IPIFF Position Paper

The scientific, institutional, market and industrial validation of the critical role of insect meal for

Sustainable, Competitive and Resilient Vision for

Fisheries & Aquaculture 2040

Date: March 2026

Objective: To present the robust scientific foundation, verified environmental benefits, and market potential of insect meal, and to propose urgent, concrete policy measures to support its integration into EU aquaculture, aligning with the goals of the EU Protein Strategy, Vision for Agriculture and Food and European Commission Guidelines for Sustainable Aquaculture, which already recommends the use of insect meal as aquafeed but lacks concrete measures to support its wider adoption.

This position paper was submitted by IPIFF as a response to the open consultation of the European Commission towards a 'Fisheries and aquaculture – Vision 2040'.

Introduction: A Collaborative and Evidence-Based Paper

This Position Paper is the culmination of an extensive, multi-channel structural dialogue between the International Platform of Insects for Food and Feed (IPIFF) and the European Commission since July 2025 until the present day. It represents a concerted effort to provide policymakers with a comprehensive, evidence-based foundation for decision-making regarding the future of EU aquaculture and the role of insect meal as a sustainable aquafeed source.

This process has been driven by a series of key engagements and inputs:

A) **High-Level Policy Engagement**

On 29 February 2025, IPIFF Board Members and current Secretary-General met with the cabinet of Commissioner for Fisheries and Ocean, European Commission (EU), to present the insect sector's current state, the nutritional and health benefits of insect meal as aquafeed, and its potential to improve the competitiveness of the EU aquaculture sector. Discussions were maintained between IPIFF, representing the European Insect Sector, and representatives and DG MARE towards the provision of input to the study developed by the European Commission on 'Sustainable Aquafeed'. This dialogue was enriched by the contribution of aquafeed producers and researchers. These discussions included the organization of two online sessions with representatives of EU insect sector, aquafeed producers, researchers and the European Commission.

B) **Formal Position Papers Submissions**

Building on this dialogue, IPIFF submitted a formal Position Paper on the 'Evaluation of the Common Fisheries Policy Regulation' on 21 April 2025, outlining concrete recommendations for promoting novel aquafeed ingredients in the Post-2027 CFP.

C) **Direct Contribution to Commission Studies**

Through discussions organised by IPIFF with DG MARE, EU insect producing companies provided direct input to the survey feeding the study promoted by the European Commission on 'Sustainable Aquaculture'. The compilation of the results of the survey were translated into a Report and key Recommendations.

D) **Scientific validation**

The arguments presented are further validated by a growing body of independent research. This briefing incorporates findings from over 400 scientific papers. A dedicated Annex with Scientific bibliography was prepared to support the recommendations of this Position Paper.

E) **Market validation**

The arguments of this paper are contextualized by recent major market analyses, including the 2025 World Bank Report: Harnessing the Waters- A Trillion Dollar Investment Opportunity in Sustainable Aquaculture highlighting an exponential growth in alternative feeds like insect meal, and the 2025 Global Aqua Feed Market Outlook market outlooks confirming a clear industry shift toward sustainable, insect-based proteins to meet rising global demand and address raw material price volatility.

The largest worldwide aquafeed producers (Biomar; Skretting) have publicly demonstrated their commitment towards investment in insect meal to improve the competitiveness and sustainability of their production while enhancing their resilience in face of geopolitical instability, climate-change related events, trade uncertainty and expected gradual decrease of availability of fishmeal, as highlighted in the aforementioned reports.

F) **Industry Consensus**

The conclusions and policy recommendations herein reflect the unified position of the European insect sector and aquafeed producers alike.

G) **Institutional validation**

This document recalls recommendations from EU institutions such as the European Commission[1], the European Parliament[2] [3]or the European Court of Auditors[4], which validates and strengthens the recommendations set forward in this document relating to the need of incentives towards a wider adoption of insect meal as sustainable aquafeed.

This document synthesises all these contributions—from high-level policy discussions, formal Position Papers submissions, direct scientific input, industry contributions and institutional recommendations—into a coherent and urgent call for action.

