

FeedKind

Trials continue to show value of single cell protein in aquafeed



by Allan LeBlanc, Senior Director and FeedKind Product Manager, Calysta

In just a few short years, the hunt for a sustainable protein that matches the nutritional value of fishmeal has gone from a pipe dream to reality.

Aquaculture has grown significantly over the last decade, but it has done so in spite of limited growth in protein availability, especially animal derived proteins. The market has effectively allocated this scarce resource, and cost pressures have driven significant reductions in marine ingredients across many applications.

Removing the natural resource bottleneck is essential to aquaculture's growth. But as consumers pay increasing attention to how their food is produced, sustainability has become critical.

Calysta's FeedKind® protein offers the aquaculture supply chain a solution to this challenge. FeedKind is a sustainable feed that requires no animal or plant matter in its production, very little water use and requires no greenbelt land, contributing to global food security. In addition, it helps keep fish healthy and can improve growth rates, with full traceability, making it one of the most exciting new products to come to the aquaculture market.

Originally developed in Norway for the Atlantic salmon industry, FeedKind Aqua protein is a non-GMO single cell protein produced via natural fermentation. It is approved for use in organic systems in the UK and listed on the EU Catalogue of Feed Materials.

Highly traceable, FeedKind also contains a unique elemental profile that persists in the feed and in the final product; meaning a fish fed on FeedKind can be differentiated from a fish fed other diets with a simple test.

At Calysta's market introduction facility operating in Teesside, UK, sample quantities of FeedKind have been produced and are being shipped across the world. Studies have shown FeedKind Aqua is an ideal high-protein feed ingredient for several areas of aquaculture, including salmon, trout, shrimp and warm water finfish. Trials have shown promising results measured by growth rate, feed conversion, palatability, and gut health.

Performance in salmonids

With a nutrient density and amino acid profile comparable to fishmeal, FeedKind Aqua protein can easily be incorporated into

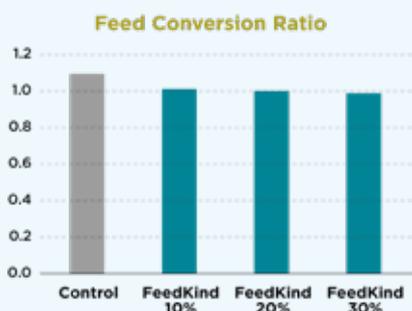


Figure 1

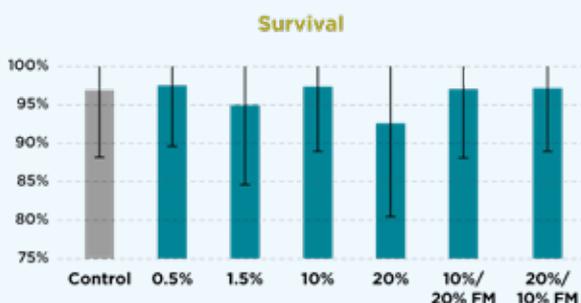


Figure 2



Figure 3

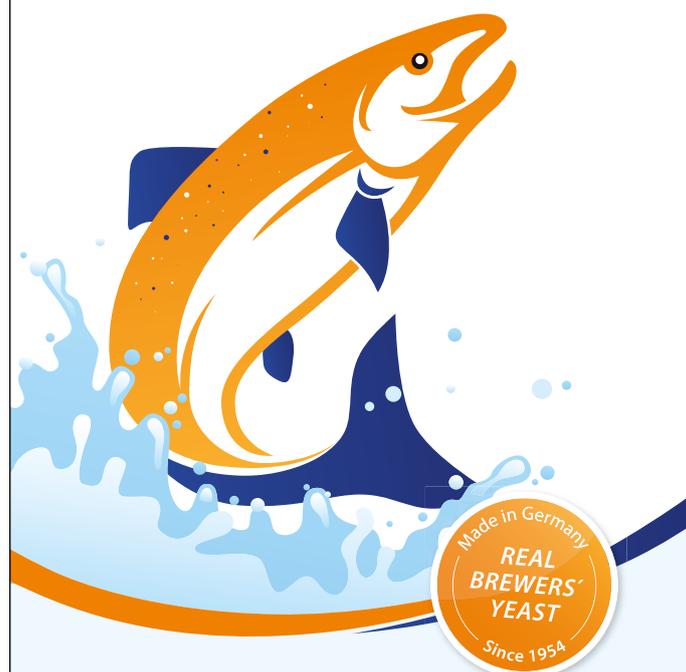
salmonid diets at all life stages.

Using material from Calysta’s UK facility, Calysta has carried out a trial in Rainbow Trout with Pontus Research Ltd. The trial included a reference diet with 45 percent superprime fishmeal, and three treatments with 10, 20 and 35 percent FeedKind protein, each with corresponding reduction in fishmeal. Feeds were formulated by Pontus and manufactured by Sparos as extruded floating 2.5mm pellets.

