



南极磷虾粉的品质及特点

Quality and Advantages - Antarctic Krill Meal

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阿克海洋生物 中国区销售总监

Sales Director, Aker BioMarine (China)

Agenda 目录

1

Aker BioMarine Introduction
阿克海洋生物公司简介

2

Quality and Advantages - Antarctic Krill meal
南极磷虾粉的品质及特点

Antarctic krill (*Euphausia superba*) 南极磷虾

Largest of 86 species 86个种之中体量最大

Glows in the dark 在黑暗的环境中发光

~6cm, up to 2g
长约6cm, 重约2g

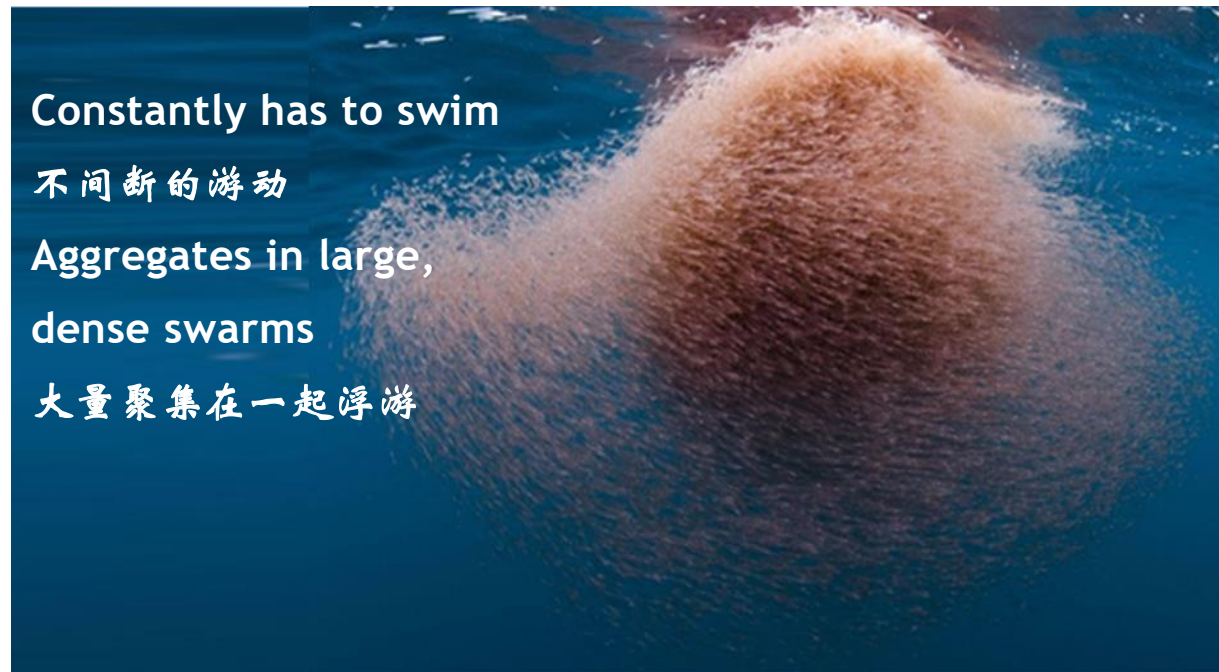


Constantly has to swim

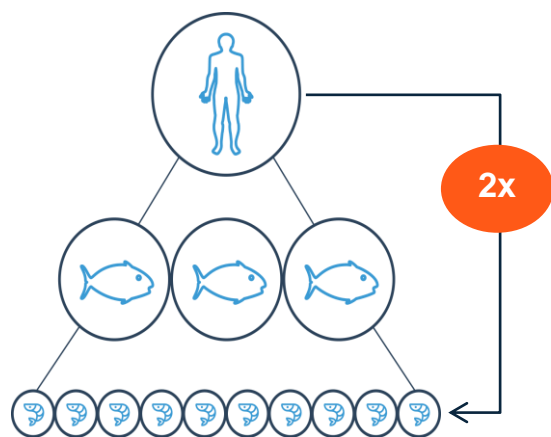
不间断的游动

Aggregates in large,
dense swarms

大量聚集在一起浮游

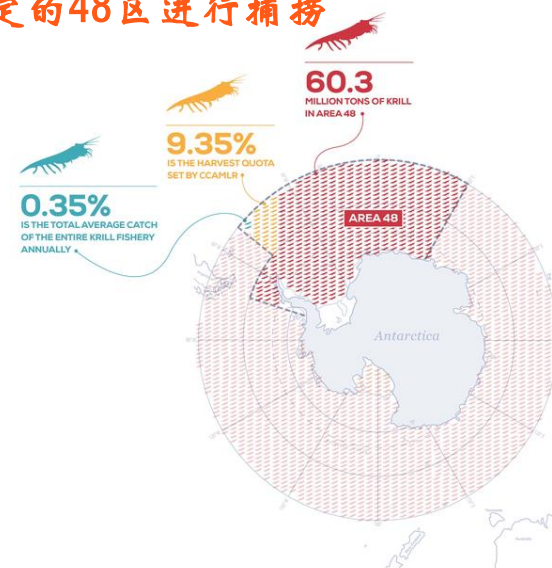


One of the largest biomasses 地球最大生物体量之一



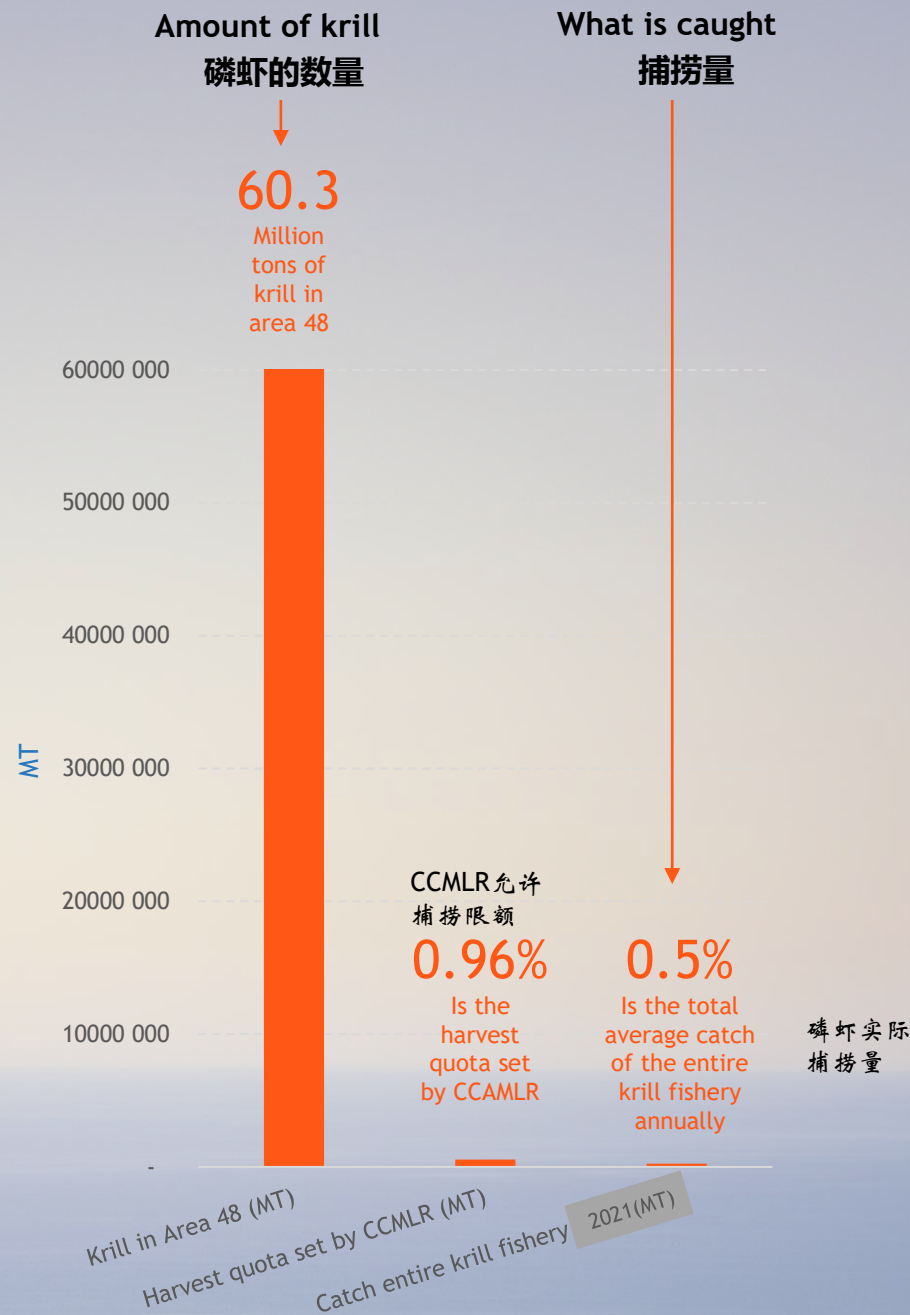
Harvesting only allowed in Area 48

只能在南极特定的48区进行捕捞



Despite the largest biomass on earth,
only a fraction of the available quota
is harvested

