



SCIENTIFIC DOCUMENTATION

## Benefits for Shrimp Farming



**Aker QRILL Company** is an Antarctic krill-harvesting company dedicated to improving health across species. We develop krill-based ingredients for nutraceutical, aquaculture, and animal feed applications. Sustainability is at the core of our operations, rooted in world-class standards.

Our business spans the entire value chain – from sustainable harvesting in pristine Antarctic waters to our logistics hub in Montevideo, ensuring a fully transparent process that brings products to customers worldwide.



**The QRILL™ Aqua** brand consists of sustainable and natural krill-derived ingredients suitable for aquaculture feeds. QRILL Aqua Total is a functional value added ingredient solving the main challenges in shrimp farming. It provides a valuable package of nutrients and attractants.

Documented through science on both fish and shrimp, QRILL Aqua products keeps demonstrating increased appetite and growth in animals. It's dietary inclusion enhances shrimp robustness through improvement of several health parameters, and can lead to improved shrimp end-quality.

## MEAL PRODUCTS



### QRILLAqua Total

- 15-30 % Fat
- 40 % Phospholipids
- 1.5 % Cholesterol
- 5 % Choline

~ 57 % Protein  
120 ppm Astaxanthin

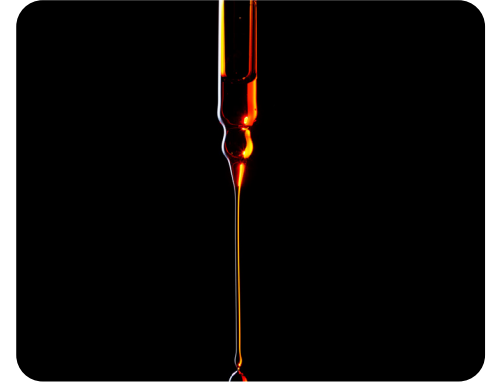


### QRILLAqua Total *Protein Boost*

- 10-17% Fat
- 40 % Phospholipids
- 1.5 % Cholesterol
- 5 % Choline

~ 65 % Protein  
120 ppm Astaxanthin

## OIL PRODUCT



### QRILLAqua AstaOmega Oil

- 98% fat
- 100 % Triglycerides
- 8-13 % Omega-3 fatty acids
- 4-6 % EPA
- 1-2 % DHA
- >0.3 % Cholesterol

700-1250 ppm Astaxanthin

# Antarctic krill, a combination of nutrients and feed attractants important for growth and health of shrimp

NUTRIENTS AND ATTRACTANTS



	<p><b>CHOLINE</b> Structural component of phosphatidylcholine and acetylcholine</p> <p>Methionine and betaine precursor</p> <p>Metabolic methyl donor Antioxidant system regulator</p>	<p><b>OMEGA-3 PHOSPHOLIPIDS</b> Structural component of cell membranes and fat transport particles</p> <p>Omega-6 (pro-inflammatory) to Omega-3 (anti-inflammatory) balance</p>	<p><b>NUCLEOTIDES</b> Structural units of nucleic acids</p>
	<p><b>CHOLESTEROL</b> Plays a role in lipid transport</p>	<p><b>ASTAXANTHIN ESTERS</b> Anti-inflammation and anti-oxidation to protect protein, lipids and DNA from oxidative damage</p>	<p><b>WATER SOLUBLE AMINO ACIDS</b> Protein metabolism Energy source</p>
<p><b>FAT SOLUBLE VITAMINS</b> Vitamin A: boosts immune function Vitamin D3: improves gut health Vitamin E: antioxidant</p>	<p><b>TAURINE</b> Important for protein synthesis</p>	<p><b>CHITIN</b> Immunostimulatory effects to improve health and disease resistance and reduce mortalities due to infections</p>	<p><b>TRIMETHYLAMINE N-OXIDE (TMAO)</b> Fluid balance Protein stabilizer</p>
	<p>Important for physiological functions</p>		<p>Improved feed attractability and palatability Increased feed intake</p>
	<p>Increased survival and growth</p>		<p>Enhanced shrimp growth Decreased FCR Increased yield</p>

EFFECTS

BENEFITS

# Shrimp index

THE QRILL TEAM EMBRACES RESEARCH AND DOCUMENTATION ON THE EFFECTS OF KRILL.

SEVERAL STUDIES WERE PERFORMED TO ENSURE AND UNDERSTAND THE ADVANTAGES AND MECHANISMS OF DIETARY KRILL INCLUSION IN SHRIMP DIETS.

## HEALTH IMPROVEMENT

- 7 Krill meal as an immunostimulant in shrimp
- 8 AstaOmega Oil improves growth in hypersalinity
- 9 AstaOmega Oil improves survival of post-larvae after osmotic and thermal stress
- 10 Krill phospholipid oil in QRILL Aqua Total promotes ovarian developments
- 11 Highest gene expression as well as serum cholesterol and triglyceride levels after feeding with krill
- 12 Krill phospholipid oil in QRILL Aqua Total improves antioxidant capacity and innate immunity
- 13 Krill phospholipid oil in QRILL Aqua Total enhances innate immunity to resist pathogen infection
- 14 Krill meal improves growth, FCR and survival in EHP infected shrimp
- 15 Krill meal improves hepatopancreas function and immune response

## VALUE CREATION

- 17 Krill can replace costly ingredients
- 18 Krill improves yield while reducing feed cost
- 19 Krill improves feed efficiency and lowers feed cost
- 20 Krill meal improves digestibility and reduces cost
- 21 Krill ensures optimal performance of shrimp diets in a cost-effective way

## APPETITE STIMULATION AND GROWTH

- 24 Krill extends feeding time
- 25 Krill improves performance of plant-based diets
- 26 Krill improves feed attractability
- 27 AstaOmega Oil improves growth under normal and stressful conditions
- 28 Krill in low and moderate fish meal diets in an Indian context
- 29 AstaOmega Oil improves growth under stressful conditions

## QUALITY IMPROVEMENT

- 31 AstaOmega Oil improves color and flavor

## REFERENCES

- 32 Reference list



## HEALTH IMPROVEMENT

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# Krill meal as an immunostimulant in shrimp



