STRATEGIC FCR IMPROVEMENT MASTER PLAN FOR AQUACULTURE

1. EXECUTIVE SUMMARY

This document consolidates a **Feed Conversion Ratio (FCR) Improvement Master Plan** designed to transform feeding from a mere operational task into a **strategic production control system.**

Through GRC analysis (SGR–FCR–SFR), the technical redesign of the feeding strategy, and disciplined field implementation, a progressive FCR reduction is projected from **3.0 (baseline)** to **≈2.2 at month 6** and **≈1.8 by the end of the first year**. This will generate direct impacts on profitability, production stability, and environmental sustainability.

2. INTRODUCTION

Feed accounts for **50% to 70% of operating costs** in aquaculture. An FCR of 3.0 reflects structural inefficiencies usually associated with **misaligned feeding strategies** rather than feed quality itself.

This plan approaches feeding as a **dynamic process**, integrating biological, environmental, and human variables through a quantifiable, replicable, and scalable framework.

3. OBJECTIVES

General Objective

To implement a data-driven feed management system that achieves a sustained reduction in FCR and stabilizes production performance.

Specific Objectives

- Identify overfeeding and underfeeding gaps through macro and micro GRC analysis.
- Define biological inflection points for timely strategy shifts.
- Standardize operational feeding criteria.
- Train key personnel in indicator-based decision-making.
- Achieve a **40% cumulative improvement in FCR** by the end of month 12.

4. GUIDING PRINCIPLES

- Every pellet must be converted into biomass.
- FCR is controlled through timing and precision, not volume.
- Human error is the primary factor for deviation.
- Every decision must be backed by quantitative thresholds.

5. PHASED DEVELOPMENT PLAN

PHASE 1: RESULTS EVALUATION (Month 1 – Month 2)

5.1 Macro GRC Analysis

- Start-to-end comparison of harvested units.
- Classification by overfeeding, underfeeding, and other deviations.

5.2 Specific GRC Analysis Between Samplings

- Evaluation by weight ranges.
- Identification of efficiency breakdowns.
- Detection of secondary scenarios (density, thermal stress, handling).

5.3 Audit of Existing Feeding Strategy

Variables evaluated:

- Intake–growth ratio.
- Schedules and number of rations.
- Spread area and control depth.
- Feeding speed and ration duration.
- Pellet size.
- Water temperature.

Deliverable: Results Evaluation Report (Product 1.0)

PHASE 2: FEEDING STRATEGY DESIGN (Month 2 – Month 3)

5.4 Growth Model Definition

- Adjustment of real vs. theoretical curves.
- Integration of temperature and biomass.
- Validation of the GRC model.

5.5 Determination of the Inflection Point

- Identification of the point of metabolic efficiency loss.
- Definition of the exact timing for strategy changes.

5.6 Development of the New Strategy

- Optimized ration curves by weight and temperature.
- Standard Operating Procedures (SOPs).
- Clear adjustment parameters.

Deliverable: Optimized Feeding Strategy (Product 2.0)

PHASE 3: OPERATIONAL IMPLEMENTATION (Month 3 – Month 12)

5.7 Staff Training

- **Feeders:** Behavioral reading and ration control.
- **Supervisors:** KPI interpretation.
- **Management:** GRC-based decision-making.

5.8 Field Implementation

- Gradual and controlled application.
- Technical oversight and support.
- Initial operational adjustments.

5.9 Continuous Evaluation and Feedback

- Weekly indicator tracking.
- Fine-tuning of the model.

Deliverable: Implemented and Validated Strategy (Product 3.0)

6. QUANTITATIVE DECISION CRITERIA

Indicator	Threshold	Corrective Action
Partial FCR	>10% over target	Review feeding speed and duration
SGR	−15% vs model (2 samplings)	Adjust ration / pellet size
Weight CV	>25%	Modify spread area and speed
Visual pellet loss	Present	Immediate ration reduction; check feeding speed

7. GANTT CHART – CRITICAL IMPLEMENTATION PATH

Phase / Activity	M1	M2	M3	M4	M5	M6	M7-12
Results Evaluation	■■	■■					
Strategy Design		■■	■■				
Training			■	■			
Operational Implementation			■■	■■	■■	■■	■■
Tracking & Optimization				■	■	■	■■