地球上最大的生物量，仅完成很少一部分的捕捞配额



阿克海洋生物公司是挪威工业引以为豪的历史和遗产的一部分

AKER BIOMARINE IS PART OF PROUD NORWEGIAN INDUSTRIAL HERITAGE AND HISTORY

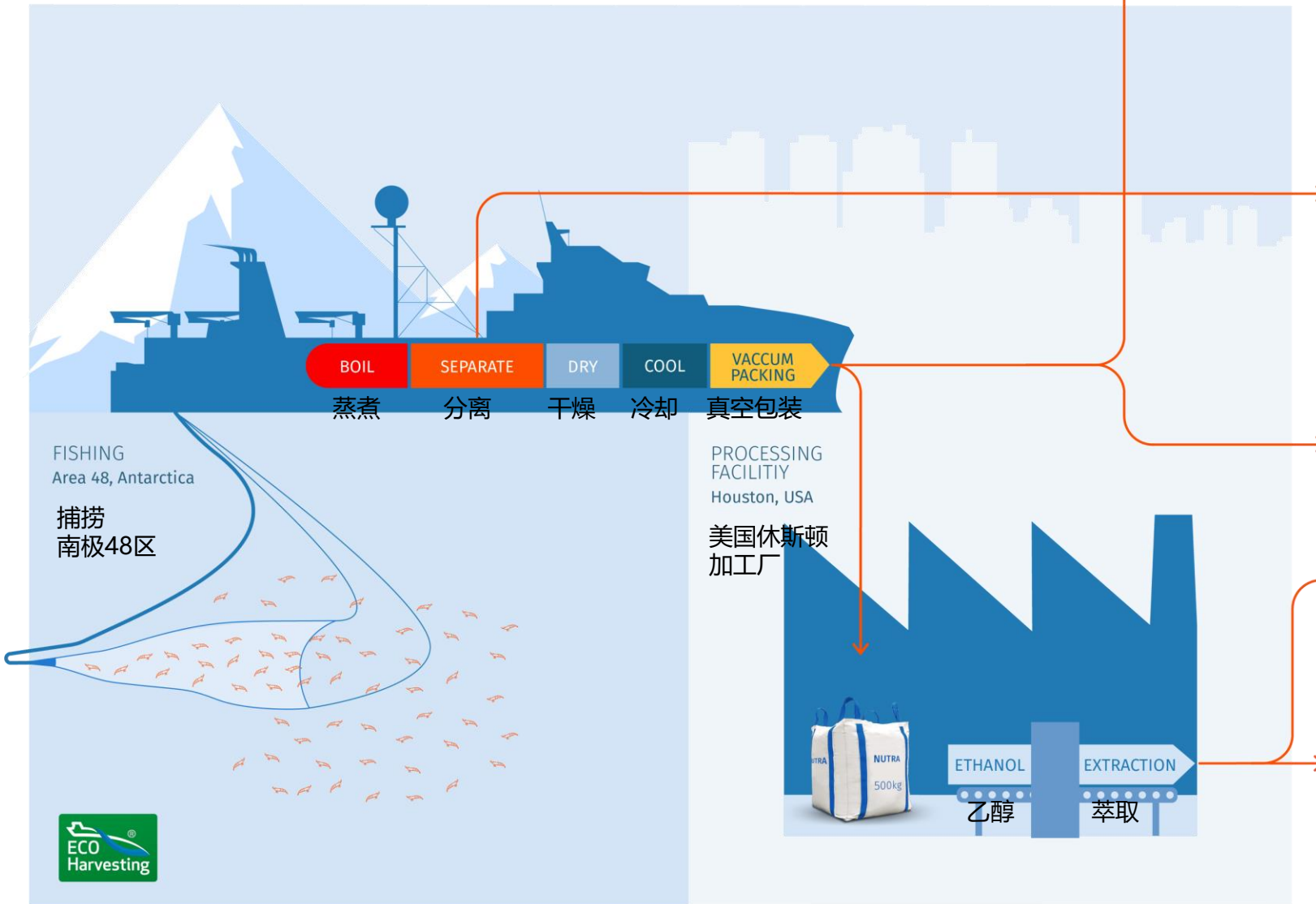
阿克海洋生物公司由建立于1841年的挪威工业集团 Aker ASA 全资控股，是一家生物技术创新公司和南极磷虾渔猎公司，我们以磷虾为原料，开发保健品，水产养殖和动物饲料，致力于改善人类健康和地球环境。

Aker BioMarine is a leading supplier of high quality, **krill-derived products to animal and human health and nutrition.**

We supply bioactive marine ingredients through a 100% traceable and **sustainable supply** chain. As a company, we are fully owned by the Norwegian industrial investment company **Aker ASA**, an industrial pioneer established in 1841



Most of the QRILL products are being produced on board the vessels
 大部分的磷虾产品都是在船上完成生产



宠物级磷虾粉
Petfood grade krill meal

- 20-32% Fat
- 55-69% Protein
- 41% PL
- 130 ppm Astaxanthin
- 1.1-1.4% Choline

虾青素油 Asta krill oil

- 98% fat (TG)
- 8 - 15% omega-3 FA
- 0% protein
- 650 - 1600 ppm Astaxanthin
- 0.5-2% Cholesterol

饲料级全脂磷虾粉
Feed grade krill meal total

- 15-30% Fat
- >54% Protein
- 40% PL
- >0.8-1.5% Cholesterol
- 114 ppm Astaxanthin
- 1.1-1.4% Choline

高蛋白磷虾粉
High protein krill meal

- 7-15% Fat
- >65% Protein
- >0.5% Cholesterol

食品级磷虾油 **Food grade krill oil**

Abbreviations: FA, fatty acids; PL, phospholipids; TG, triglycerides

QRILL™ Aqua products 饲料级磷虾产品



- 15-30% Fat
- >54% Protein
- 40% PL
- 1.1-1.4% Choline
- >0.8-1.5% Cholesterol
- 114 ppm Astaxanthin

全脂粉是我们的主打产品
Main product



- 7-15% Fat
- >65% Protein
- >0.5% Cholesterol
- 18-68 ppm Astaxanthin

其他产品：磷脂油/虾青素油/脱脂粉
Other products



- 98% fat (TG)
- 8% omega-3 FA
- 0% protein
- 0.5-2% Cholesterol
- >750 ppm Astaxanthin
- Phospholipids 35 %
- Total omega-3 fatty acids 25 g/100 g
- EPA 15 ± g/100 g
- DHA 6 ± g/100 g
- Cholin 4 %
- Astaxanthin 250 ± mg/kg
- Total cholesterol 1,5%