1. The Strategic Context: A Protein Deficit and the Need for Sustainable Solutions

The Challenge:

The EU relies on imports for 70% of its animal feed protein (e.g., soy, fishmeal), creating high vulnerability to climate change, geopolitical instability, and market volatility. As highlighted in the February 2025 presentation to Commissioner Kadis' team, the EU accounts for less than 1% of global aquaculture production, and the sector is stagnating despite Commission efforts.

The European Parliament[5] *'stresses the need to promote ecologically sustainable marine proteins and oils to be used as feed (…), such as insect meal (…) and the partial replacement of marine proteins and oils with non-marine alternatives that are sustainably produced'.*

Furthermore, the **European Parliament**[6] stresses that insects, *'(…) contributing to reducing the EU protein deficit and increasing the circularity of (…) recognises that undue regulatory burdens hinder the development (…), such as the ban on using biodegradable waste as feed for insects'.*

European Commission Guidelines on Sustainable Aquaculture[7] highlights the need of *'ensuring sustainable feed systems. This means using feed ingredients that are sourced in the way that is most respectful of ecosystems and biodiversity and which, at the same time, are appropriate for ensuring the health and welfare of the animals. It also means*

[1] European Commission: Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030
[2] Striving for a sustainable and competitive EU aquaculture: the way forward- European Parliament resolution of 4 October 2022 on striving for a sustainable and competitive EU aquaculture: the way forward (2021/2189(INI))
[3] European Parliament resolution of 19 October 2023 – European protein strategy
[4] European Court of Auditors-Report- special report 25/2023: EU aquaculture policy – stagnating production and unclear results despite increased EU funding
[5] Striving for a sustainable and competitive EU aquaculture: the way forward- European Parliament resolution of 4 October 2022 on striving for a sustainable and competitive EU aquaculture: the way forward (2021/2189(INI))
[6] European Parliament resolution of 19 October 2023 – European protein strategy
[7] European Commission: Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030

limiting feed producers' reliance on fish meal and fish oil taken from wild stocks (e.g. using alternative protein ingredients such as algae or insects or the waste from other industries). This also covers the use of feed supplements and efficient feed-management systems'.

World Bank Report and the 2025 Global Aqua Feed Market Outlook confirms that high fluctuations in traditional protein prices are paving the way for **wider use of alternatives like insects. In addition, studies warn about feed shortage may limit aquaculture growth and the need for investment in alternative and sustainable aquafeed sources such as insect meal**[8]**.**

The Opportunity:

Insect meal, produced within the EU in controlled environments, offer a circular, secure, and high-performing alternative. It directly addresses the EU's protein deficit by replacing imported proteins with a reliable European source. By being domestically produced it reduces the volatility of the EU aquaculture sector to trade uncertainty and geopolitical instability. By being produced in controlled environments, reduces the exposure to climate-change related events that may have impact in the availability of aquafeed resources.

The recent survey conducted by the European Commission towards its study on 'Sustainable Aquafeed' confirms that traditional supply chains are viewed as fragile and unsustainable, while alternative ingredients like insect meal are rated as having more secure and reliable future supply chains. The insect sector has already created over 3,500 jobs and expects to create up to 30,000 by 2030. The 2025 World Bank Report explicitly notes that the multiplier effect of aquaculture growth will *"spark exponential growth in investment opportunities for alternative feed sources such as... insect meal."*

2. The Scientific and Commercial Consensus: A Decade of Validation

An extensive and rapidly growing body of scientific literature (over 350 papers in the last decade), confirm the efficacy and safety of insect meal in aquafeeds. Research covers the beneficial nutritional and health benefits of insect meal as aquafeed in dozens of fish species, from high-value marine fish like Atlantic salmon and European seabass to freshwater trout and tilapia, as well as shrimp.

[8] Study warns feed shortage may limit aquaculture growth

A) **Proven Nutritional Performance from an Industry Leader**: According to what was described by **Biomar** in the sessions organized by IPIFF with the European Commission, practical experience shows that insect meal is an "**effective ingredient**." It further demonstrated that with up to 20% inclusion in diets for species like salmon and trout, there is "no performance drop" in growth or feed conversion ratio (FCR).