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



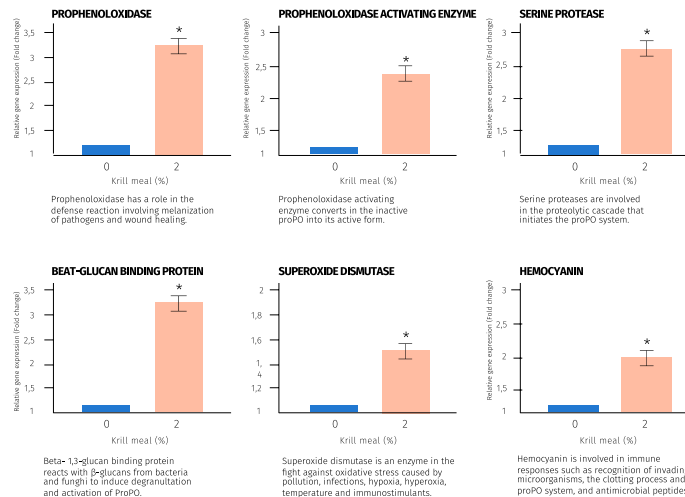
## 8-WEEK GROWTH EXPERIMENT

TEST DIETS: 0, 2, 4 and 6% krill meal in addition to either 6 or 12% fish meal

### TAKE HOME MESSAGE

- Innate immunity is of great importance to shrimp, because they lack antibodies. Innate immunity involves phagocytosis, encapsulation, hemocyte coagulation and activation of the prophenoloxidase (proPO) or metabolic centre responsible for the production of reactive oxygen species and is an important tissue for immune defence in shrimp (Soderhall and Cerenius, 1998).
- Dietary inclusion of 2% krill meal in a diet containing 12% fishmeal significantly increases the expression of six immune-related genes in the hepatopancreas of *L. Vannamei*.

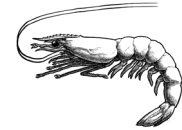
### 12 (%) FISH MEAL



# AstaOmega Oil improves growth in hypersalinity



**PACIFIC WHITE SHRIMP**  
*(Litopenaeus vannamei)*  
Juvenile. Initial body weight: 1.08 g



## 74-DAY GROWTH EXPERIMENT

### TEST DIETS:

A commercial grower feed (control) was top-coated with:

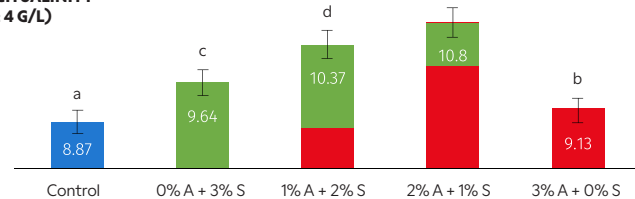
- 0% AstaOmega Oil (A) + 3% soybean oil (S)
- 1% A + 2% S
- 2% A + 1% S
- 3% A + 0% S

### TAKE HOME MESSAGE

- Under longer exposure periods to hypersalinity in enclosed tanks, 2% AstaOmega Oil mixed with 1% soybean oil is sufficient to cope with out of range parameters and enhance body weight.
- 1% AstaOmega Oil mixed with 2% soybean oil leads to significantly improved growth
- 2% AstaOmega Oil mixed with 1% soybean oil leads to significantly improved growth under high salinity

FINAL BODY WEIGHT (g)

**ENCLOSED TANK  
(HIGH SALINITY  
36 ± 4 G/L)**



A: QRILL AstaOmega Oil | S: Soybean Oil

# AstaOmega Oil improves survival of post-larvae after osmotic and thermal stress



**PACIFIC WHITE SHRIMP**  
(*Litopenaeus vannamei*)  
Post-larvae 2.5 mg (PL10)



## 10-WEEK GROWTH EXPERIMENT

### TEST DIETS:

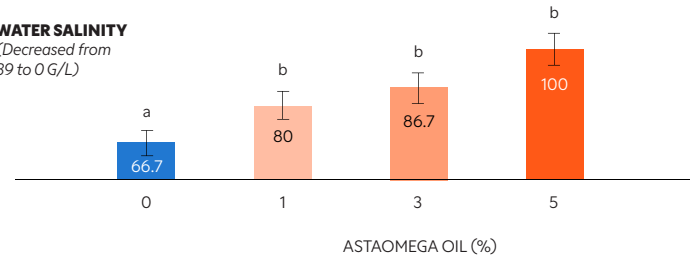
Control (18% salmon meal, 2% salmon oil)  
1, 3 and 5% AstaOmega Oil (replacing soybean oil,  
18% salmon meal, 2% salmon oil)

### TAKE HOME MESSAGE

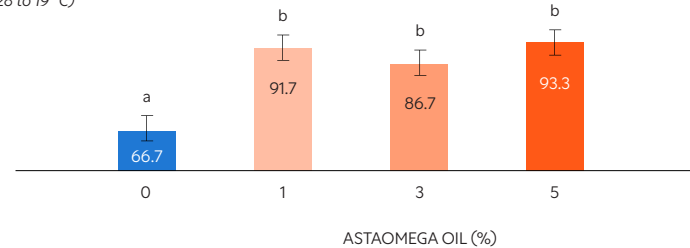
- At 5% AstaOmega Oil, no shrimp mortality was recorded after 30 min of osmotic stress.
- AstaOmega Oil promotes enhanced survival compared to the control diet after 30 min of thermal stress.

CUMULATIVE SURVIVAL (%) AFTER 30 MIN EXPOSURE

#### WATER SALINITY (Decreased from 39 to 0 G/L)



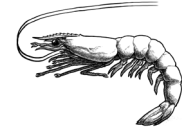
#### TEMPERATURE (Decreased from 28 to 19 °C)



# Krill phospholipid oil in QRILL Aqua Total promotes ovarian developments



**PACIFIC WHITE SHRIMP**  
(*Litopenaeus vannamei*)  
Female broodstock 35 g



## 3-WEEK MATURATION EXPERIMENT

### CONTROL DIET:

Broodstock diet without phospholipids (52% protein, 14% lipid, 20% fish meal, 1% fish oil)

### TEST DIETS:

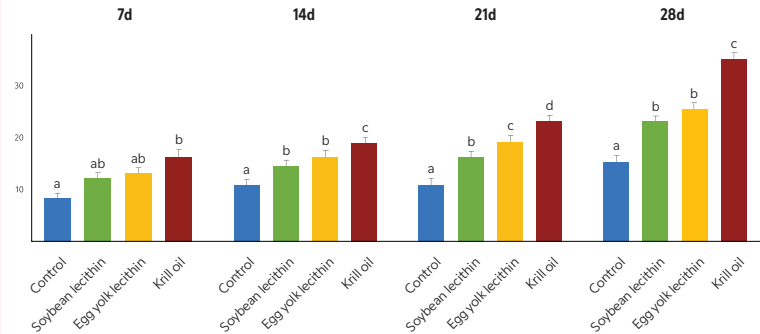
Instead of palm oil:

- 4% soybean lecithin
- 4% egg yolk lecithin
- 4% krill phospholipid oil from krill meal

### TAKE HOME MESSAGE

- Highest promotion of ovarian development in krill group
- Krill leads to the highest gonadosomatic index
- Highest serum total cholesterol and hepatopancreas triglyceride content in the krill group
- Highest serum hormone levels and lowest gonad inhibiting hormone in the eyestalk in the krill group