AKER BIOMARINE



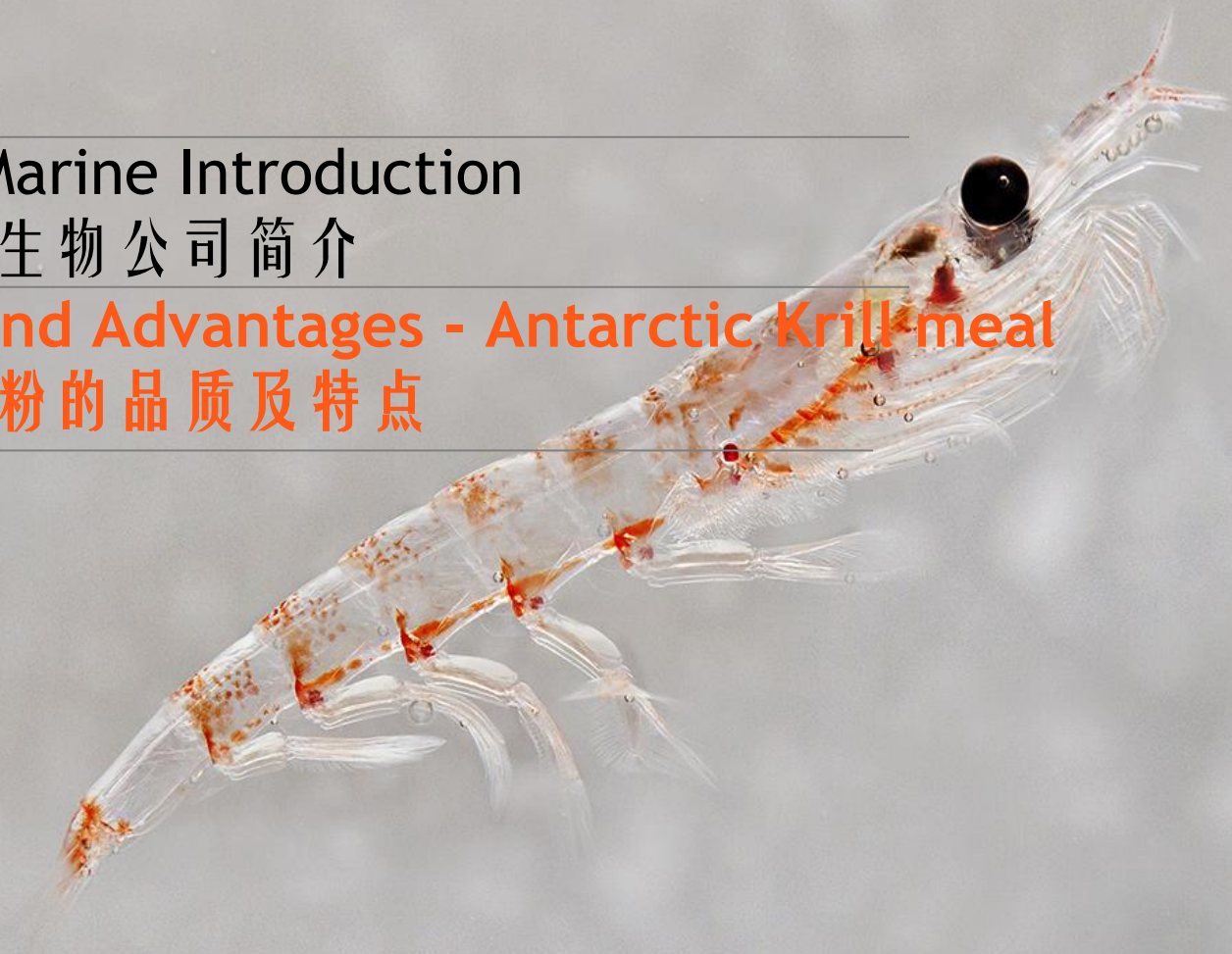
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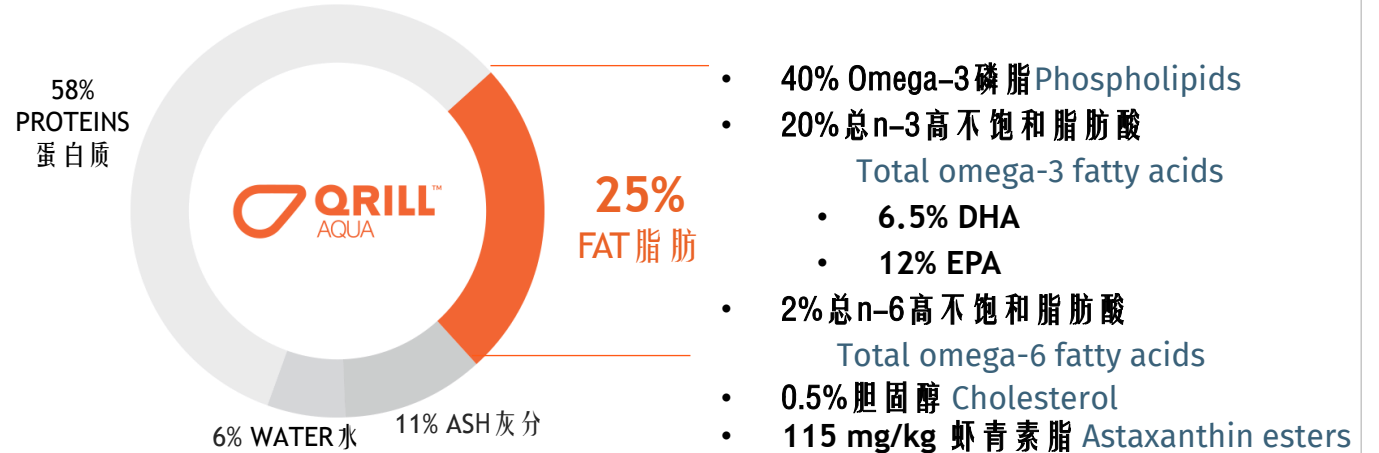


THE POWER OF ANTARCTIC KRILL MEAL - A COMBINATION OF IMPORTANT NUTRIENTS

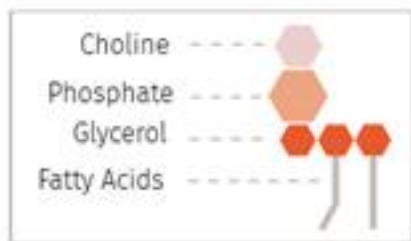
南极磷虾粉-多种重要营养物质的最佳组合



TYPICAL QRILL AQUA MEAL COMPOSITION 磷虾粉成分表



胆碱
磷酸盐
甘油
脂肪酸



磷脂型 omega-3
Phospholipid omega-3

甘油三酯型 omega-3
Triglyceride omega-3



甘油
脂肪酸



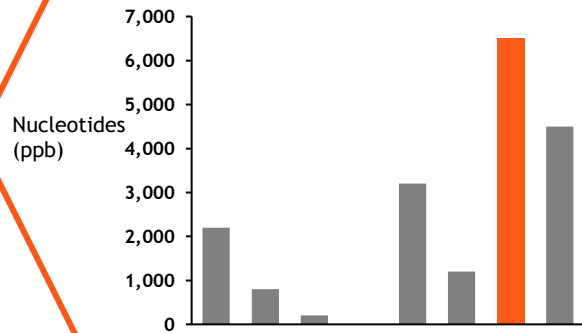
Cell membrane
细胞膜

KRILL MEAL HAS A COMBINATION OF DIFFERENT FEED ATTRACTANTS

磷虾粉的诱食性

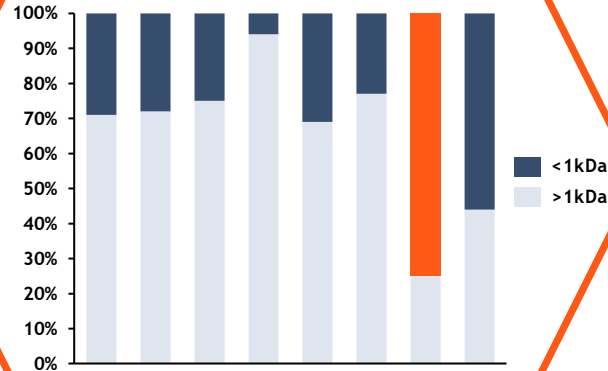
- 增强适口性，采食量和生长表现/Increase palatability, feed intake and growth performance

Nucleotides/核苷酸



Suresh et al. 2011

Short peptides/短肽



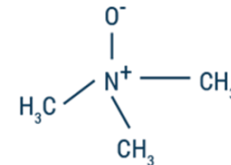
Suresh et al. 2011

实验结果, Suresh et al. 2011:

1. 鸡肉粉, 宠物级别 Poultry byproduct meal, petfood grade (PBP)
2. 鸡肉粉, 饲料级别 Poultry byproduct meal, feed grade (PBF)
3. 水解羽毛粉 Feather meal, hydrolyzed (HFM)
4. 血浆粉 Blood meal, spray-dried (BLM)
5. 鳀鱼粉 Fishmeal, anchovy (AFM)
6. 鱼溶浆 Fish hydrolysate (FHD)
7. 磷虾粉 Krill meal (KRL)
8. 鱿鱼肝粉 Squid liver meal (SQL)