B) **This commercial validation is supported** by a 2022 meta-analysis of 107 studies[9], which found that defatted insect meal has a significant positive effect on growth. Recent 2025 studies on **Atlantic salmon**[10], **rainbow trout**[11] and **European seabass**[12], further reinforce this.

C) **Superior Nutritional Value** In discussions between the EU insect sector and the European Commission, invited researchers presented data showing that insect meals often have a "high content of digestible essential amino acids," [13]:frequently higher than soybean meals (SBM), and can cover the nutritional requirements of key farmed species like rainbow trout[14]. It was also added that mealworm protein has an ideal digestibility (>95%) and covers most essential amino acid requirements for fish and crustaceans, citing a 2024 meta-analysis[15].

D) **Significant Functional Health Benefits**: Beyond basic nutrition, insects provide bioactive compounds that act as functional feed additives, a key growth driver identified in the Rabobank (2021)[16] analysis. **These health benefits include:**

- **Gut Health**: In the discussions between the EU insect sector and the European Commission, researchers highlighted that insect meal acts as a prebiotic, consistently modulating the gut microbiota. Research on rainbow trout[17] shows "increasing microbiota diversity and richness" and a rise in beneficial lactic acid- and butyrate-producing bacteria, which "contribute to the global fish health." This is further supported by a wealth of studies cited by insect producers[18] [19]

[9] Systematic review and meta-analysis of production performance of aquaculture species fed dietary insect meals
[10] Black Soldier Fly Larvae Meals with and Without Stickwater Highly Utilized in Freshwater by Atlantic salmon (Salmo salar) Parr
[11] Influence of feeding black soldier fly (Hermetia illucens), cricket (Gryllodes sigillatus), and superworm (Zophobas morio) on the gut microbiota of rainbow trout (Oncorhynchus mykiss)
[12] Combining Hermetia illucens and Tenebrio molitor meals in diets for European seabass: Effects on growth, nutrient utilisation, intestinal morphology and muscle quality
[13] From Gut to Fillet: Comprehensive Effects of Tenebrio molitor in Fish Nutrition
[14] Digestibility of defatted insect meals for rainbow trout aquafeeds
[15] R E V I E W Essential amino acid requirements of fish and crustaceans, a meta-analysis
[16] No Longer Crawling: Insect Protein to Come of Age in the 2020s
[17] Rainbow trout (Oncorhynchus mykiss) gut microbiota is modulated by insect meal from Hermetia illucens prepupae in the diet
[18] Combined Effects of Yellow Mealworm (Tenebrio molitor) and Saccharomyces cerevisiae on the Growth Performance, Feed Utilization Intestinal Health, and Blood Biomarkers of Nile Tilapia (Oreochromis niloticus) Fed Fish Meal-Free Diets
[19] The utilization of full-fat insect meal in rainbow trout (Oncorhynchus mykiss) nutrition: the effects on growth performance, intestinal microbiota and gastrointestinal tract histomorphology

showing improvement in gut health, digestive enzymes, and intestinal morphology. More recent work on European seabass[20] [21] and the potential of insect exuviae[22] confirm these findings.

- **Immune System Stimulation**: A wealth of studies demonstrates enhanced immune responses[23] found that defatted Black Soldier Fly diets improved immune responses in Nile tilapia[24] challenged with bacteria. Furthermore, compiled evidence shows that replacing fish meal with insect meal such as *Tenebrio molitor* "stimulates the immune system," leading to 'higher resistance to bacterial challenge'. Similar effects have been documented in large yellow croaker[25], rainbow trout[26] and Pacific white shrimp[27].

- **Antioxidant Capacity:** Insect-based diets have been shown to enhance the activity of key antioxidant enzymes (SOD, CAT, GPx), reducing oxidative stress in fish, as noted by review and studies on rainbow trout[28] and meagre[29].

- **No Compromise on Final Product Quality**: Extensive research shows that insect meal inclusion does not negatively affect the final product. As summarized by several studies, there are "no significant differences in physical traits of the fillets" (texture, water-holding capacity) and no compromise on nutritional profile, shelf-life, or organoleptic properties[30] [31]. This has been confirmed for Atlantic salmon[32], European seabass[33], and turbot[34].