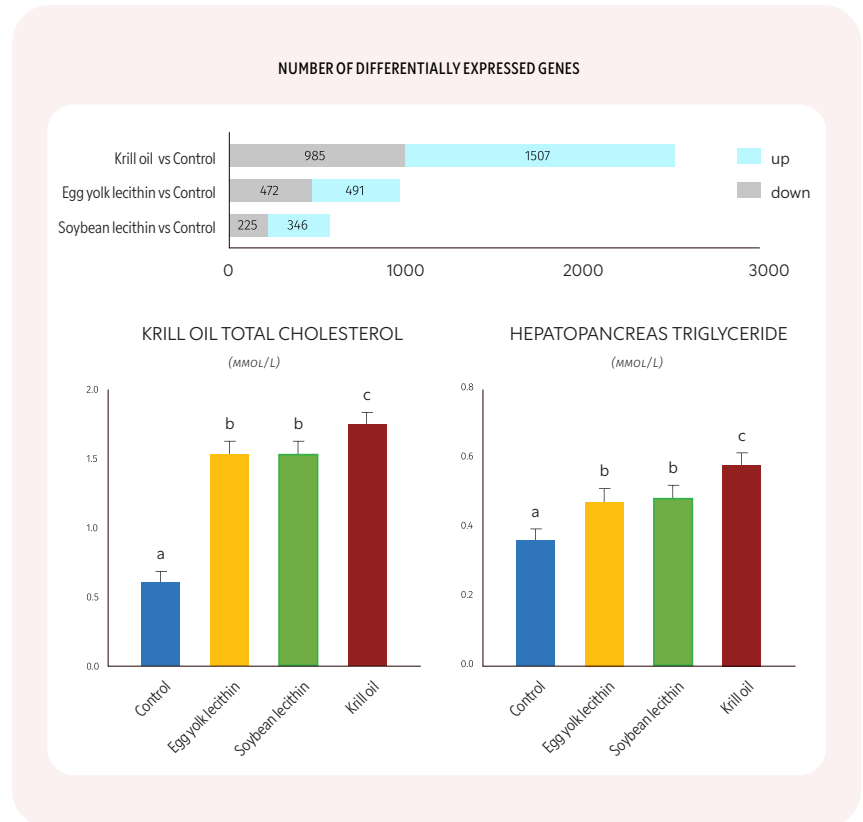
THE PROPORTION OF OVARIAN DEVELOPMENT FROM PHASE 3 TO PHASE 5 AT DIFFERENT TIMES



# Highest gene expression as well as serum cholesterol and triglyceride levels after feeding with krill

Krill supplementation led to:

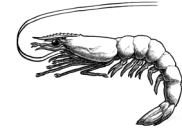
- Promoting sterol hormone secretion and enhancing the regulation of hormones on ovarian development
- Improves lipid metabolism (glycerides, glycerophospholipids,  $\alpha$ -linolenic acid and arachidonic acid) which enriches ovarian lipid composition and lipid mobilization to provide energy for ovarian development and to promote yolk accumulation
- Improves amino acid metabolism (tryptophan, methionine, arginine) which participate in the secretion of steroid hormones to promote ovarian development.



# Krill phospholipid oil in QRILL Aqua Total improves antioxidant capacity and innate immunity



**PACIFIC WHITE SHRIMP**  
(*Litopenaeus vannamei*)  
Female broodstock 35 g



## 4-WEEK MATURATION EXPERIMENT

### CONTROL DIET:

Broodstock diet without phospholipids (52% protein, 14% lipid, 20% fish meal, 1% fish oil)

### TEST DIETS:

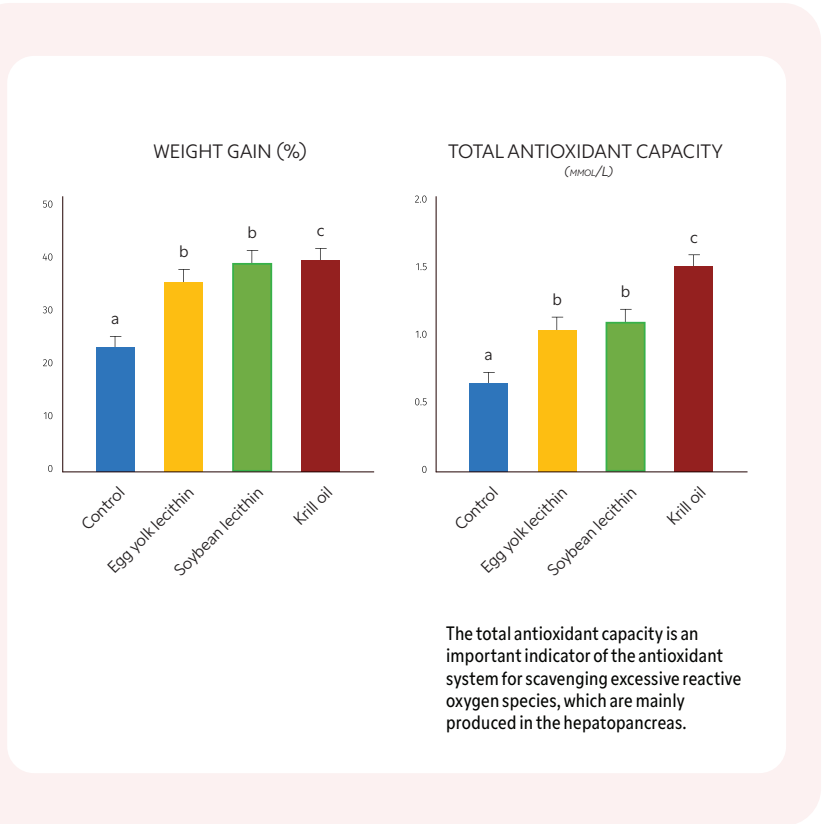
Instead of palm oil:

- 4% soybean lecithin (SL)
- 4% egg yolk lecithin (EL)
- 4% krill phospholipid oil from krill meal

### TAKE HOME MESSAGE

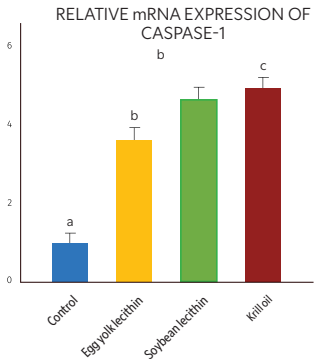
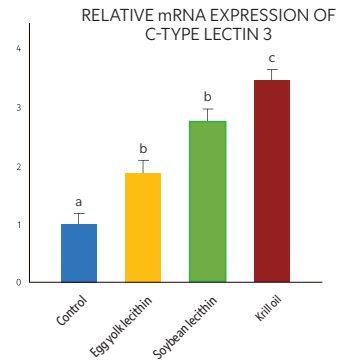
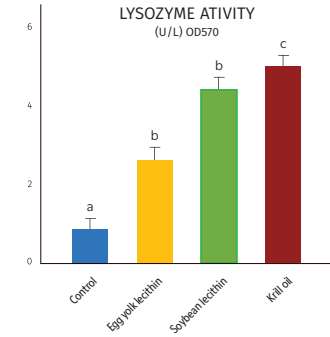
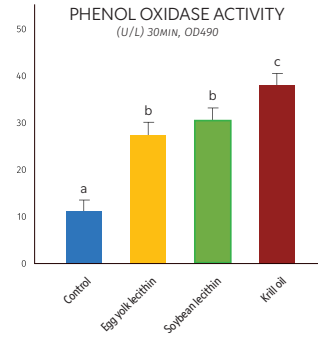
- Highest growth and hepatopancreatic antioxidant capacity in the krill group.
- Innate immunity of shrimp fed the EL and krill diets were significantly higher than shrimp fed the SL diet.
- Krill supplementation increased gut microbiota diversity and richness.
- The richness of Proteobacteria, Photobacterium, and Vibrio decreased, whereas the richness of Firmicutes and Bacteroidetes increased in the shrimp fed the krill diet.