Trimethylamine N-oxide (TMAO)/氧化三甲胺

- 体液平衡
Fluid balance
- 蛋白质稳定剂
Protein stabilizer



Krill, a complex of nutrients important for growth and health of fish/shrimp

南极磷虾，有益于鱼虾生长和健康的重要营养集合

FEED ATTRACTANTS

饲料诱食剂

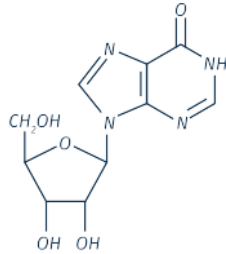
(Low molecular weight soluble compounds)
(低分子可溶性化合物)

Nucleotides: e.g. IMP and Inosine

- Structural units of nucleic acids

核苷酸：如肌苷酸(IMP)和次黄酸

- 核酸单位结构

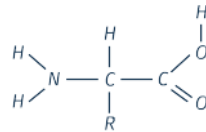


Water-soluble amino acids

- Protein metabolism
- Energy source

水溶性氨基酸

- 蛋白质代谢
- 能量来源

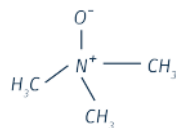


Trimethylamine N-oxide (TMAO)

- Fluid balance
- Protein stabilizer

氧化三甲胺(TMAO)

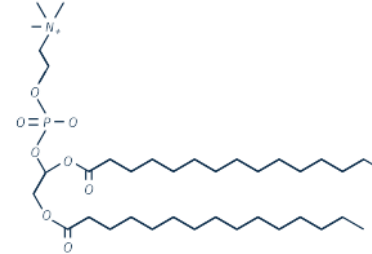
- 体液平衡
- 蛋白质稳定剂



IMPORTANT NUTRIENTS 重要营养

Omega-3 phospholipids

- Structural component of cell membranes and fat transport particles
- Omega-6 (pro-inflammatory) to omega-3 (anti-inflammatory) balance

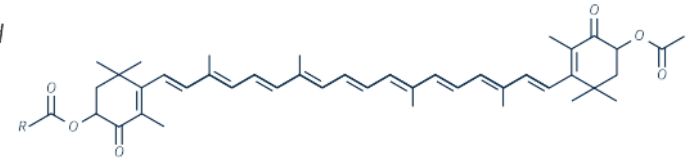


Omega-3 磷脂

- 细胞膜和脂肪转运的结构组分
- Omega-6(促炎性)和Omega-3(抗炎性)的平衡

Astaxanthin esters

Anti-inflammation and -oxidation to protect proteins, lipids and DNA from oxidative damage

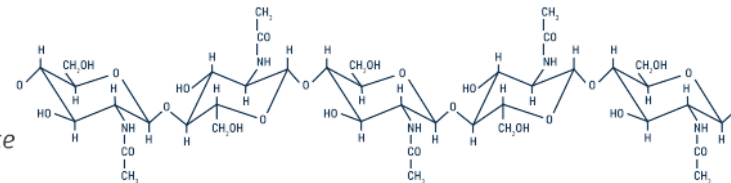


虾青素酯

具有抗炎性和抗氧化性，防止蛋白质，脂肪和DNA受到氧化伤害

Chitin

Immunostimulatory effects to improve health and disease resistance and reduce mortalities due to infections



几丁质

具有免疫刺激作用，可改善健康和增强抗病力，降低死亡率

AKER BIOMARINE'S KRILL INGREDIENTS AND THEIR BIOLOGICAL EFFECTS HAVE BEEN BROADLY RESEARCHED AND DOCUMENTED

AKER BIOMARINE 的磷虾产品及其应用已被广泛研究

	Pre 08	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
ORILL™ AQUA	Salmonids		Growth and feed utilization	Growth & heart omega-3 increase (Chile)		Large salmon Growth and fat distribution (Norway)	Smolt Feed intake & growth stimulation HSMI study - NOFIMA (Norway)			Fillet quality improvement ²	QMAR Salmon fundamental study					Skin health	
	Marine, freshwater fish and others	Krill meal improves egg quality Krill meal as feed attractant for fish larvae and juveniles Seabream feeding stimulation	Increased growth, feed intake, protein efficiency in Tilapia No fluorine accumulation in tissue from krill meal fed salmon, cod, trout and halibut	Cod Feed intake & growth stimulation (Norway)		Seabream larvae Growth stimulation & liver fat reduction ¹ Protein characterization Qrill meal ²	Juvenile seabream feed utilization, immunity and disease resistance Seabream larvae optimum diet ³	Improved growth performance and immunity stimulator in seabream and olive flounder			Juvenile sea bream Growth & fillet quality	Olive Flounder: Performance and disease resistance Sea bass Disease resistance Tilapia Perform. & health Zebrafish Neural stem cells Tuna Nutr. Require. Abalone Performance Lumpfish Welfare and Survival					
	Shrimp		<i>P. monodon</i> Growth stimulation <i>L. vannamei</i> Feeding and growth stimulation	<i>L. vannamei</i> Feed savings in green-water tanks <i>L. stylirostris</i> Palatability enhancement	<i>L. vannamei</i> Increased body weight with krill meal/squid meal combinations	<i>L. vannamei</i> Increased yield with low fish meal diets <i>L. vannamei</i> Increased yield with low cholesterol diets	<i>L. vannamei</i> Longer feed consumption <i>L. vannamei</i> Increased yield with soy diets	<i>L. vannamei</i> Astaxanthin krill oil Growth stimulation in hypersalinity	<i>L. vannamei</i> Feeding cost optimization <i>L. vannamei</i> Disease and temperature challenge	<i>L. vannamei</i> Feeding cost optimization	<i>L. vannamei</i> Marine feed attractants	<i>L. vannamei</i> Post-larvae Astaxanthin krill oil <i>L. vannamei</i> Growth & hepatopancreas <i>L. vannamei</i> Astaxanthin krill oil Salinity stress	<i>L. vannamei</i> Broodstock Qrill oil <i>L. vannamei</i> Health & gut microbiota <i>L. vannamei</i> Digestibility <i>L. vannamei</i> EHP infection Immune genes & growth	Acoustic monitoring Soybean meal Optimize low-cost Diets with QHP	<i>L. vannamei</i> Broodstock Qrill oil <i>L. vannamei</i> Ovary development		
ORILL™ PET	Dog						Palatability	Omega-3 index	Sperm quality	Iditarod Inflammation & muscle damage	TG vs PL comparison		Plasma choline	Short- vs long-chain omega-3s	3% dietary inclusion	Omega-3 index conversion	
	Chicken		In vitro Intestinal microflora								Growth & health						
SUPERBAKRILL™	Heart health & metabolic syndrome	Diet-induced obesity Genetic obesity model	Endocannabinoids	Endocannabinoids (human) Lipogenesis Hepatic gene regulation	Heart failure Fat distribution (human) Liver mitochondria	Plasma triglycerides (human)	Glucose tolerance	Blood lipids	Omega-3 index (human)	Norseman Pilot (Omega-3 and sports human)	Lupus (human) Sport High Performance (human) Norseman II/III (inflammation) Pro-liver (NAFLD/NASH) Chronic fatigue syndrome NAFLD pilot						
	Joints & inflammation					HIV (human)				Osteoarthritis (human)	OA knee pain I (KAROAKE) OA knee pain II Muscle function during weight loss						
	Woman				Rheumatoid arthritis Inflammatory bowel disease Chronic inflammation	Women health (human)	Weight loss (human)	Exercise and immune function (human)	Skin hydration (human)	Skin hydration II (human)	Skin hydration III (human) Curcumin Bioavailability (in vitro)	Muscle strength in elderly Muscle mass (diabetes 2) Skin IV Japan					
	Brain		ADHD in boys (human)			Depression	Brain Lipidomics	Cognition adolescents (human)	Performance (US Rangers) Healthy ageing (C. elegans)								
	Safety and fundamental	Safety study in obesity (human) Kinetics (human)	PL characterization of krill oil Omega-3 index (human)	Metabolic effect (human)	Review article on phospholipids Mutagenicity and genotoxicity tests	Allergy testing (in vitro) Toxicology study	Subchronic PL toxicology	Review article preclin. studies Radio-labelled FA kinetics	NMR fingerprint of krill oil	Brain growth	PC uptake/distribution Choline uptake (human)					Dry macular degeneration PL+EE bioavailability	

