

# EXPLORING THE POTENTIAL OF LOCALLY SOURCED INGREDIENTS FOR TILAPIA AQUAFEED

## FORMULATION IN THE BAHAMAS

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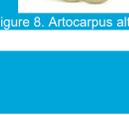
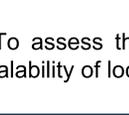
### Abstract

This study assessed locally available resources as alternative ingredients for nutritionally balanced fish feeds in Eleuthera, The Bahamas. Proposed ingredients included plant materials (cassava, breadfruit, coconut, moringa), marine by-products (finfish viscera, conch and spiny lobster discards, Irish moss), and brewer's spent grain. All materials were dried, milled, and analyzed for proximate composition. Marine by-products demonstrated strong potential as alternative protein sources. Finfish viscera contained 56.4% crude protein and 16.2% crude fat, lobster discards 46.8% crude protein and 4.8% crude fat, and conch discards 30.9% crude protein and 5.9% crude fat. In contrast, cassava and breadfruit were predominantly carbohydrate-rich, with nitrogen-free extract (NFE) values of 83% and 78.9%, respectively, while moringa contained 28.3% crude protein and 32.4% NFE. These results suggest that local resources could potentially replace conventional ingredients in local feed formulation in The Bahamas and wider Caribbean, while supporting circular bioeconomy practices.

### Introduction

Expansion of the aquaculture sector in the Caribbean restricted by access to resources, especially feed, which depends on expensive and unreliable imports. Localized aquafeed production has been identified by farmers as a potential solution.<sup>1</sup> Conventional aquafeed ingredients need to be imported, however many locally available resources have potential to be suitable aquafeed ingredient substitutes.

Table 1. Characteristics of proposed ingredients

Ingredient	Biological Value	Economic Feasibility
 Figure 1. Finfish offal/ viscera	High-quality protein & lipids	Low-cost fishery byproduct
 Figure 2. <i>Aliger gigas</i>	Protein-rich marine source	Processing-dependent waste stream
 Figure 3. <i>Panulirus argus</i>	Protein & minerals (chitin limits inclusion)	Seasonal, higher processing cost
 Figure 4. Brewer's spent grain	Moderate protein & energy	Consistent, low-cost supply
 Figure 5. <i>Moringa oleifera</i>	High protein & micronutrients	Low-input crop; labour-intensive processing
 Figure 6. <i>Manihot esculenta</i>	Energy source & binder	Widely available, low cost
 Figure 7. <i>Gracilaria</i> spp. & <i>Eucheuma</i> spp.	Functional additive (minerals, bioactives)	Best use of surplus biomass
 Figure 8. <i>Artocarpus allilis</i>	Lipid/energy contributor	Readily available residue

### Objectives

- To evaluate the proximate composition of locally available plant, marine, and agro-industrial byproducts.
- To assess their regional availability to determine the scalability of local feed production.

### Methods

#### Proximate Analysis

Raw Materials were sourced locally from foraging, artisanal fishers and farmers, and the Commonwealth Brewery in Nassau, dehydrated at 105°C and ground into a uniform meal.

Proximate analyses were conducted on the samples using standard AOAC methods as follows:

- Moisture: Oven Drying
- Crude Protein: Kjeldahl (N x 6.25)
- Crude Lipid: Ether Extraction
- Ash: Combustion

Nitrogen free extract was calculated using

$$NFE = 100 - (Moisture + Crude protein + Crude lipid + Ash)$$

#### Regional data sources and processing

National crop production and marine capture statistics (2020–2024) were obtained from FAOSTAT, FAO FISHPSTATJ, and national fisheries departments across English-speaking Caribbean countries.

Marine byproduct biomass (B) was estimated using species-specific processing yield coefficients derived from published literature<sup>2</sup>. Estimated recoverable biomass was calculated as:

$$B = Total\ landings\ (t) \times Discard\ fraction$$

#### Discard fractions applied:

Spiny lobster: 0.45 Queen conch: 0.50 Finfish viscera: 0.2

### Results

Table 2. Proximate composition of proposed ingredients

Sample	Moisture	Protein	Fat	Fibre	Ash	NFE
Conch	6.2	30.9	5.9	1.5	29.5	26.0
Fish	5.1	56.4	16.2	0.8	20.8	0.6
Lobster	8.8	46.8	4.8	12.5	30.9	0
Moringa	7.5	28.3	6.9	13.6	11.3	32.4
BSG	7.5	22.2	9.6	19.9	2.6	38.2
Seamoss	19.6	4.5	0.2	8.6	20.8	46.3
Breadfruit	9.7	3.1	0.7	3.0	4.6	78.9
Cassava	9.9	0.6	0.4	4.3	1.8	83

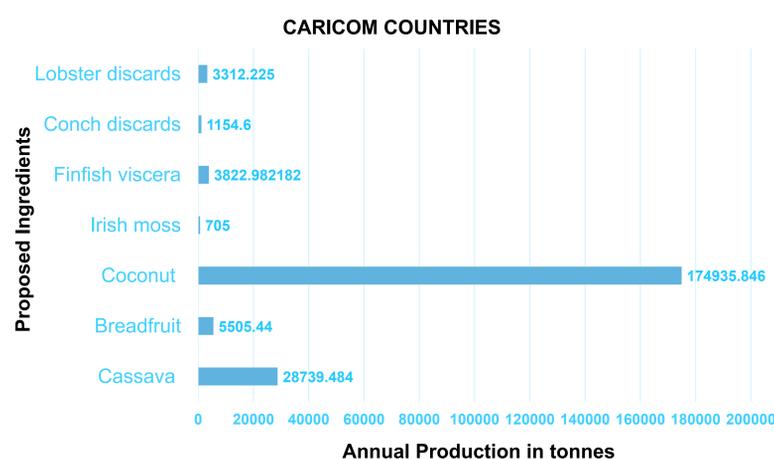


Figure 9. Average annual production of proposed ingredients in the wider Caribbean.<sup>3,4</sup>

### Discussion

Marine byproducts (lobster and conch discards) showed the highest crude protein (>50%) and lipid levels, positioning them as viable primary protein replacements for imported fishmeal.

Brewer's spent grain and moringa provided moderate protein (18–30%) and higher fiber, indicating value as complementary plant ingredients with the potential to replace imported corn and soy meal.

Cassava and breadfruit flours function primarily as carbohydrate sources, while Irish moss appears more suitable as a mineral-rich functional additive, and a binder.

#### Implications for Caribbean Aquaculture

Regional production data demonstrate that both marine byproducts and crop-derived ingredients are available at meaningful annual volumes. Particularly, lobster and conch fisheries generate substantial processing discards (~45–50% of landed biomass), representing an underutilized resource with the potential to reduce reliance on imported fishmeal and retain economic value within local supply chains, although this is contingent on scalable processing infrastructure. Leveraging these resources could reduce exposure to volatile imported feed markets while strengthening value retention within regional food systems.

Feasibility will depend on digestibility, processing costs, and seasonal supply stability.

Next steps will focus on *in vivo* tilapia trials to evaluate growth performance, feed efficiency, health metrics, and economic viability of locally formulated diets.

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