



STUDY

Higher Dietary EPA & DHA Levels Improve Feed Efficiency and Harvest Quality in Chilean Salmon Farming

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Summary

This 'first of its kind' commercial Big Data study, carried out by Aquabench Salmobench®, demonstrates how dietary inclusion of eicosapentaenoic and docosahexaenoic acids (EPA & DHA, respectively) influences both production efficiency and harvest quality outcomes in Chilean Atlantic salmon farming.

Drawing on data from 151 commercial farms, the analysis shows that higher dietary EPA & DHA inclusion is consistently linked to improved feed conversion ratio as well as reduced melanosis prevalence and severity at

harvest. The analysis further indicates that better outcomes depend not only on dietary EPA & DHA inclusion levels but also on maintaining an appropriate omega-6 to omega-3 (N6:N3) fatty acid balance.

These findings provide quantitative evidence to inform feed formulation strategies and offer practical guidance for stakeholders across the value chain seeking to improve feed efficiency while reducing quality-related value loss.

Key Findings

Farm data performance results

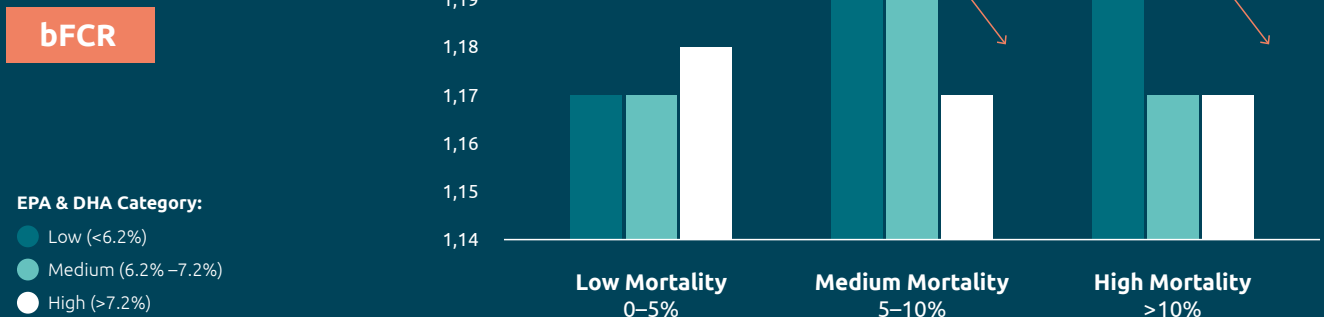
Biological feed conversion ratio (bFCR) is a key performance indicator in salmon farming, as it directly affects feed cost, resource efficiency and the carbon footprint of farmed salmon.

Commercial farm data from Chilean farmers in regions X & XI (Los Lagos & Aysén) show that salmon receiving diets containing EPA & DHA inclusion levels above 7.2 % (of total fatty acids) achieved improved feed conversion

performance compared with those receiving EPA & DHA inclusion levels below 6.2 %.

When the data is classified by mortality pressure, the improvements in eFCR and bFCR become even more pronounced in those groups experiencing higher mortality. These results indicate that the performance advantage associated with higher EPA & DHA inclusion becomes more pronounced when fish are challenged.

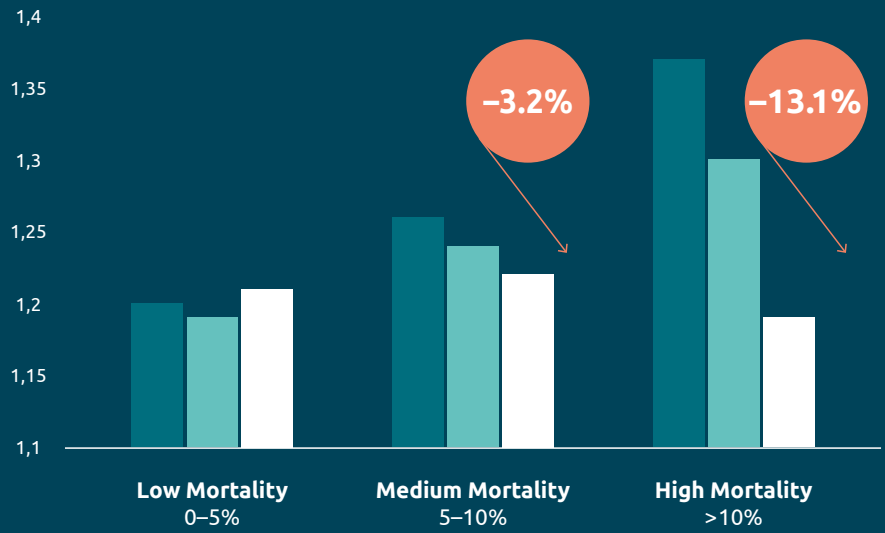
Higher dietary levels of EPA & DHA improve feed conversion under challenging conditions



