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PhD project - Net energy evaluation for low-trophic fish

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Sustainable aquaculture requires a balance between what benefits the environment and farmed fish. By-products, residual flows, and novel ingredients like insects and unicellular meals are environmentally friendly, but it remains unclear what their energetic value is for fish. In this project, net energy (NE) systems will be used to evaluate the specific contribution of macronutrients in the diet to the retained energy of low-trophic fish. The focus fish species are grass carp *(Ctenopharyngodon idellus)* and giant gourami *(Osphronemus goramy)*. Main objectives of this project are 1) establishing two general NE equations in which retained energy is predicted based on digestible intakes of three macronutrients (fat, protein, carbohydrates), 2) establishing two improved NE equations in which the variable *carbohydrate* is split into *starch* and *non-starch polysaccharides (NSP)*, or *starch* versus *insoluble* and *soluble NSP*, 3) Establishing NE equations in each body compartment, and 4) to test the robustness of the equation in ponds. Side objectives include the disclosure of how different starch types affect the deposition location of fat in the fish body and how NSP is fermented in the fish gut. Different experimental diets with highly contrasting levels of nutrients will be fed to the fish. Multiple linear regression will be fitted to estimate the energy utilization efficiency coefficients of the nutrients. Gut microbiota will be analyzed and mapped using 16s rRNA sequencing. The production of volatile fatty acids (VFA) will be quantified as an indicator of intestinal fermentation and coupled with gut microbiota to explore its mode of action when NSP is present in diets.