1

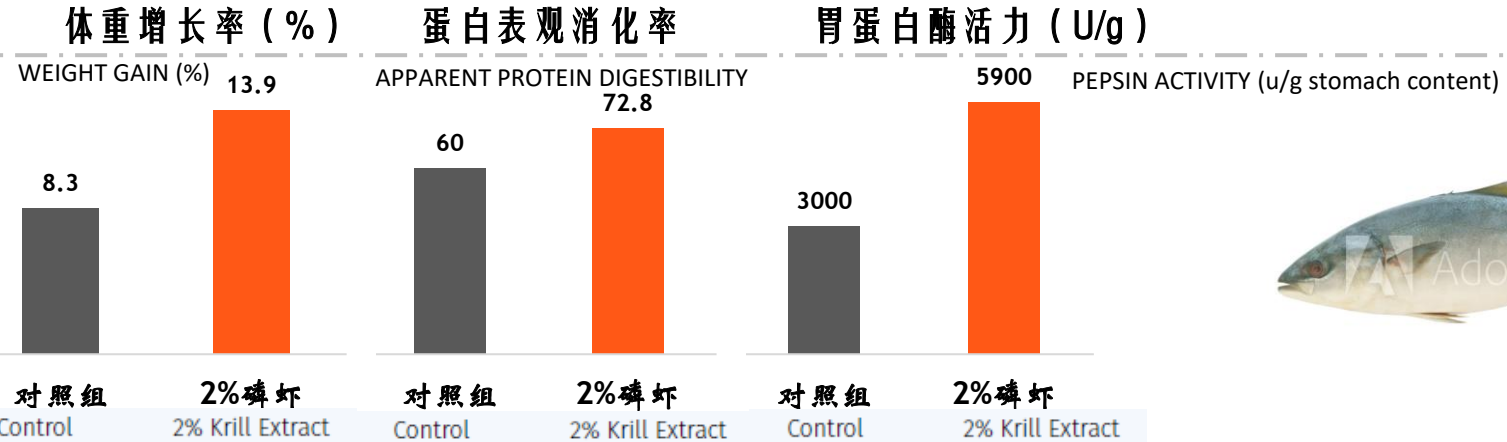
KRILL OVERCOMES LOW WINTER GROWTH OF YELLOWTAIL

磷虾帮助鲷鱼克服冬季生产缓慢的现象

鲷鱼 Yellowtail

- 6周生长实验
6-WEEK GROWTH EXPERIMENT
- 对照组 (48% 鱼粉)
CONTROL DIET: 48% fish meal
- 实验组 2% 磷虾粉 + 48% 鱼粉
TEST DIET: 2% krill extract + 48% fish meal

Source: Kofuji *et al.*, (2006)



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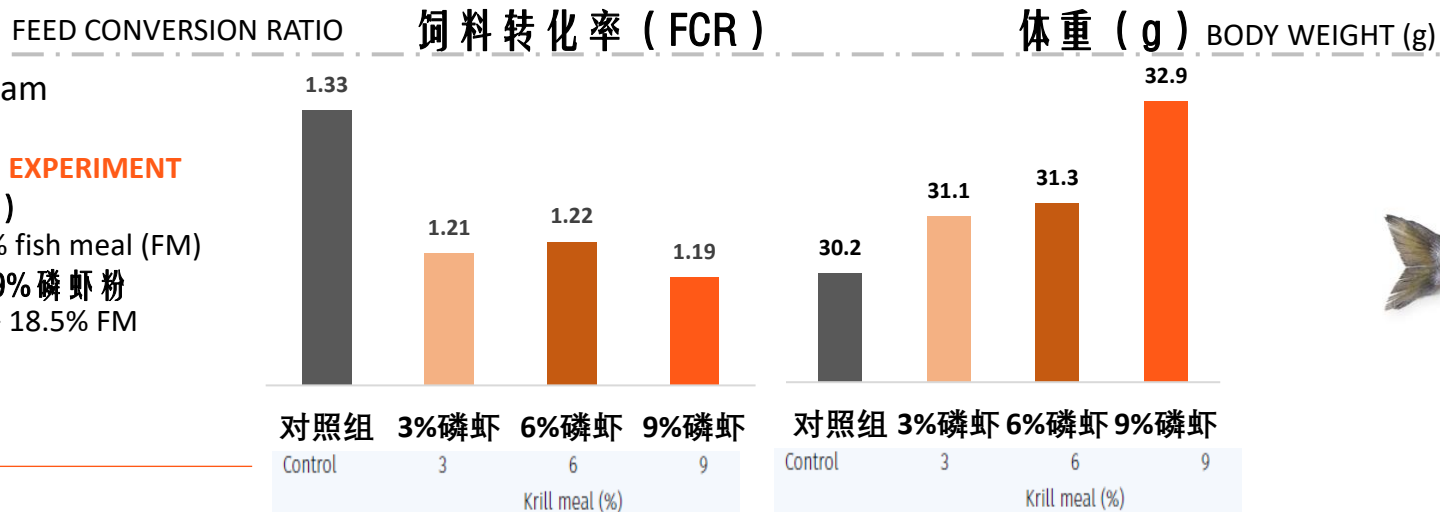
KRILL IMPROVES GROWTH PERFORMANCE IN SEABREAM JUVENILES

磷虾改善鲷鱼幼鱼生长发育表现

鲷鱼 Gilthead Seabream

- 12周生长实验
12-WEEK GROWTH EXPERIMENT
- 对照组 (20% 鱼粉)
CONTROL DIET: 20% fish meal (FM)
- 实验组 3%, 6%, 9% 磷虾粉
3% krill meal (KM) + 18.5% FM
6% KM + 17% FM
9% KM + 16% FM

Source: Saleh *et al.*, (2018)



3

INCREASED SURVIVAL WHEN SEABREAM LARVAE ARE FED KRILL PHOSPHOLIPIDS COMPARED TO SOYBEAN PHOSPHOLIPIDS

相较于使用大豆磷脂，使用磷虾油磷脂饲养鲷鱼幼鱼可显著提高其存活率

鲷鱼 Gilthead Seabream

4周生长实验

4-WEEK GROWTH EXPERIMENT

对照组：69% 鱿鱼粉

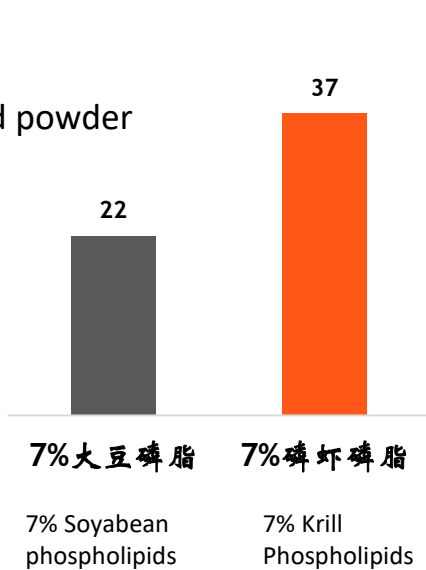
CONTROL DIET: 69% squid powder

实验组：
7% 磷虾磷脂和
7% 大豆磷脂

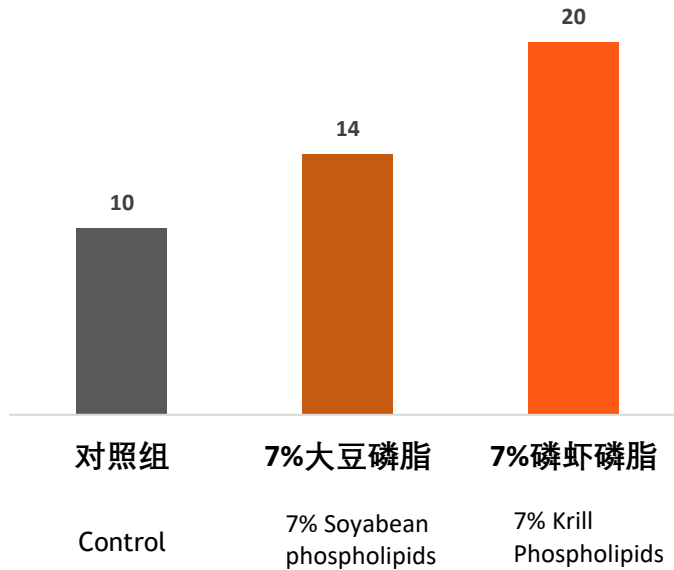
TEST DIET:

69% squid powder+
7% krill PLs or
7% soybean PLs

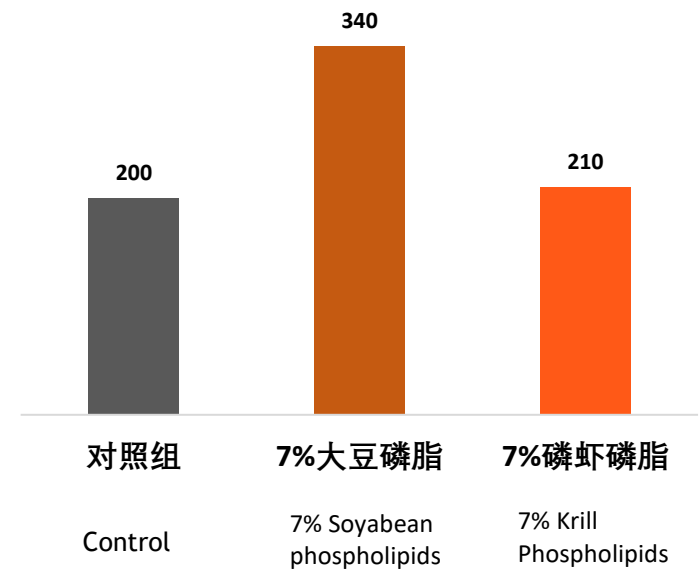
Survival rate
存活率 (%)



The average number of mineralized vertebrae
椎骨平均矿化程度



The malondialdehyde (MDA) content in larvae
氧化压力 (nM MAD/g 幼鱼)

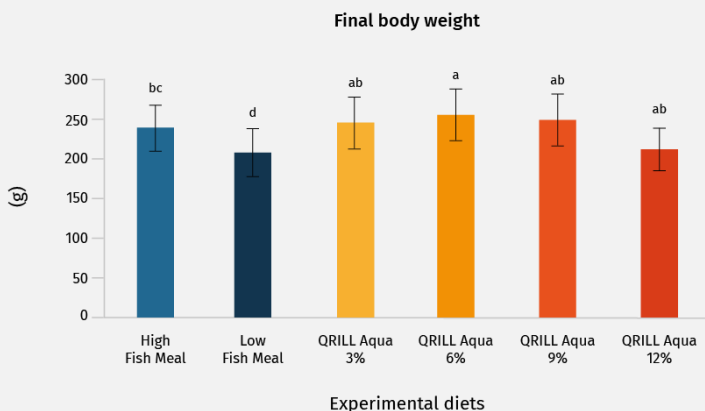


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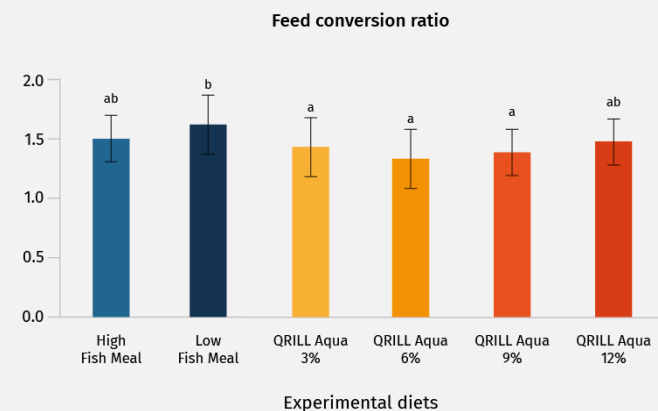
IMPROVING OLIVE FLOUNDER PERFORMANCE AND DISEASE RESISTANCE WITH DIETARY KRILL MEAL

Krill meal 可以改善褐牙鲈的生长表现和抗疾病能力

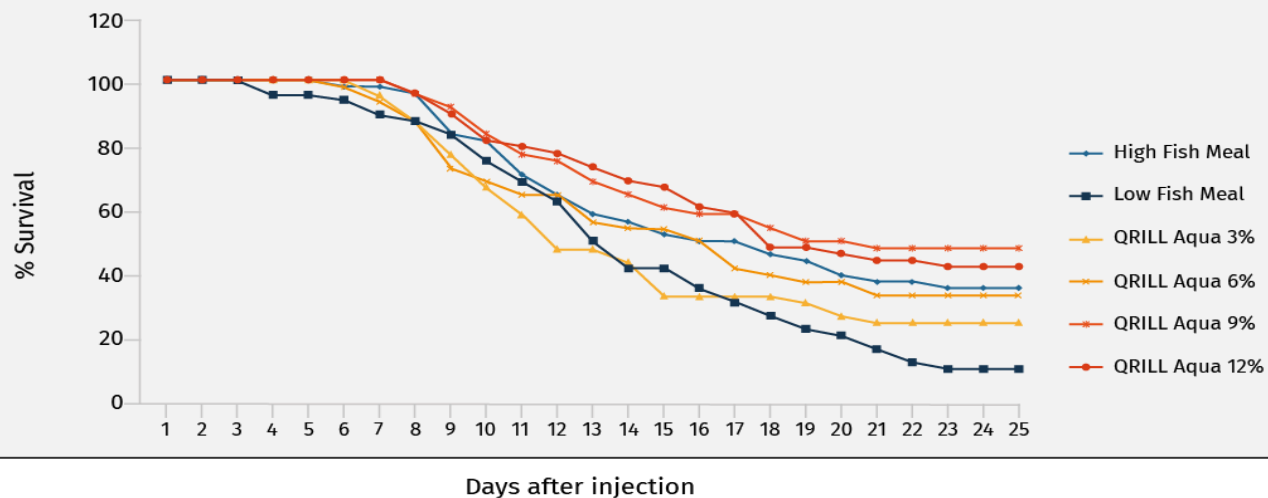
Enhanced growth 促进生长



Better feed conversion ratio 优化FCR



Increased disease resistance 增强疾病抵抗能力



5

SHRIMP GROWS MORE THAN 20% FASTER WITH THE INCLUSION OF 5% KRILL MEAL

相较对照组添加5%磷虾粉组，虾的周生长率提高超过20%

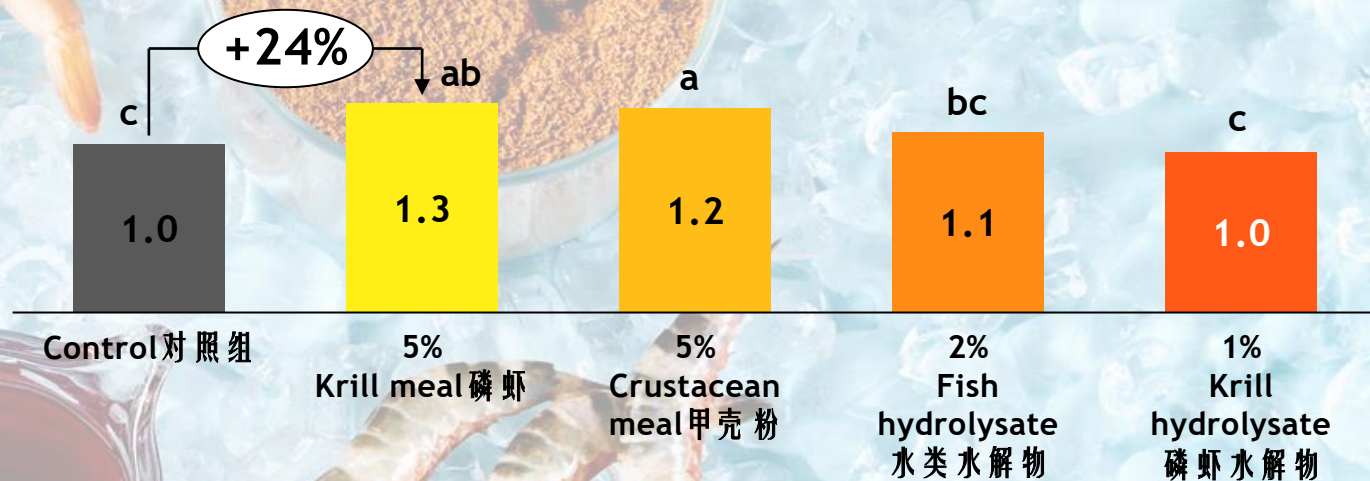
➤ 实验对象：黑虎虾 6周生长实验
BLACK TIGER SHRIMP (*PENAEUS MONODON*)
 6-WEEK GROWTH EXPERIMENT