[20] Replacing fishmeal with an insect meal blend: Implications for intestinal microbiota in European seabass
[21] Differential Modulation of the European Sea Bass Gut Microbiota by Distinct Insect Meals
[22] The Replacement of Fish Meal with Poultry By-Product Meal and Insect Exuviae: Effects on Growth Performance, Gut Health and Microbiota of the European Seabass, Dicentrarchus labrax
[23] Defatted black soldier fly (Hermetia illucens) diets improved hemato-immunological responses, biochemical parameters, and antioxidant activities in Streptococcus iniae-infected Nile tilapia (Oreochromis niloticus)
[24] Intestinal histopathology and immune responses following Escherichia coli lipopolysaccharide challenge in Nile tilapia fed enriched black soldier fly larval (BSF) meal supplemented with chitinase
[25] Effects of the Replacement of Dietary Fish Meal with Defatted Yellow Mealworm (Tenebrio molitor) on Juvenile Large Yellow Croakers (Larimichthys crocea) Growth and Gut Health
[26] Partially Defatted Tenebrio molitor Larva Meal in Diets for Grow-Out Rainbow Trout, Oncorhynchus mykiss (Walbaum): Effects on Growth Performance, Diet Digestibility and Metabolic Responses
[27] Replacing Fish Meal with Defatted Insect Meal (Yellow Mealworm Tenebrio molitor) Improves the Growth and Immunity of Pacific White Shrimp (Litopenaeus vannamei)
[28] Effects of butane-defatted black soldier fly larvae meal replace dietary fishmeal on growth, antioxidant capacity and intestine health of rainbow trout (Oncorhynchus mykiss)
[29] Oxidative Stress Response of Meagre to Dietary Black Soldier Fly Meal
[30] Influence of dietary soybean meal replacement with yellow mealworm (Tenebrio molitor) on growth performance, antioxidant capacity, skin color, and flesh quality of mirror carp (Cyprinus carpio var. specularis)
[31] Recent advances in the utilization of insects as an ingredient in aquafeeds: A review
[32] Evaluating the fillet quality and sensory characteristics of Atlantic salmon (Salmo salar) fed black soldier fly larvae meal for whole production cycle in sea cages
[33] Nutritional, organoleptic and sensory quality of market-sized European sea bass (Dicentrarchus labrax) fed defatted Tenebrio molitor larvae meal as main protein source
[34] Effects of dietary replacement of fishmeal by defatted Tenebrio molitor meal, Clostridium autoethanogenum protein meal and Chlorella vulgaris meal on the freshness of turbot (Scophthalmus maximus) during chilled storage

3. Environmental Sustainability: Verified by LCAs

A) **Feed is the Key Hotspot:** In the exchanges between EU insect sector and the European Commission researchers from the National Research Council of Italy confirmed that, as "widely demonstrated... in other farmed species, feed represents the main hotspot in several impact categories." It reinforced that aquafeed accounts for up to 80% of a producer's environmental footprint.

B) **Quantifiable Benefits**: Peer-reviewed LCA studies demonstrate that insect meal production has a lower environmental footprint[35] than conventional proteins in several key categories, particularly land use[36] [37]. A 2025 systematic review by Cantillo & Deshpande specifically confirmed the competitive carbon footprint of alternative proteins for Atlantic salmon feed[38]. **The June 2025 Market Report for Animal Feed Proteins**[39] confirms that sustainability and circular economy models are becoming an increased priority for producers.

Competitive and Rapidly Improving Carbon Footprint:

- **Aquafeed Producer Perspective**: In the sessions organized by IPIFF between the EU insect sector and the European Commission where Biomar was one of the presenters, it noted that insect meal has a "strong start in sustainability criteria," with a carbon score of approximately 1kg CO_2e/kg, which is lower than many fish meals (1.5+ kg CO_2e/kg).

- **Innovafeed's Industrial Symbiosis Model**: Innovafeed (France) presented data showing how their unique model, using wet co-products and waste energy, enables a "drastic reduction in emissions." This has led to an "80% CO_2 emissions reduction" in three years, with a 2025 forecast of 1250 kg CO_2/t, already making their products "emit less [than] conventional ingredients being substituted." This is corroborated by their published LCA data[40] and studies on circular economy models using agri-food side-streams[41] [42] [43].