Source: W Liang *et al.*, Antioxidants (2022)



# Krill phospholipid oil in QRILL Aqua Total enhances innate immunity to resist pathogen infection

- Krill diets improves antioxidant capacity and innate immunity compared to other dietary phospholipid sources.
- Krill diets can help establish the intestinal immune barrier by increasing the richness of Fusibacter that promotes growth and antioxidant capacity of female shrimp.



# Krill meal improves growth, FCR and survival in EHP infected shrimp



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 8 WEEK CHALLENGE TRIAL

### CONTROL DIET:

NC: negative control group without EHP fed on commercial control diet

PC: positive control group with EHP infected shrimp fed on commercial control diet

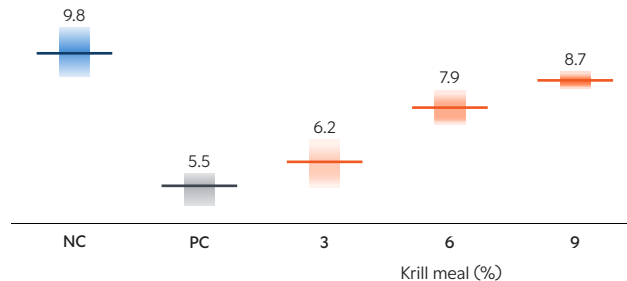
### TEST DIETS

- 3% krill meal: EHP infected shrimp fed with 3%KM
- 6% krill meal: EHP infected shrimp fed with 6%KM
- 9% krill meal: EHP infected shrimp fed with 9%KM

### TAKE HOME MESSAGE

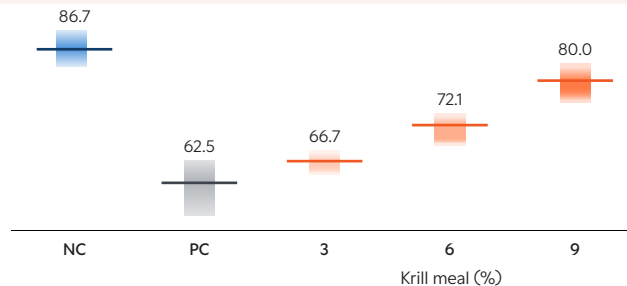
- Krill meal boosts growth in EHP-infected shrimp.
- Krill meal improves survival under EHP challenge.
- Krill meal enhances FCR in infected shrimp.

### WEIGHT GAIN (g)



Body weight gain for the different trial groups. The shrimp fed with 6% and 9% krill meal had significantly higher body weight gain compared to PC.

### SURVIVAL (%)



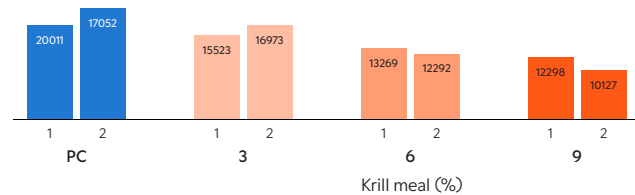
Survival in the different trial groups. The shrimp fed with 6% and 9% krill meal showed significantly higher survival compared to PC.

# Krill meal improves hepatopancreas function and immune response

## TAKE HOME MESSAGE

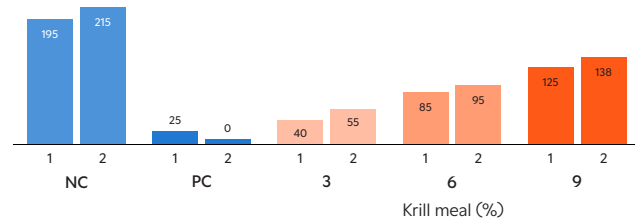
- QRILL Aqua supports healthier hepatopancreas function.
- QRILL Aqua improves shrimp's targeted immune response and lowered EHP load.

### DEGREE OF EHP INFECTION



Degree of infection was measured in trial groups as EHP copy number at days 28 (1) and 56 (2). Reduced EHP copy number at days 28 and 56 was measured in shrimp fed with krill meal compared to PC. EHP copy number increases in PC whereas it decreases with krill meal. This indicates improved immune health in shrimp with krill meal to combat infection levels. This result was supported by proteomics measurement of significantly higher activation of targeted immune responses in EHP infected shrimp fed with krill meal compared to PC.

### HEPATOPANCREAS FUNCTION



The R cell count was measured at days 28 (1) and 56 (2). The R cell count increases in shrimp fed with krill meal, while it decreases in PC. This indicates a better ability to cope with EHP infection in shrimp fed with krill meal.



## VALUE CREATION

- 17** Krill can replace costly ingredients
- 18** Krill improves yield while reducing feed cost
- 19** Krill improves feed efficiency and lowers feed cost
- 20** Krill meal improves digestibility and reduces cost
- 21** Krill ensures optimal performance of shrimp diets in a cost-effective way

# Krill can replace costly ingredients



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 7-WEEK GROWTH EXPERIMENT

### CONTROL DIET:

30% soybean meal, 19% fish meal, 13% broken rice, 2.3% meat and bone meal, 2% fish oil, 1.5% soybean lecithin, 0.15% cholesterol.

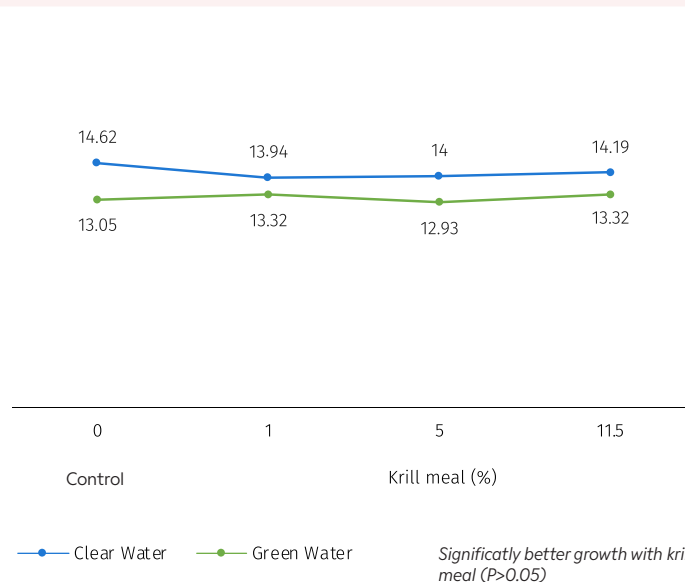
### TEST DIETS:

1 or 5% krill meal replacing parts of fish meal, fish oil, broken rice, soybean lecithin and cholesterol. 11% krill meal diet contained no fish meal, fish oil, soybean lecithin and cholesterol.