8. EXPECTED FCR EVOLUTION

Milestone	Timeline	Expected FCR	Type of Improvement
Baseline	Start	3.0	—
Quick Adjustment	3 months	2.6–2.7	Waste elimination
First Breakthrough	6 months	≈2.2	Strategic shift
Consolidation	12 months	≈1.8	Structural optimization

9. IMPROVEMENT LEVERS BY TIME HORIZON

- **Short term (0–3 months):** Speed, duration, and scheduling.
- **Medium term (3–6 months):** Inflection points and uniformity.
- **Long term (6–12 months):** Thermal adjustment and continuous feedback.

10. HUMAN FACTOR AND RISK MANAGEMENT

Role	Main Risk	Control Measure
Feeder	Overfeeding based on perception	Standardized protocol
Supervisor	Delayed adjustments	Mandatory weekly KPI report
Management	Decisions without data	GRC Dashboard

11. EXPECTED ECONOMIC IMPACT

Every incremental improvement of **0.1 points in FCR** represents a direct reduction in feeding costs of **0.15 USD / kg** and a proportional increase in operating margin, with additional benefits in water quality and sustainability.

12. LIMITING CONDITIONS

This plan may lose effectiveness if:

- Operational discipline is lacking.
- Biomass data is inaccurate.
- There is high turnover of key personnel.

13. CONCLUSION

FCR improvement is not a one-time event but an **operational maturation process.** This plan allows for the control, anticipation, and optimization of feeding, ensuring that every delivered pellet translates into biomass, profitability, and long-term sustainability.

ANNEXES: INFORMATION REQUIREMENTS

To execute the evaluation analyses and technical modeling, the following information is required in **.xlsx (Excel)**format, structured as follows:

1.0 Data for GRC Analysis (Production Efficiency)

This dataset allows for the evaluation of biological and feeding performance at both the macro (full cycles) and micro (specific periods) levels. Information must be consolidated under the following headers:

Required Column Structure:

- **Start Date / End Date:** Start and end dates of the evaluated period.
- **Cage / Batch:** Identification of the cage/pen and batch number.
- **Start Weight / End Weight:** Initial and final average weights (grams).
- **SGR (Specific Growth Rate):** Specific growth rate.
- **FCR-B (Biological FCR):** Biological feed conversion ratio.
- **SFR (Specific Feeding Rate):** Specific feeding rate.

Two distinct databases must be consolidated to evaluate historical and current efficiency:

- **Closed Cycle History (Stocking to Harvest):** Consolidated final data per culture unit, allowing for macro-analysis of deviations and cumulative results.
- **Periodic Biometric Tracking (Between Samplings):** Detailed data from inter-sampling periods to identify efficiency breakdowns in real-time.

Information Format:

Start Date	End Date	Cage	Batch	Start Wei	End Weig	SGR	FCR-B	SFR

2.0 Data for Growth Modeling and Inflection Curves

This database is critical for validating the relationship between growth, time, and environmental variables (temperature). It must be presented with a periodic breakdown (monthly or per sampling).

Required Column Structure:

- **Cage / Month:** Identification of the unit and time period.
- **Mean Weight:** Average weight recorded during sampling.
- **SGR / FCR:** Performance indicators for the period.
- **Temperature:** Daily average temperature record for the period.
- **Days Period / Days Cumm:** Days elapsed in the interval and total cumulative days.
- **Days Degrees Period / Cumm:** Cumulative thermal units (Degree Days) for the period and total.

Information Format:

Cage	Month	Mean Weight	SGR	FCR	Temperature	Days Period	Days Cumm	Days Degrees Period	Days Degrees Cumm

Data Handling Notes:

- **Integrity:** Do not omit cells in the temperature and weight columns, as they form the basis for calculating metabolic inflection points.
- **Standardization:** Use metric units (grams for weight, degrees Celsius for temperature).
- **Frequency:** It is recommended that data for item 2.0 has a biweekly or monthly recording frequency for greater model precision.