[35] Transformative potential of insect bioconversion and its role in circular economy
[36] Exploring sustainable alternatives in aquaculture feeding: The role of insects
[37] The environmental sustainability of insects as food and feed. A review
[38] A 2025 systematic review by Cantillo & Deshpande specifically confirmed the competitive carbon footprint of alternative proteins for Atlantic salmon feed.
[39] Animal Feed Protein Ingredients Market Size, Share
[40] Industrial Symbiosis in Insect Production—A Sustainable Eco-Efficient and Circular Business Model
[41] Bioconversion of olive oil pomace by black soldier fly increases eco-efficiency in solid waste stream reduction producing tailored value-added insect meals
[42] Fisheries and aquaculture by-products modulate growth, body composition, and omega-3 polyunsaturated fatty acid content in black soldier fly (Hermetia illucens) larvae
[43] Innovafeed announces validation of its environmental data by the Global Feed LCA Institute (GFLI), a world's reference database for the environmental footprint of animal feed ingredients

- **Tebrio's LCA Insights**: During the discussions with the European Commission, Tebrio (Spain) identified that the highest contributors to the carbon footprint are feed, energy, and transport, highlighting clear opportunities for improvement through alternative feed inputs, process optimization, and scale-up.

4. The Critical Barriers: A Broken Market and Regulatory Framework

The survey replies to the study promoted by the European Commission by insect producers sends a clear message: the technology and will for a sustainable transition exist, but the market and regulatory frameworks are failing. The primary barriers are no longer technical, but systemic.

A) A Broken Regulatory Landscape

The framework is unanimously criticized by survey respondents as unclear, inconsistent, and highly ineffective in promoting sustainability. Key failures include illogical barriers that block circular nutrient loops, a complete lack of incentives, a slow reactive process, and weak enforcement on imports, creating an unlevel playing field.

While past legislative barriers (like the ban on using insects in aquafeed) are gone, "several other challenges are laying in front of the sector, including on the legislative side." The June 2025 Market Report stresses that while market trends are promising, "European Commission's action is crucial."

B) A Distorted Market

As Biomar clearly stated, despite its benefits, "*insect meal... is twice the price of soy protein concentrate,*" its key competitor. The survey replies to the study developed by the European Commission on 'Sustainable Aquafeed' confirms that the primary driver of demand is cost, with sustainability a secondary consideration. This is exacerbated by market distortions caused by subsidies for the fishing industry, which artificially lower the price of fishmeal.

C) Transparency Gaps

The survey replies to the study of the European Commission rates traceability in supply chains as low to moderate, hampered by a lack of unified standards and cooperation. Research using stable isotope analysis[44] and tandem mass spectrometry[45] demonstrates that

[44] Traceability of insects as feed: stable isotope ratio analysis ofHermetia illucens larvae and pre-pupae reared on different protein sources
[45] Species-Specific Discrimination of Insect Meals for Aquafeeds by Direct Comparison of Tandem Mass Spectra

traceability of insect-based feed is scientifically achievable, but policy is needed to implement it at scale.

5. Recommendations: A Call for Urgent and Decisive Action by EU policymakers

To unlock the proven potential of insect meal and secure a sustainable future for EU aquaculture, we propose a coherent, multi-pronged strategy based on the survey's policy recommendations and the IPIFF Policy Roadmap. The unanimous call from industry and the weight of scientific evidence demand urgent, comprehensive policy action.

A) Overhaul The Regulatory Framework

- **Recognise the Nuance in LCA:** Acknowledge the diversity within the insect sector and avoid oversimplified environmental assessments. The most reliable data comes from verified company-specific LCAs.

- **Support the Safe Valorisation of Side-Streams (Improving Competitiveness):** Advocate for a science-based pathway to expand the list of permitted substrates, including the authorisation of meat and fish-containing former foodstuffs. This would allow about 30% of EU food waste to be transformed into high-quality protein, maximizing circularity and reducing costs. **This recommendation is backed by the Aquaculture Advisory Council Recommendations on 'Circularity of Fish Feed'**[46].

