

# Feasibility Analysis of Shrimp Waste Processing Alternatives

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## General Information

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*Participants*

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## Objectives

1. Identify different processing alternatives for utilizing shrimp head and other wastes from shrimp and other seafood processing. Include alternative preparations for high-protein meals for animal feeding, high-value natural products, and specialty foods.
2. Perform marketability study of these alternative materials, including hands-on interactions with different specialty marketing venues in Hawaii.
3. Complete an engineering cost analysis of basic operations for processing waste streams from shrimp and other seafood processing. Include the costs of transport, storage and handling, separation of viscera from chitinous materials, and subsequent grinding and biological processing, under various realistic scenarios of volume and distributed generation of waste.

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## Principal Accomplishments

***Objective 1: Identify different processing alternatives for utilizing shrimp head and other wastes from shrimp and other seafood processing. Include alternative preparations for high-protein meals for animal feeding, high value natural products, and specialty foods.***

In the first stage of the project, published literature, trade magazines, and industry experts were consulted to identify a variety of products that can be made from shrimp heads, shells, and legs. These products included high-protein materials for animal feed, high-value natural products from chitinous material, specialty foods, and compost. In this stage of research, the processing methods available to produce these materials were also compiled to facilitate the economic analysis to meet subsequent objectives. While it was difficult to obtain detailed information about processing methods and product compositions due to industry secrecy, enough information about the main processing steps and potential yields was obtained for each product in order to perform relevant economic comparisons.

***Objective 2: Perform marketability study of these alternative materials, including hands-on interactions with different specialty marketing venues in Hawaii.***

Based on the results of the first stage of the project, a marketability study of byproducts from shrimp head utilization was conducted. Potential markets were evaluated, taking into consideration the market value of byproducts, competition, and market trends. The market study included interactions with specialists and experts in Hawaii, on the mainland, and abroad. Results of the market study were summarized in Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis.

Based on the SWOT analysis, a decision was made to focus detailed analysis on four of the most promising byproducts and on the selected processing methods for

producing them. These products included shrimp flavor, shrimp protein hydrolysate, chitin (industrial grade), and compost, produced using a variety of low cost biological processes.

**Objective 3: Complete an engineering cost analysis of basic operations for processing waste streams from shrimp and other seafood processing. Include the costs of transport, storage and handling, separation of viscera from chitinous materials, and subsequent grinding and biological processing, under various realistic scenarios of volume and distributed generation of waste.**

In the third stage of the project, an engineering cost analysis of basic operations for processing waste streams from shrimp and other seafood processing was completed. The analysis covered costs of manufacturing byproducts from shrimp heads, using different methods and various realistic scenarios.

Analysis revealed that under certain scenarios shrimp head waste could provide a new revenue stream for potential processors of locally produced waste products. Different processing alternatives were determined that could be economically viable for converting shrimp heads and other wastes into valuable biological materials under the prevailing conditions in Hawaii and other Pacific Islands.

A capital budgeting model was applied to perform financial feasibility analysis. During the research, equipment, capital, labor, energy, building, and space requirements were determined for all processing alternatives. Analysis included examinations of production cost structure for each type of byproduct and of operating cashflow, as well as a profitability and sensitivity analysis. Return on investment was estimated by using a combination of investment analysis criteria. Payback period, net present value, and internal rate of return were applied to the estimated annual after-tax cash flow for the investment over a 10-year planning horizon.

Based on our analysis, we believe that the most profitable waste processing alternative for locally produced shrimp wastes would be shrimp flavor, or the simultaneous production of shrimp flavor and chitin — although profitability is subject to availability of wastes from 100,000 lbs. of shrimp per year and to the ability of a producer to incorporate additional processing requirements into his/her own operation to save on overhead and other fixed costs. It is also highly advisable that any potential processor invest in industry professionals to help develop a marketable product and design a processing facility of an appropriate scale.

## Impacts

The findings of this study may help Hawaiian aquaculture producers decide on alternative processing schemes for generating a supplemental source of income from their production. Because the economic constraints of Hawaiian aquaculture production are similar to those constraints of aquaculture production on other islands in the Pacific, this study also may be useful in making economic decisions in the same industries throughout the CTSA region.

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## Recommended Follow-up Activities

We believe that the information compiled during this project should be made publicly available to all aquaculture producers in Hawaii and throughout the Pacific in order to facilitate their decisions regarding production and processing. To that end, we recommend that the detailed findings of the project be published by CTSA in an extended report of approximately 100-pages. In order to more effectively publicize this work to the aquaculture community, we are also preparing a brief summary of the project for inclusion in the next issue of CTSA's *Regional Notes*, and an article for submission to a peer-reviewed aquaculture journal.

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## Publications in Print, Manuscripts, and Papers Presented

At the time of this report, no official publications have been submitted based on work completed under this project. However, as noted above, we believe the information compiled in the course of this study would be extremely valuable in a special publication by CTSA, and we are working on condensed versions of the study for inclusion in the CTSA newsletter and a peer-reviewed aquaculture journal.