### TAKE HOME MESSAGE

- Krill meal is able to fully replace costly ingredients in shrimp diets without detriment to final body weight.
- The effect of krill meal on shrimp performance replacing costly ingredients is the same in clear- versus green-water tanks.

FINAL BODY WEIGHT (g)



# Krill improves yield while reducing feed cost



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 8-WEEK GROWTH EXPERIMENT

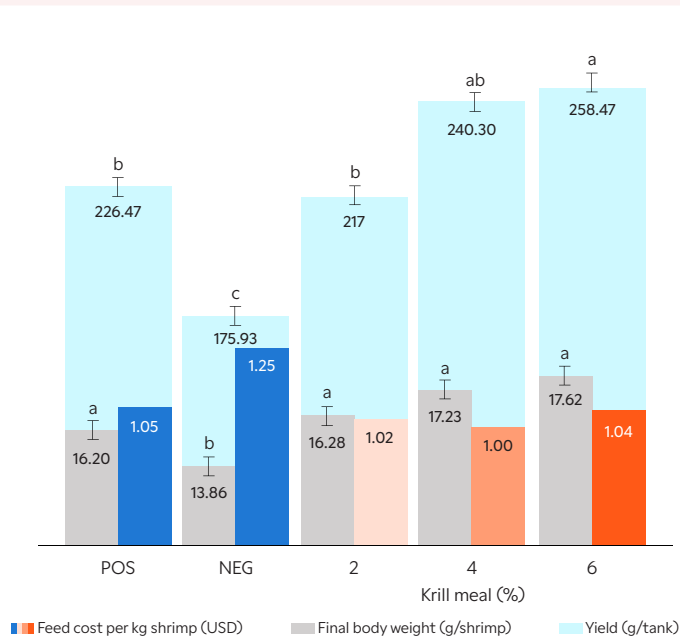
### TEST DIETS:

Plant-based diets with 20% tuna meal (positive control), 7.5% fish meal (negative control diet), or 2 to 6% krill meal added to the negative control diet (2, 4 and 6% krill meal)

### TAKE HOME MESSAGE

Krill meal is highly nutritional with superior attractant properties. Krill meal can play a key role in balancing shrimp growth performance and farm's operational costs with fishmeal-challenged diets.

FORMULA COST AND GROWTH PERFORMANCE



# Krill improves feed efficiency and lowers feed cost



PACIFIC WHITE SHRIMP  
*(Litopenaeus vannamei)*



## 10-WEEK GROWTH EXPERIMENT

### CONTROL DIET:

15% fish meal, 3% fish oil, 1% squid meal, 0.01% cholesterol

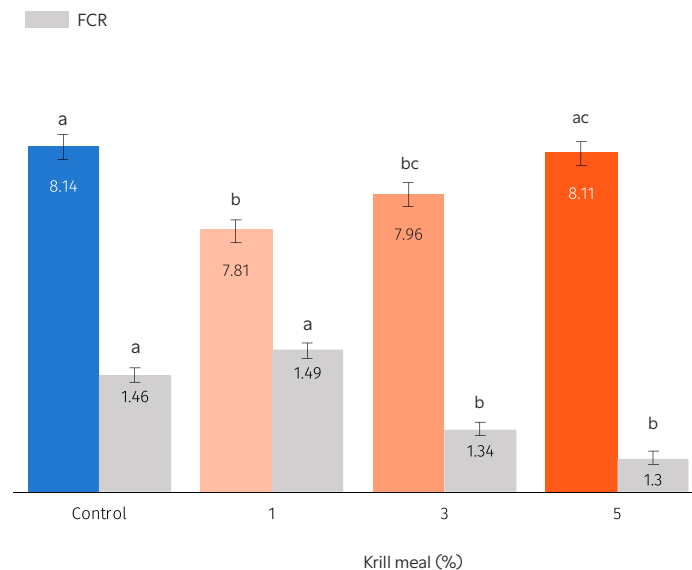
### TEST DIETS:

1,3 or 5% krill meal replacing fish meal (7%), fish oil (2%), squid meal (0%) and cholesterol (0%)

### TAKE HOME MESSAGE

- A reduction in fish meal (from 15 to 7%) and other costly ingredients (squid meal, cholesterol, fish oil) is offset by a 5% dietary inclusion of krill meal.
- Feed efficiency is enhanced starting at a 3% dietary inclusion of krill meal.
- Replacement of fish meal by krill meal at levels results in a 7% savings in a grower feed.

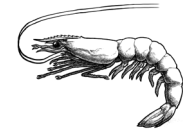
FINAL BODY WEIGHT (g) AND FCR



# Krill meal improves digestibility and reduces cost



**PACIFIC WHITE SHRIMP**  
*(Litopenaeus vannamei)*  
Post-larvae 2.5 mg



## 30-DAY DIGESTIBILITY EXPERIMENT

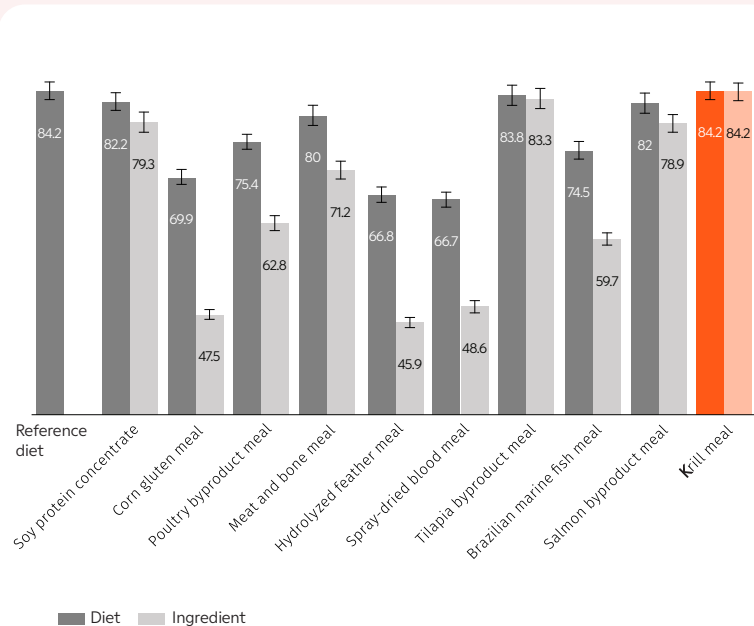
### TEST DIETS:

- Reference diet (REF)
- 70% REF + chromium oxide III (inert marker) + 30% test diet (soy protein concentrate, corn gluten meal, poultry byproduct meal, meat and bone meal, hydrolyzed feather meal, spray-dried blood meal, tilapia byproduct meal, Brazilian marine fish meal, salmon byproduct meal and krill meal)

### TAKE HOME MESSAGE

- Shrimp fed with krill meal diet exhibits the highest apparent crude protein digestibility (84.3%) and apparent essential amino acid digestibility (86.5%) among all test ingredients.
- The krill meal diet results in growth performance with the highest weekly growth and lowest FCR.