- **Strengthen Controls and Standards for Imported Ingredients**: Enforce mandatory EU sustainability and traceability criteria for all imported aquafeed ingredients to ensure a level playing field for EU producers.

B) Create a Level Economic Playing Field (The Highest Priority)

- **Introduce mandatory, progressive inclusion targets for sustainable aquafeed ingredients (Promoting Demand)**. This is the single most impactful lever. As the results of the survey concluded, mandatory rates of inclusion of insect meal as aquafeed would allow insect meal to provide its "additional beneficial functions" and reduce exposure to market volatility. **The EU insect sector explicitly calls for binding requirements, drawing a parallel to the successful EU ReFuel Aviation Initiative. The survey respondents unanimously endorsed this mechanism.**

[46] Recommendation on the circularity of fish feed AAC 2023-7 July 2023

- **Suggested targets**: 3% by 2027, 5% by 2028, 7% by 2029, and 15% by 2030, with a long-term vision of 50% by 2050. The technical feasibility of inclusion levels up to 20-30% is overwhelmingly supported by both commercial practice (Biomar) and the scientific literature[47]

- **Rebalance subsidies and introduce fiscal incentives (Catalysing Finance):** Phase out harmful subsidies for unsustainable fishing practices and use tax credits or levies to make sustainable ingredients cost competitive. This recommendation, aligned with the European Court of Auditors' recommendation to improve the targeting of EU funds, namely those under the European Maritime, Fisheries and Aquaculture Fund, to promote sustainability in Aquaculture.

- **Establish dedicated EU funding for industrial scale-up:** Grant the insect industry access to funding under the Common Fisheries Policy and European Maritime, Fisheries and Aquaculture Fund (EMFAF), namely under its objective 2.1. which envisages to promote sustainable aquaculture activities. The innovative, capital-intensive industry needs support to avoid "innovative capital destruction" and job losses. According to the Report of the European Court of Auditors, current funding allocated to promote sustainable aquaculture has not achieved the desired objectives, despite the increased funding[48].

C) Drive Transparency and Strategic Resilience

- **Mandate a unified EU-wide digital traceability framework** for aquafeeds to build trust and verify claims, building on scientific methods already available for tracing insect-based ingredients. Provide technical and financial support to SMEs for implementation.

- **Integrate sustainable alternative feed ingredients into the EU's Strategic Autonomy Agenda**, recognizing insect meal as critical for food security and resilience, promoting new economic and job opportunities in EU coastal regions[49]. Other organizations have called attention to the role of sustainable aquafeed producing sectors, such as insects, to boost economic dynamism of coastal regions and promote employment.[50]

[47] Total fishmeal replacement by defatted Hermetia illucens larvae meal in diets for gilthead seabream (Sparus aurata) juveniles
[48] European Court of Auditors-Report- special report 25/2023: EU aquaculture policy – stagnating production and unclear results despite increased EU funding
[49] IPIFF Position Paper: The Contribution of the EU Insect Sector to Resilient, Diversified, and Prosperous Coastal Communities
[50] EIT Food-Fish feed: Why we need sustainable alternatives

Conclusion

Over a decade of peer-reviewed science and commercial application has validated insect meal not just as a novel ingredient, but as a high-performing, functional, and environmentally beneficial component of a sustainable aquafeed strategy.

The EU stands at a critical crossroads: it can continue with a vulnerable and environmentally costly status quo, or it can act decisively to unlock the potential of a circular, resilient, and innovative European industry. The scientific foundation is solid; the industry is ready.

The path forward is clear: by adopting the targeted policy measures outlined above—particularly mandatory inclusion rates—the EU can turn proven potential into market reality, fulfilling the objectives of a sustainable and competitive aquaculture sector.

The current work being developed by the European Commission towards a renewed Common Fisheries Policy and a 'Vision for Fisheries and Aquaculture for 2040' and even the 'EU Strategy for Coastal Communities' are the perfect opportunities for the European Commission to implement support measures to increase the uptake of insect meal as a sustainable aquafeed source and reinforce the competitiveness, resilience and sustainability of the EU aquaculture sector.