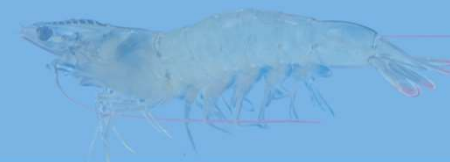
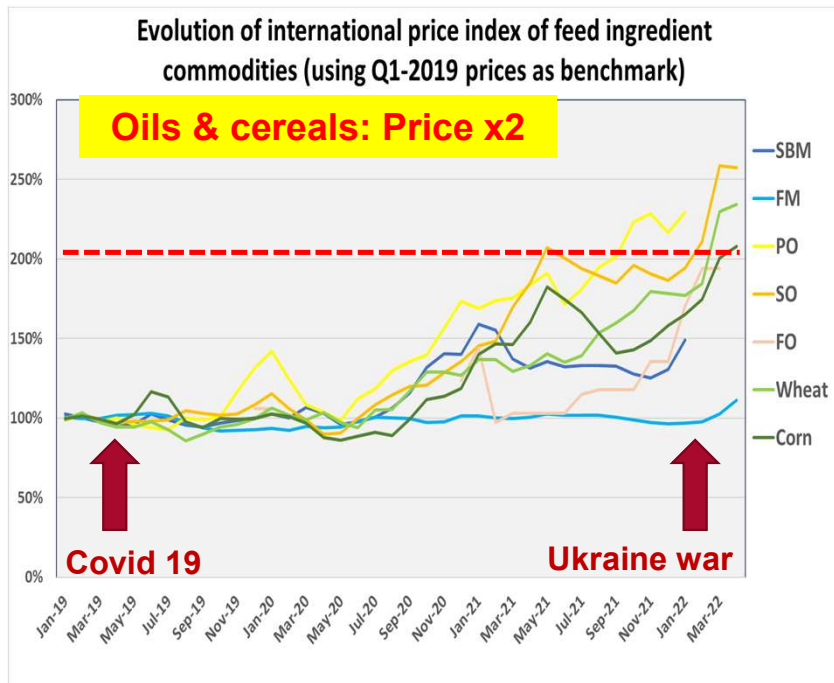


NUTRITIONAL STRATEGIES TO REDUCE COST OF SHRIMP AND FISH FEED

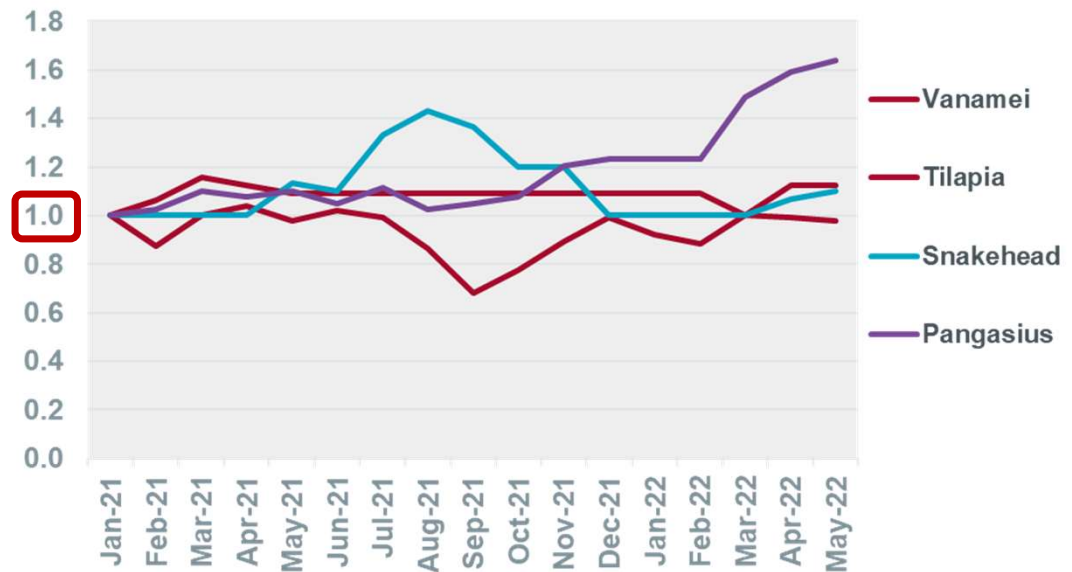
Waldo Nuez, DVM, PhD
Global R&D Manager Aquaculture