Higher dietary levels of EPA & DHA improve feed conversion under challenging conditions

eFCR

- EPA & DHA Category:**
- Low (<6.2%)
 - Medium (6.2% -7.2%)
 - High (>7.2%)



At commercial scale, improving bFCR translates directly into measurable feed savings per kilogram of biomass produced, supporting both production economics and

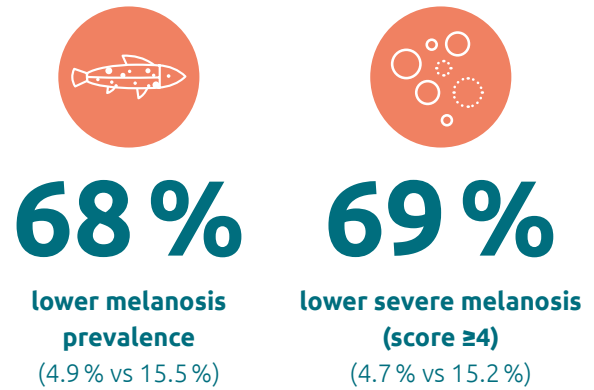
more-resource-efficient, lower carbon footprint salmon farming.

Processor Data Results

Melanosis is one of the most economically significant quality defects in salmon processing, influencing grading outcomes, downgrade risk, and value retention. Published evidence¹ shows that melanosis can reduce product price by approximately 9% in mild cases (score 1), 26% in moderate cases (score 2), and between 67% and 100% in severe cases (score ≥4). Such reductions represent a direct margin risk for producers and processors.

Fillet data from this Big Data study show that higher dietary EPA & DHA inclusion (>7.2%) was associated with substantially lower melanosis prevalence and severity compared with lower EPA & DHA inclusion (<6.2%).

Specifically, dietary EPA & DHA inclusion levels above 7.2% (of total fatty acids) were associated with:



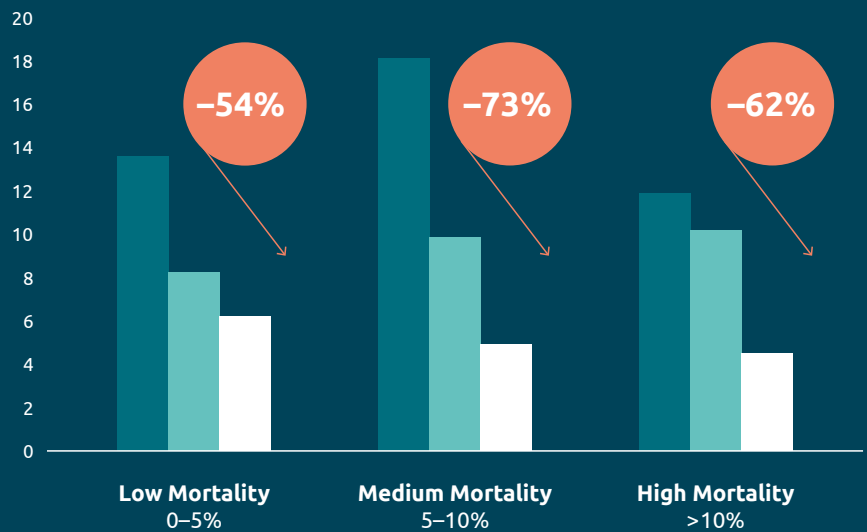
The Benefits of Better Nutrition Were Consistently Observed across All Mortality Levels:

Higher dietary levels of EPA & DHA consistently improve melanosis prevalence

melanosis prevalence (%)

EPA & DHA Category:

- Low (<6.2%)
- Medium (6.2% –7.2%)
- High (>7.2%)

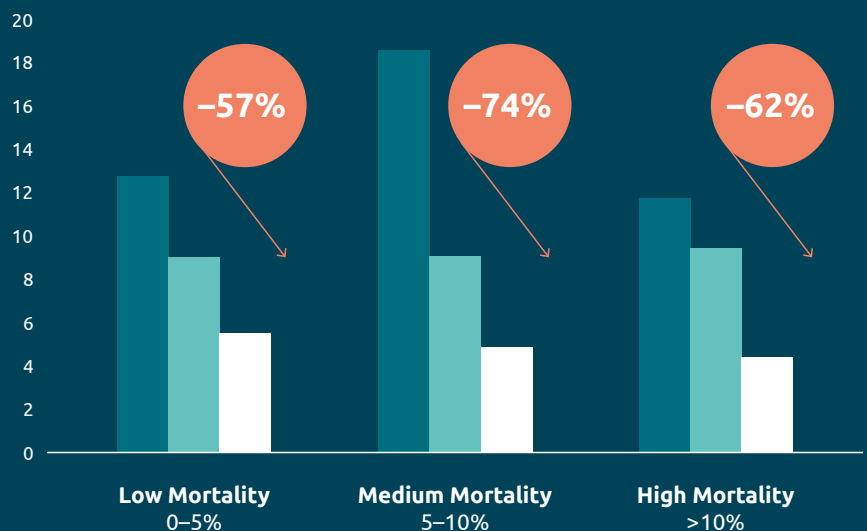


Higher dietary levels of EPA & DHA consistently improve melanosis severity (Score ≥4)

melanosis severity (%)

EPA & DHA Category:

- Low (<6.2%)
- Medium (6.2% –7.2%)
- High (>7.2%)



The consistency of these reductions across all mortality levels strengthens confidence that higher dietary EPA & DHA contributes to lower melanosis prevalence under commercial farming conditions, in line with observations from controlled scientific studies².

In practical terms, lower melanosis incidence indicates better welfare and reduces downgrade risk, trimming losses, and reprocessing requirements, helping protect product value at harvest. Lower defect incidence also improves quality predictability, supporting more reliable sales planning and stronger trust between producers, processors, and retailers.

Nutrient Levels and Interactions are both Important Performance Levers

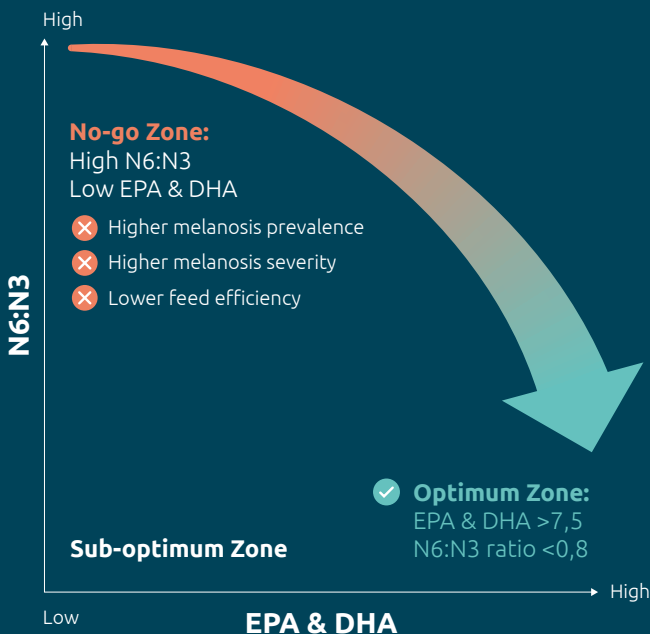
Beyond EPA & DHA inclusion alone, the modelling analyses indicate that the overall fatty acid ratio in the diet also plays an important role in production outcomes. The most favourable feed conversion and melanosis outcomes were predicted when dietary EPA & DHA levels exceeded 7.2 % of total fatty acids) and the N6:N3 ratio remained below 1.2:1

As the N6:N3 ratio increased above this level, both feed conversion and melanosis prevalence became less favourable, even when EPA & DHA inclusion levels were similar.

