading capacity throughout the whole season. Research efforts will focus on the fine tuning of the separation system by improving some components and optimizing the management strategies, as well as addressing the problems identified above. Production data will also be collected for further performance evaluation.

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