APPARENT PROTEIN DIGESTIBILITY (%)



# Krill ensures optimal performance of shrimp diets in a cost-effective way



**PACIFIC WHITE SHRIMP**  
(*Litopenaeus vannamei*)



## STUDY:

Various diets were formulated to evaluate the effect of krill meal and alternative ingredient inclusions on nutritional profile, pellet quality and cost.

### FEED FORMULATIONS

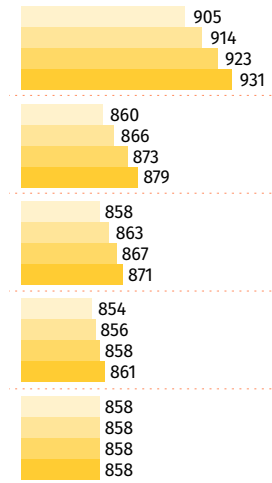
Fish meal : Krill meal	Fish meal	Salmon oil	Terrestrial protein sources <sup>1</sup>	Krill meal	Other ingredients <sup>2</sup>
10 : 2	10	1.4	81.4	2	5.2
7.5 : 2.5	7.5	1.7	84.5	2.5	3.8
5 : 3	5	2.1	87.1	3	2.8
2.5 : 4	2.5	2.1	88.2	4	3.2
0 : 4	0	2.7	89.8	4	3.5

### TAKE HOME MESSAGE

- Diets formulated with krill meal and alternative ingredients is more cost efficient than traditional diets
- Krill meal enables the replacement of fish meal with alternative protein sources without compromising feeds nutritional profile or physicochemical properties.

### \$ IMPACT OF FISH MEAL PRICE IN FEED FORMULATIONS

- Feed formula cost\*
- 5% increase in FM price
- 10% increase in FM price
- 15% increase in FM price





## APPETITE STIMULATION AND GROWTH

- 24 Krill extends feeding time
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- 26 Krill improves feed attractability
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- 29 AstaOmega Oil improves growth under stressful conditions

# Krill extends feeding time



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 10-WEEK GROWTH EXPERIMENT

### CONTROL DIET:

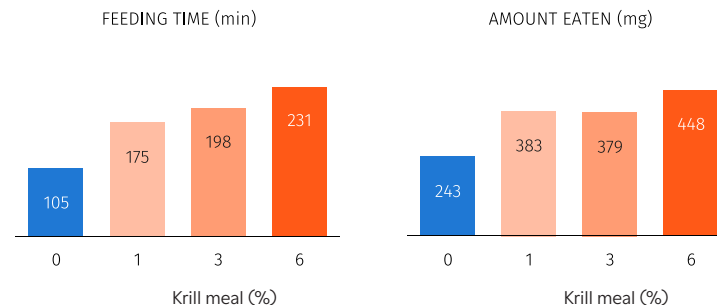
No fish meal, high in terrestrial meal (30% soybean meal, 27% poultry meal, 34% wheat flour)

### TEST DIETS:

1, 3 or 6% krill meal replacing 1, 3 or 6% of control diet

### TAKE HOME MESSAGE

- Addition of 6% krill meal to pellets significantly increases consumption by 29% within 1h. After 3h, 6% krill meal increases pellet consumption by 69% over the control.
- Krill meal is a chemostimulant that increases the palatability by increasing the feeding time (not the speed) and thus the amount eaten.

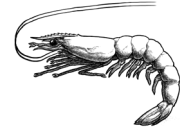


ONE-WAY ANOVA SHOWS A SIGNIFICANT EFFECT FOR BOTH FEEDING TIME AND AMOUNT EATEN

# Krill improves performance of plant-based diets



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 10-WEEK GROWTH EXPERIMENT

### CONTROL DIET:

No fish meal, high in plant-based proteins (30% soy protein concentrate, 24% wheat flour, 15% soybean meal, 11% corn gluten meal)

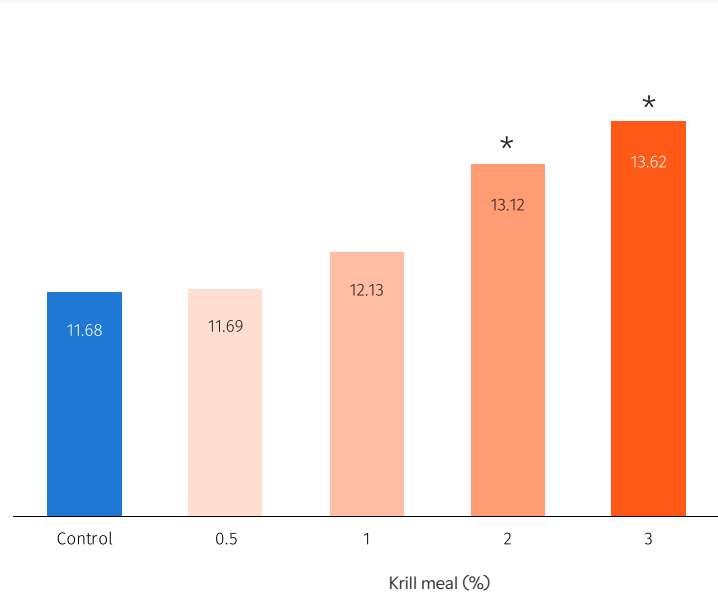
### TEST DIETS:

0.5, 1, 2 or 3% krill meal replacing corn gluten meal & soybean oil to provide same crude protein and lipid content

### TAKE HOME MESSAGE

- By including krill meal in a plant-based diet the yield increases in a dose dependent manner.
- 2% of krill meal is sufficient in plant-based diets to significantly enhance shrimp performance.
- By including 3% krill meal the yield is increased by 17%.