➤ 对照组
 17%鱼粉，高含量其他蛋白源（25%肉，20%羽扇豆和5%鱿鱼粉）
CONTROL DIET: LOW FISH MEAL (17%), HIGH IN ALTERNATIVE PROTEIN SOURCES (25% MEAT, 20% LUPIN AND 5% SQUID MEAL)

➤ 实验组: 对照组基础上分别添加:
 5%磷虾粉
 5%甲壳纲粉
 2%鱼类水解物
 1%磷虾水解物

TEST DIETS: CONTROL+
 5% CRUSTACEAN,
 5% KRILL MEAL,
 2% FISH HYDROLYSATE
 1% KRILL HYDROLYSATE

Weekly growth rate 周生长率 (g)



6周的试验表明，磷虾组的平均生长率显著高于对照组。

The mean growth rates of shrimp fed krill meal for 6 weeks are significantly greater than of the control group.

6

KRILL IMPROVES PERFORMANCE OF PLANT-BASED DIETS

磷虾粉可改善植物性饲料的性能表现

➤ 南美白对虾 10周生长实验

Pacific white shrimp (*Litopenaeus vannamei*)

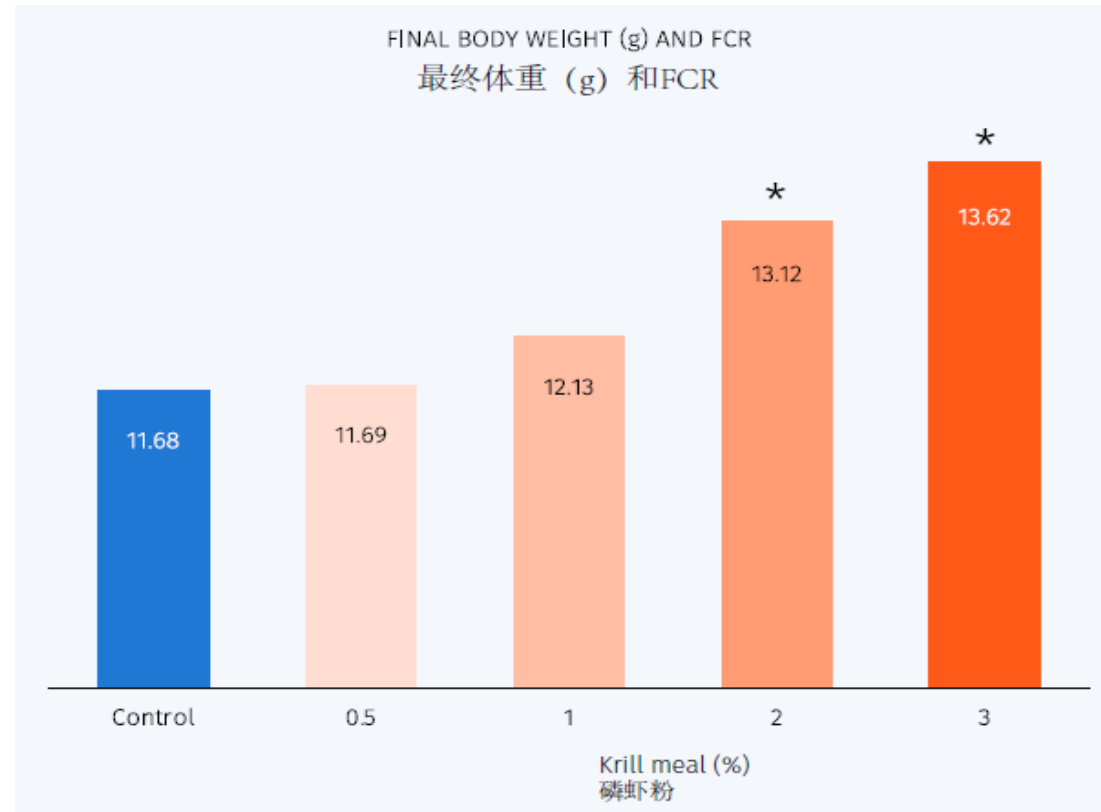
10-WEEK GROWTH EXPERIMENT

- 对照组：不含鱼粉，高含量植物源蛋白（30%大豆浓缩蛋白，24%小麦粉、15%豆粕、11%玉米蛋白粉）

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

- 实验组：0.5, 1, 2 或 3% 磷虾粉替代玉米蛋白粉和大豆油，以达到相同的粗蛋白和脂肪含量。

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

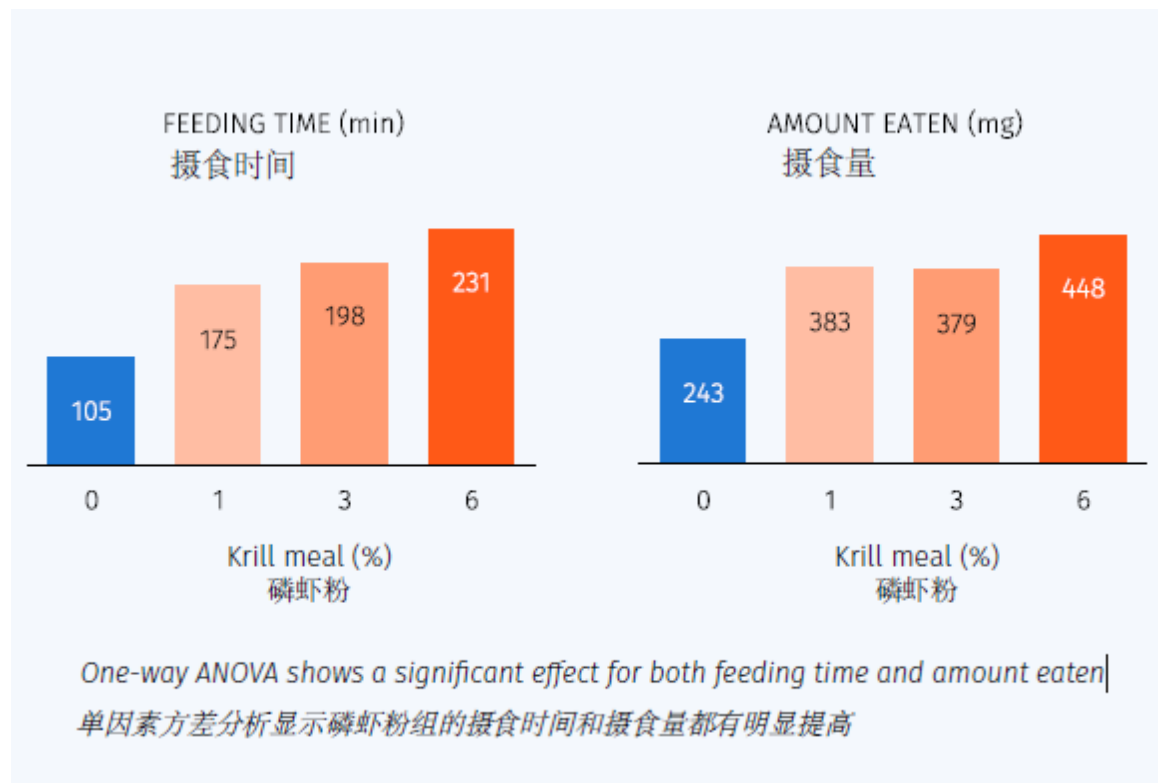


- 在植物性饲料中最低添加2%的磷虾粉可明显改善对虾的生长表现。
A minimum of 2% krill meal is needed in plant-based diets to significantly enhance shrimp performance.