For producers, managing both EPA & DHA inclusion and the N6:N3 ratio therefore supports efficient feed utilisation while reducing the risk of quality defects at harvest. In practice, this combined nutritional approach strengthens production stability and improves economic outcomes by supporting better feed efficiency and higher harvest value.

Nutrient Interaction

EPA & DHA and N6:N3 work together



Omega Balance Drives Performance

What improves?



Lower melanosis prevalence



Lower melanosis severity



Lower FCRb

Background

The long-chain omega-3 fatty acids EPA and DHA are well established as essential nutrients supporting salmon health, membrane function and metabolic regulation.

Previous **Big Data studies** of Norwegian commercial farms in 2023 and 2025 demonstrated that higher dietary EPA & DHA inclusion (approximately 8–9 % of total fatty acids), was associated with improved feed conversion, lower mortality and a higher share of superior/premium-grade fish at harvest.

The present study extends this evidence to Chile,

one of the world's largest salmon-producing regions. Production performance and health data were analysed using the Aquabench Salmobench® database, which includes information from 100% of registered Atlantic salmon farming operations in the regions of Los Lagos and Aysén.

The results further support current industry nutritional guidance, including **Veramaris' Optimum Omega Nutrition guidelines**, highlighting the importance of both EPA & DHA inclusion and a balanced N6:N3 fatty acid ratio.

Study Goals and Methodology

This Big Data study evaluated 2023–2024 production cycles to determine how dietary EPA & DHA inclusion is associated with measurable improvements in feed efficiency and harvest quality under real commercial farming conditions.

Processor data were integrated to evaluate post-harvest quality outcomes. Stratified comparisons across mortality levels were also conducted to determine whether observed differences were maintained under varying production pressures (mortality). Melanosis severity was classified according to lesion size into five categories: Score 0 (no melanosis), Score 1 (< 0.5 cm), Score 2 (0.5–3 cm), Score 3 (3–6 cm), and Score 4 (> 6 cm).

In addition, advanced modelling and machine learning analyses were applied to evaluate the interaction between EPA & DHA inclusion and the N6:N3 ratio on production outcomes.



The analysis incorporated production and processing data from:



151 commercial farms



Approximately **143 million fish**



Approximately **464,000 fillet observations**



Farms were grouped according to the dietary EPA & DHA inclusion levels:

- **Low EPA & DHA:**
below 6.2 % of total fatty acids
- **Medium EPA & DHA:**
between 6.2 and 7.2 % of total fatty acids
- **High EPA & DHA:**
above 7.2 % of total fatty acids

Conclusions

This study confirms that higher dietary EPA & DHA inclusion positively influences production outcomes in salmon farming, consistent with previous commercial observations from Norwegian farming systems. Inclusion levels exceeding 7.2 % are associated with improved biological feed conversion and reduced melanosis incidence and severity at harvest.

The results also show that the benefits of higher EPA & DHA inclusions become more pronounced under higher mortality pressure. Importantly, the best outcomes are observed when higher EPA & DHA inclusion is combined with a balanced N6:N3 ratio.

Together, these findings indicate that managing fatty acid composition within salmon diets provides a practical pathway to improve feed efficiency, maintain harvest quality and support resilient farmed salmon production.

References

1. Färber F. *Melanin spots in Atlantic salmon fillets: an investigation of the general problem, the frequency and the economic implication based on an online survey.* 2017. <https://fileserver-az.core.ac.uk/download/249961430.pdf>.
2. Bjørgen, H., Rimstad, E. and Koppang, E.O. (2025), *Melanisation in Salmonid Skeletal Muscle*

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