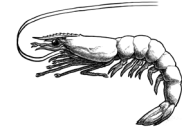
FINAL BODY WEIGHT (g)



# Krill improves feed attractability



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



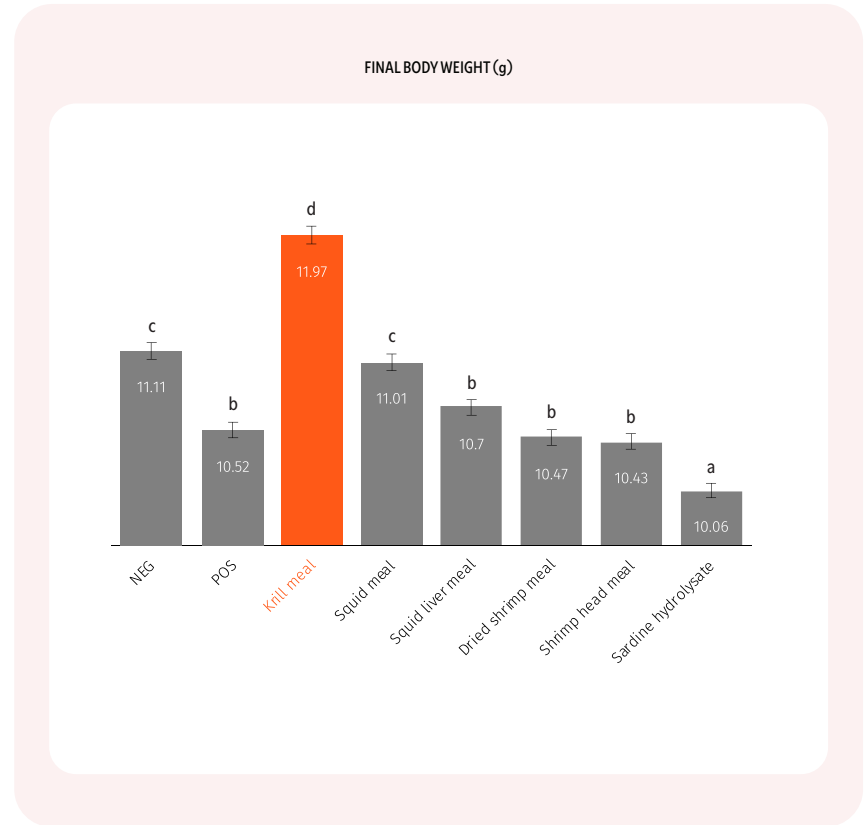
## 10-WEEK GROWTH EXPERIMENT

### TEST DIETS:

Plant-based diet supplemented with 3% salmon meal (positive control), soy protein concentrate (negative control), krill meal (KM), squid meal, shrimp meal, shrimp head meal, sardine hydrolysate, or squid liver meal

### TAKE HOME MESSAGE

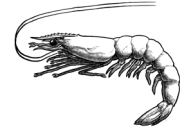
- 3% krill meal is most effective in increasing shrimp final body weight and yield
- 3% krill meal reduces FCR compared to other marine ingredients



# AstaOmega Oil improves growth under normal and stressful conditions



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 9-WEEK GROWTH EXPERIMENT

### CONTROL DIET:

3.5% soybean oil, 30% wheat flour, 10.5% poultry by-product meal, 7% fish meal, 1.7% soy protein concentrate, 1% squid meal

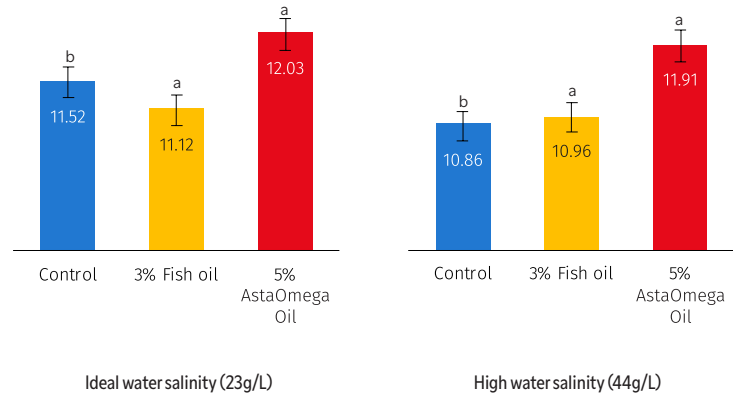
### TEST DIETS:

3% fish oil or 5% AstaOmega Oil replacing soybean oil

### TAKE HOME MESSAGE

- In optimal water conditions, shrimp fed AstaOmega Oil reaches the highest body weight, while shrimp fed the fish oil diet reaches significantly lower final weight.
- In high salinity condition, shrimp fed AstaOmega Oil shows the highest final weights.

FINAL BODY WEIGHT (g)



# Krill in low and moderate fish meal diets in an Indian context



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 8-WEEK GROWTH EXPERIMENT

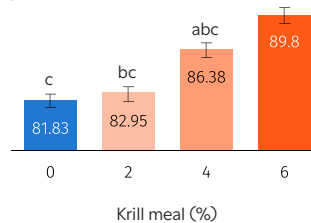
TEST DIETS: 0, 2, 4 and 6% krill meal in addition to either 6 or 12% fish meal

### TAKE HOME MESSAGE

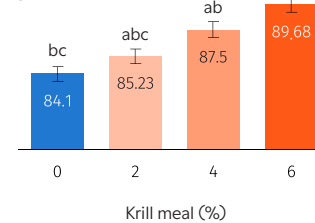
- 4% krill meal inclusion is sufficient to give a measurable difference in performance of shrimp in moderate (12%) level fish meal diets.
- In low (6%) fish meal diets every incremental increase of 2% krill meal inclusion results in a positive influence on various growth performance indicators.

SURVIVAL (%)

LOW (6%)  
FISH MEAL

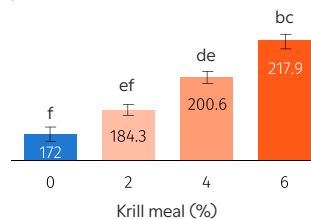


MODERATE (12%)  
FISH MEAL

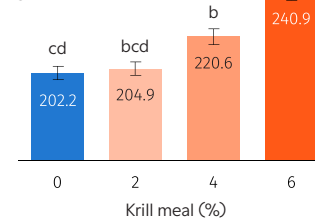


YIELD PERTANK (g)

LOW (6%)  
FISH MEAL



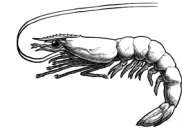
MODERATE (12%)  
FISH MEAL



# AstaOmega Oil improves growth under stressful conditions



**PACIFIC WHITE SHRIMP**  
*(Litopenaeus vannamei)*  
Juvenile. Initial body weight: 1.08 g



## 74-DAY GROWTH EXPERIMENT

### TEST DIETS:

A commercial grower feed (control) was top-coated with:

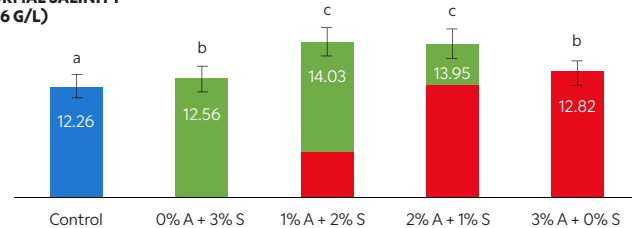
- 0% AstaOmega Oil (A) + 3% soybean oil (S)
- 1% A + 2% S
- 2% A + 1% S
- 3% A + 0% S

### TAKE HOME MESSAGE

- Under longer exposure periods to hypersalinity in enclosed tanks, 2% AstaOmega Oil mixed with 1% soybean oil is sufficient to cope with out of range parameters and enhance body weight.
- 1% AstaOmega Oil mixed with 2% soybean oil leads to significantly improved growth.
- 2% AstaOmega Oil mixed with 1% soybean oil leads to significantly improved growth under high salinity.