7

KRILL EXTENDS FEEDING TIME 磷虾粉可延长摄食时间

- **南美白对虾 10周生长实验**
- **Pacific white shrimp (*Litopenaeus vannamei*)
10-WEEK GROWTH EXPERIMENT**
- **对照组：不含鱼粉，高含量陆生动植物粉（30% 豆粕、27% 鸡肉粉、34% 小麦粉**
- **CONTROL DIET:** No fish meal, high in terrestrial meal (30% soybean meal, 27% poultry meal, 34% wheat flour)
- **实验组：1, 3, 6% 磷虾粉分别替代1, 3, 6% 对照组原料**
- **TEST DIETS:** 1, 3 or 6% krill meal replacing 1, 3 or 6% of control diet



- **磷虾粉是一种饲料诱食剂，可提高适口性，延长摄食时间（不是加快速度），从而提高摄食量。**
- **Krill meal is a chemostimulant that increases the palatability by increasing the feeding time (not the speed) and thus the amount eaten.**

8

KRILL IN LOW AND MODERATE FISH MEAL DIETS IN AN INDIAN CONTEXT

磷虾粉可促进低含量和中等含量鱼粉饲料的生长表现

➤ 南美白对虾 10周生长实验

Pacific white shrimp (*Litopenaeus vannamei*)

10-WEEK GROWTH EXPERIMENT

- 实验组：0, 2, 4, 6% 磷虾粉分别添加到 6% 或 12% 鱼粉组

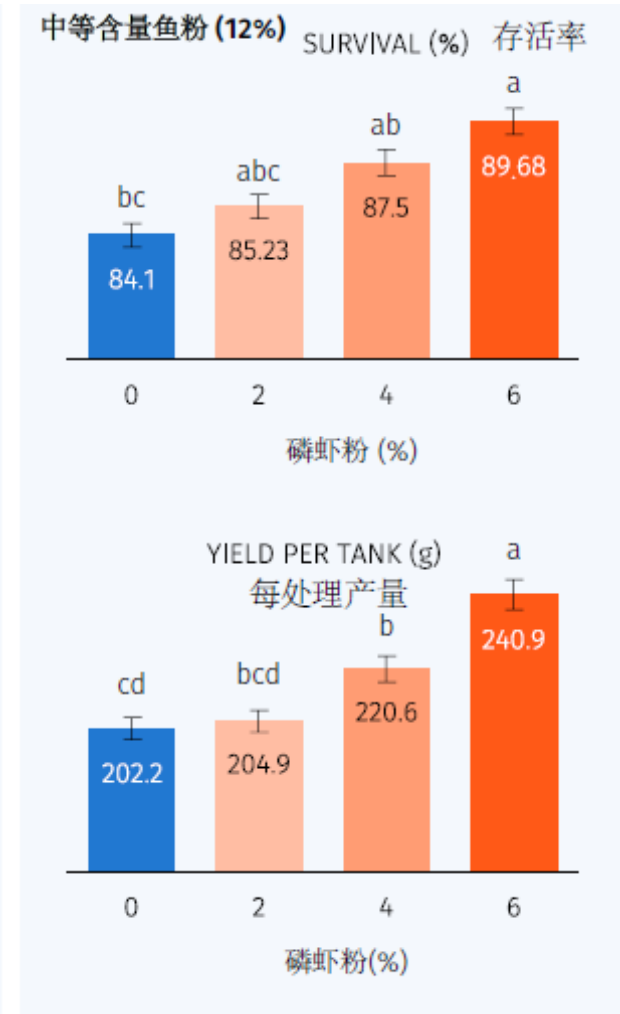
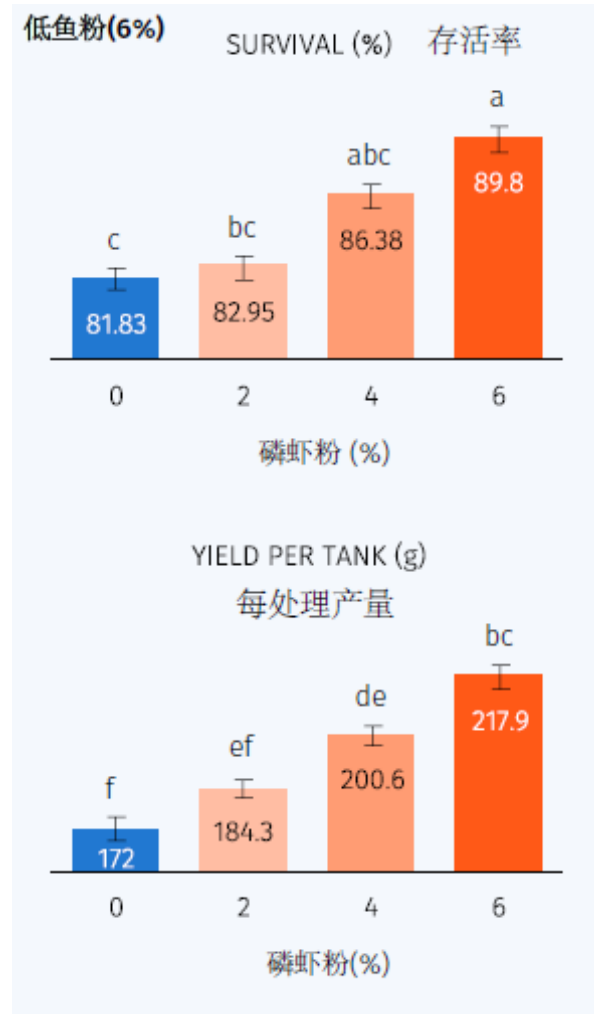
TEST DIETS: 0, 2, 4 and 6% krill meal in addition to either 6 or 12% fish meal

- 在中等鱼粉组（12%）最低添加4%的磷虾粉可明显改善对虾的性能表现。

4% krill meal inclusion is the minimum to give a measurable difference in performance of shrimp in moderate (12%) level fish meal diets.

- 在低鱼粉组（6%），磷虾粉添加量每增加2%都会对生长表现有促进作用。

In low (6%) fish meal diets **every incremental increase of 2% krill meal inclusion** resulted in a positive influence on various growth performance indicators.



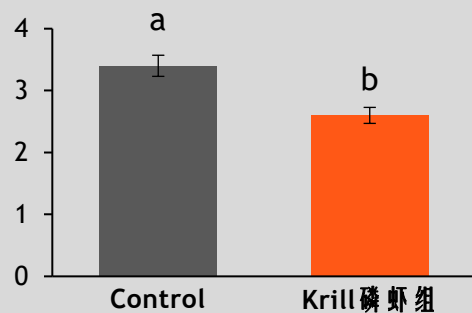
9

KRILL MEAL HAS A POSITIVE EFFECT ON SALMON FILLET: LESS GAPING – LESS MELANIN - FIRMER FILLET

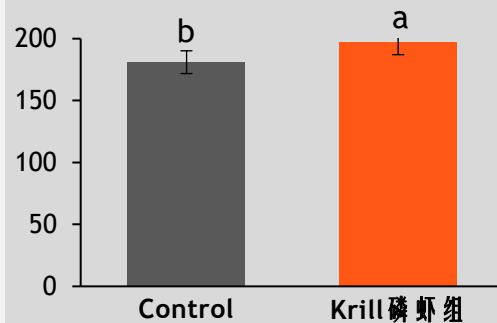
磷虾粉对三文鱼肌肉质量的提升作用：减少断纹-减少黑斑-紧实肌肉



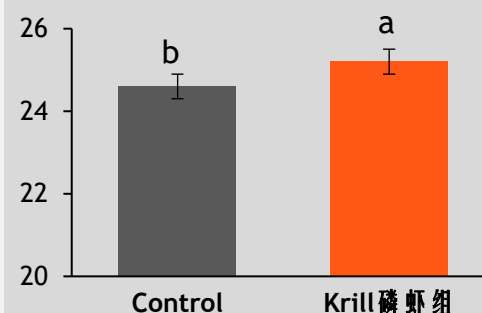
Less gaping/减少断纹



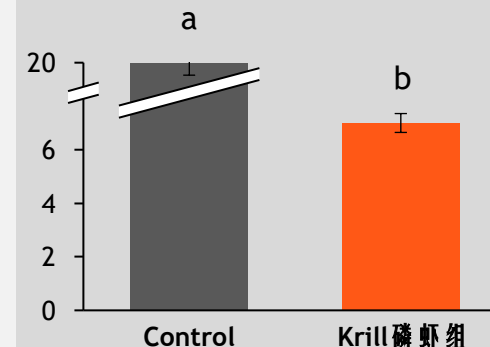
Firmer fillet/紧实肌肉



Better coloration/更优色泽



Less melanin/减少黑斑





THANK YOU!

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