Evaluating Poultry By-Product Meal (PBM) as a Replacement in Formulated Diets for Fattening Mud Crabs (*Scylla* spp.) : Effects on Growth Performance, Survival and Feed Utilization

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INTRODUCTION

Mud Crab & Market Context

- Mud Crabs (*Scylla* spp.) are a **high-value commodity** across Indo-Pacific markets including Singapore, Malaysia, and Hong Kong.
- Up to merchants apply **strict selection criteria**, rejecting crabs due to insufficient weight, or asymmetric chelipeds.
- Rejected crabs undergo "**fattening**", before reentry the market.

40% Market **rejection rate** pre-fattening → Fattening → **4×** **Increase in value** after fattening period

Research Overview

Problem Statement

1) No commercial formulated diet exists for Scylla fattening.
2) Trash fish dependency creates biosecurity risks, nutritional inconsistency, and environmental strain.
3) Singapore's Poultry Hub produces 60 t/day PBM with no aquafeed application.

Study Objective

To evaluate the effect of graduated fish meal (FM) replacement with locally-sourced PBM on growth performance, feed digestibility, meat quality, and economic viability in male *S. tranquebarica* during the commercial fattening phase.

Materials and Methods

1 Experimental Diets

Produced feeds were developed and tested rigorously to ensure both water stability and palatability.



Group	Diet
Control	Barramundi fillet
Diet 1	100% FM, 0% PBM
Diet 2	50% FM, 50% PBM
Diet 3	0% FM, 100% PBM

- *All formulated diets isonitrogenous & isoenergetic*
- *Semi-Moist Texture*

Key Finding

Balance of water stability with palatability is critical, reducing leaching, while remaining detectable to crabs.

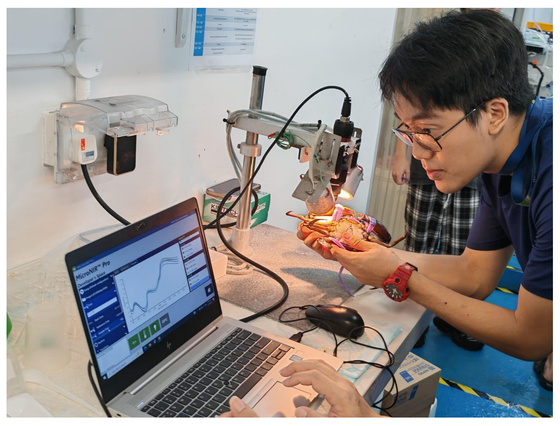
2 Experimental Set up



Pilot trials and Experiments were conducted in a Vertical RAS. Each crab was individually housed to prevent cannibalism

System salinity adjusted to match the source environment of imported crabs.

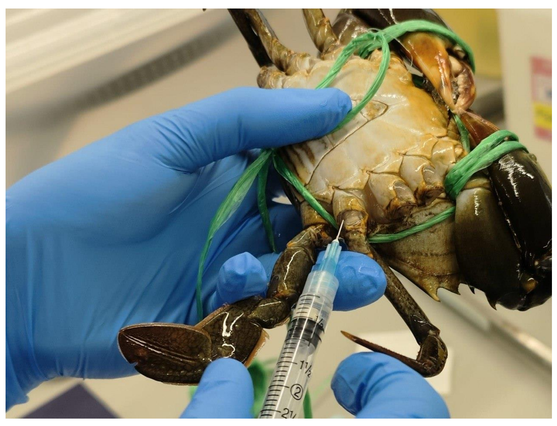
3 Fattening Trial



NIR readings provides a **real time**, **non-invasive** assessment of fullness, **eliminating operator biasness.**

Measured Growth Parameters

- Body Weight
- Carapace Length and Width
- Hemolymph refractive index
- NIR spectroscopy



4 Digestibility Study

Fecal matter collected from day 8 of fattening trial, till sufficient.

Apparent Digestibility Coefficients were assessed with the inclusion of Cr_2O_3 in formulated feeds.



Discussion and Future Directions

Current findings show the successful development of formulated feed for *S. tranquebarica* is not dependent only on nutritional composition, but more critically on physical properties which affect detectability and intake.

Future directions

- Validate findings across additional *Scylla* spp. and Fattening Systems
- Optimise amino acid profile in PBM diets

References

1 - Apine, E., Ramappa, P., Bhatta, R., Turner, L. M., & Rodwell, L. D. (2023). Challenges and opportunities in achieving sustainable mud crab aquaculture in tropical coastal regions. *Ocean & Coastal Management*, *242*, 106711.

2 - Overton, J., Macintosh, D., & Thorpe, R. (1997). Multivariate analysis of the mud crab Scylla serrata (Brachyura: Portunidae) from four locations in Southeast Asia. *Marine Biology*, *128*(1), 55-62.

3 - Quinitio, E. T. (2025). Mud crab industry status in the Philippines. Status, technological innovations, and industry development needs of mud crab (Scylla spp.) aquaculture: FAO Expert Workshop, 27–30 November 2023, Singapore,

4 - Sujan, M. H. K., Kazal, M. M. H., Ali, M. S., & Rahman, M. S. (2021). Cost-benefit analysis of mud crab fattening in coastal areas of Bangladesh. *Aquaculture Reports*, *19*, 100612.

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