Juvenile fish with an average weight of 62 grammes, +/- 4.0 grammes, were randomly assigned into groups of 30 individuals, each in 200 litre tanks maintained at 14°C. All fish were acclimatised for one week on the control diet then grown to a final weight of 187 grammes on the control or test diets, fed five times daily to satiation with feed intake monitored.

Over 49 days, all groups had comparable growth rates ranging from 2.2 to 2.3 percent of body weight per day. No statistically significant difference was found between treatments. In addition, the distribution of individual growth rates was relatively narrow across all treatments, with the margin for error ranging from 0.05 to 0.08 percent.

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The control diet yielded a feed conversion ratio (FCR) of 1.09. This fell to 1.01, 1.00 and .99 in the 10, 20 and 35 percent treatments respectively (see figure 1). All treatment groups were statistically significant from the control diet, with FCR improved by eight to nine percent.

In addition to its value as a nutrient, FeedKind Aqua protein can help maintain a healthy gut in salmonid species. When single cell protein was part of the diet, studies have reported that soya-induced enteritis in Atlantic salmon is not seen, and inflammation markers in gut epithelial cells are reduced. Anti-nutritional factors present in soybeans and other crops are easily managed by terrestrial digestive tracts but cause significant issues for fish that have never seen these compounds before.

Major feed companies in Norway are currently evaluating FeedKind protein, and a larger scale trial growing Atlantic salmon to market weight is scheduled to begin in early 2019 with Nofima.

Performance in shrimp

To assess the beneficial effects of FeedKind protein in shrimp specifically, a trial in Pacific whiteleg shrimp (*Litopenaeus vannamei*) was conducted in partnership with Texas A&M University-Corpus Christi and Auburn University.

Growth response and survival in juvenile shrimp fed graded levels of FeedKind was evaluated relative to a fishmeal-containing reference diet. Nutritionally complete diets were prepared at Texas A&M AgriLife Research and compared in an indoor, eight-week growth trial, at the E.W. Shell Fisheries Research Station, Auburn University, Alabama.

Juvenile shrimp were stocked into replicate treatment tanks of ten juveniles per tank at an average weight of approximately 0.1 grammes. Treatment tanks were connected to a recirculating aquaculture system to maintain water quality factors. Feeds comprised of a basal control diet of 15 percent fishmeal and five diets of increasing concentrations of FeedKind to replace fishmeal, at 1.5 percent, 3.8 percent, 7.5 percent, 11.3 percent, and 15 percent of total feed. Diets also included marine-based attractants that were kept constant in all diets. The average weight at termination was eight-10 grammes per animal.

The mean survival of all diets was 93.5 percent over the eight-week period, indicating



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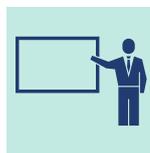
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conditions were adequate for shrimp growth. Survival rates varied from 84 percent for the control diet to 97 percent for the diet with 100 percent fishmeal replaced by FeedKind protein with all test groups, except the 3.8 percent group, showing statistically significant ($p < 0.05$) improvement relative to the control. Additionally, the 1.5 percent and 3.8 percent diets showed statistically significant improvements in aggregate shrimp weight.

A follow-up trial was performed at the Texas AgriLife Mariculture Research Facility outside Corpus Christi, Texas. Shrimp at an average weight of 1 gram were stocked into 10 replicate 30-litre tanks at a density of four animals per tank. Nutritionally complete diets were formulated using a commercially representative control formulation comprising 20 percent fishmeal with the remainder of the protein provided by soybean meal and soy protein concentrate. Increasing levels FeedKind were added as a direct replacement for fishmeal at 0.5 percent, 1.5 percent, 10 percent, and 20 percent of total feed. All diets included two percent krill meal as an attractant.

The trial was terminated after four weeks and harvested at a weight of 13-14 grammes. Survival across all diets ranged from 92.5 percent to 97.5 percent (see figure 2) with no significant differences across any diets. Similarly, final weights ranged from 13 to 14 grammes with no significant differences (see figure 3).

These data supports the ability of FeedKind to completely replace fishmeal in diets for whiteleg shrimp. The improved growth and survival of shrimp with low levels of FeedKind protein inclusion indicate that performance of FeedKind diets may even be superior to fishmeal under certain conditions.

Summary

FeedKind Aqua has shown to be an effective feed ingredient for use across several marine species at all life stages. As noted above, Calysta has partnered with Nofima to carry out large-scale trials in Atlantic salmon beginning early next year to determine how the ingredient performs in real-world conditions, with further studies to take place with shrimp, trout and warmwater finfish species.

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Pet Food Extrusion Trends

- Dr. Mian Riaz, Head Extrusion Technology Program, Texas A&M University, USA

Extrusion of Pet food and Treats with Single and Twin Screw Extruder

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- Will Henry - Extru-Tech, Inc.

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