FINAL BODY WEIGHT (g)

EXPOSED TANK  
(NORMAL SALINITY  
31 ± 6 G/L)





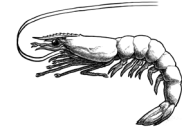
## QUALITY IMPROVEMENT

**31** AstaOmega Oil improves color and flavor

# AstaOmega Oil improves color and flavor



PACIFIC WHITE SHRIMP  
(*Litopenaeus vannamei*)



## 9-WEEK GROWTH EXPERIMENT

### CONTROL DIET:

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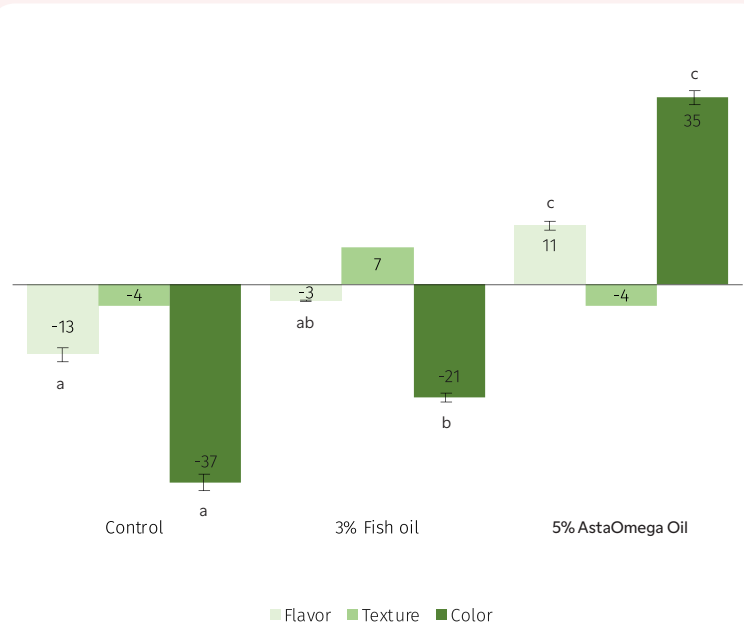
### TEST DIETS:

3% fish oil or 5% AstaOmega Oil replacing soybean oil

### TAKE HOME MESSAGE

- Shrimp fed AstaOmega Oil and fish oil diets shows a higher percentage of EPA and DHA in the shrimp tail fatty acid profile regardless the salinity.
- AstaOmega Oil inclusion promotes significantly higher consumer preference for color and flavor attributes.
- Shrimp fed with AstaOmega Oil results in significantly superior color and flavor

CONSUMERS PREFERENCE FOR SHRIMP TAILS



1. Page 7, 28. *Ambasankar et al., (2022)* <https://doi.org/10.1016/j.aquaculture.2022.738069>

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2. Page 8, 29. *LA Rufino et al., (2011)* <https://doi.org/10.1111/anu.12577>

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3. Page 9. *AJPNunes et al., (2021)* <https://doi.org/10.1111/anu.13187>

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4. Page 10, 11. *W Liang et al., (2022)* <https://doi.org/10.3389/fnut.2022.830934>

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5. Page 12, 13. *W Liang et al., (2022)* <https://doi.org/10.3390/antiox11061143>

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6. Page 14, 15. *A Uma et al., (2025)* (manuscript in press)

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7. Page 17. *AJP Nunes et al., (2011)* <https://doi.org/10.1111/j.1365-2095.2010.00791.x>

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8. Page 18. *Burri et al., (2020)* <http://dx.doi.org/10.1111/are.14809>

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9. Page 19. *AJP Nunes et al., (2017)* <https://www.cabidigitallibrary.org/doi/full/10.5555/20173369473>

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10. Page 20. *CCF Vieira et al., (2022)* <http://dx.doi.org/10.37496/rbz5120210177>

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11. Page 21, 22. *AJP Nunes et al., (2022)* <https://doi.org/10.1016/j.aqrep.2022.101422>

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12. Page 24. *CD Derby et al. (2016)* <https://doi.org/10.1016/j.aquaculture.2016.02.028>

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13. Page 25. *H Sabry-Neto et al., (2016)* <https://onlinelibrary.wiley.com/doi/10.1111/anu.12392>

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14. Page 26. *AJP Nunes et al., (2019)* <https://doi.org/10.1111/jwas.12605>

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15. Page 27, 31. *OS Castro et al., (2018)* <https://doi.org/10.1111/anu.12577>

## QRILLAqua is a feeding stimulant leading to:



Higher feed uptake



Enhanced growth



Increased stress tolerance



Boosted survival rates



Increased pigmentation



Improved visual appearance and flavor



Improved profitability

# Sustainable and Traceable

**QRILL™ Aqua products** comes from one of the most sustainable fisheries in the world.



**QRILL™ Aqua** is certified by the Marine Stewardship Council (MSC) for being 100% sustainable & traceable.



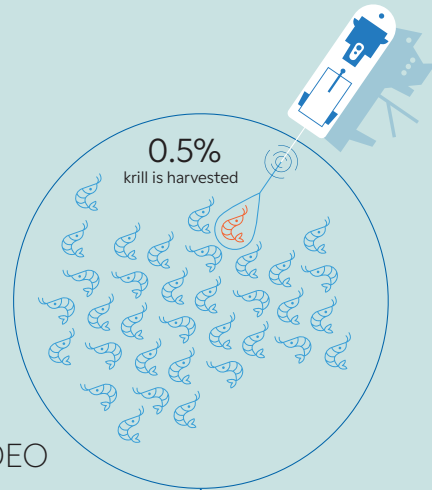
**ECO Harvesting™** to protect the environment from bycatch & on-board processing for ultimate freshness.



After harvested in the Southern Ocean and processed on board factory vessels, the product is transported to our logistic hub in Montevideo and shipped to our customers.



**URUGUAY**  
**MONTEVIDEO**



0.5%  
krill is harvested

**Area 48**

62.6  
million tonnes  
of krill

Area 48 is the only location in the Southern Ocean where Aker QRILL Company and others have a license to harvest krill.



**Antarctica**