DIFFERENT PRICE EVOLUTION OF FEED INGREDIENTS vs. AQUACULTURE PRODUCTS



Vietnam aquaculture species farm-gate price index (using Jan 2021 price as index base)⁴



Legend: SBM = Soybean meal Arg 45-46%CP CIF Rotterdam*, FM = Fish meal Peru 65%CP CIF*, FO = Fish Oil FOB Peru**, PO = Malaysia Palm Oil CIF Europe*, SO = Crude Soya Oil Ex-mill NL*, Wheat = US HRW wheat FOB US port*, Corn = US Maize #2 FOB US port*.

*Source: www.indexmundi.com, Source: **Hammersmith



SUSTAINABLE FEED IS MORE AFFORDABLE FEED



“the development that meets the needs of the present, without compromising the ability of future generations to meet their own needs”



SUSTAINABILITY

- Environmental
- Economic
- Social and community



PRACTICES

- Farm management
- Environment
- Community



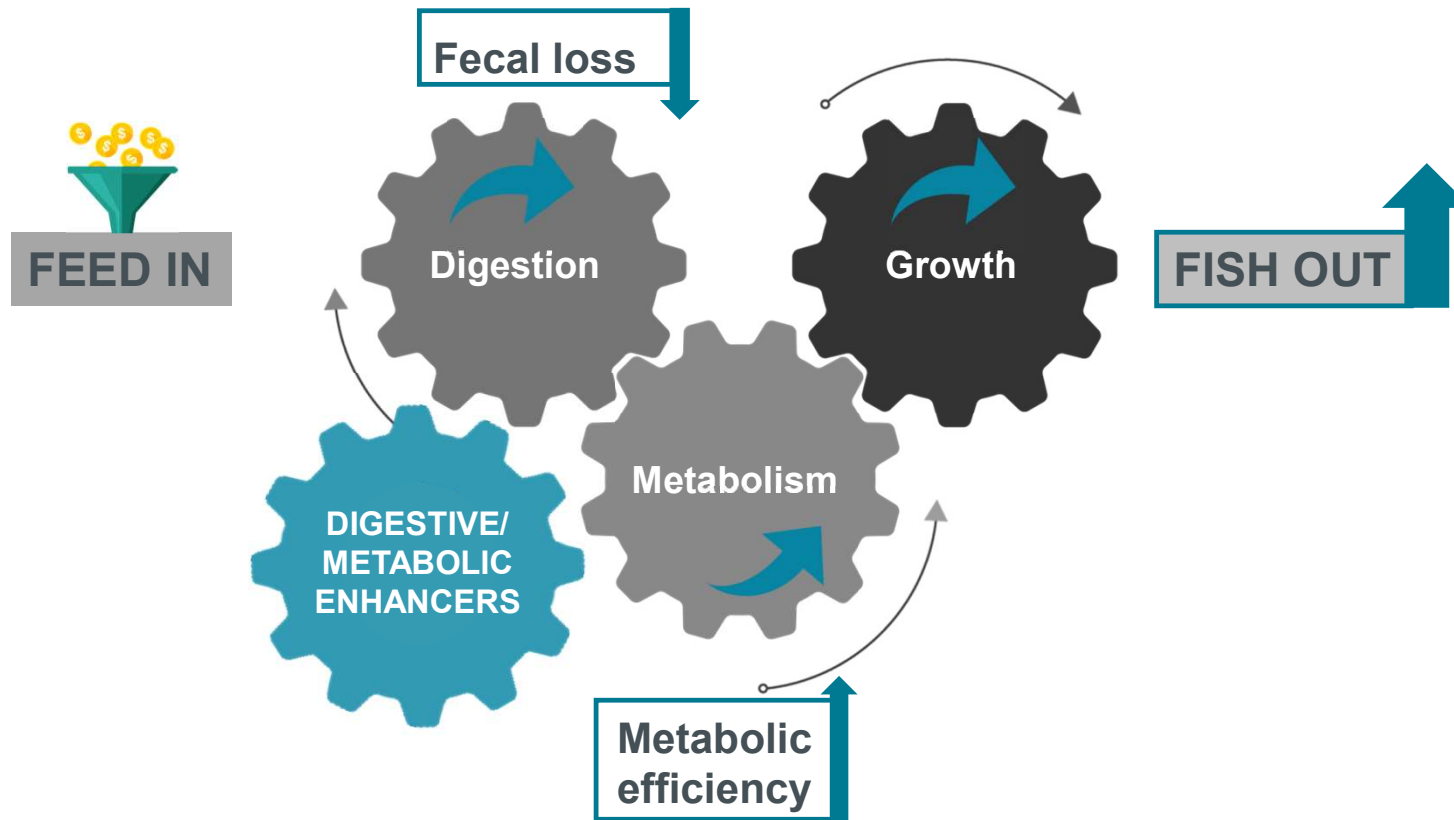
REDUCING FEED FORMULATION COST WITHOUT REDUCING QUALITY AND PERFORMANCE



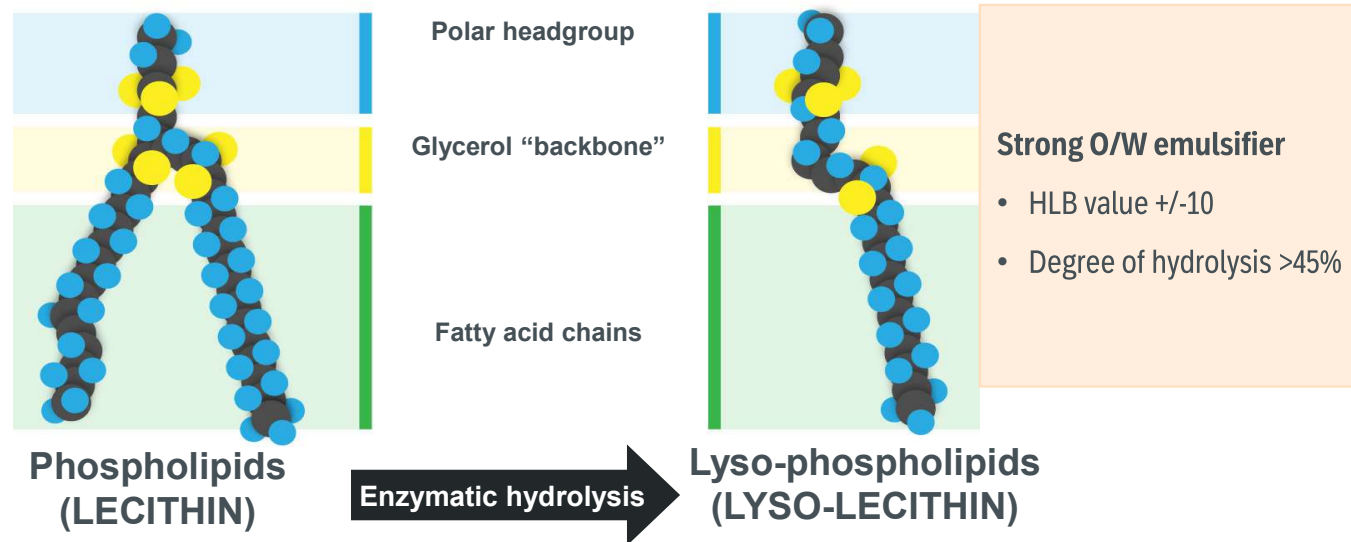
- Purchase planning and sourcing strategy
- Optimal least cost formulation
 - Essential nutrients
- R&D
- Digestive & metabolic enhancement for more efficient feeds



DIGESTIVE AND METABOLIC ENHANCEMENT FOR EFFICIENT NUTRITION



LYSO-PHOSPHOLIPIDS (LPL) AS DIGESTIVE/METABOLIC ENHANCER



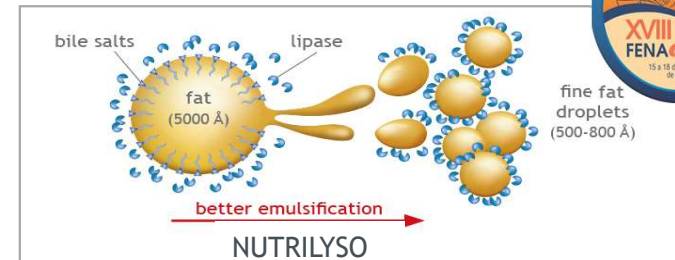
LYSO-PHOSPHOLIPIDS (LPL) AS DIGESTIVE/METABOLIC ENHANCER



1

EMULSIFICATION

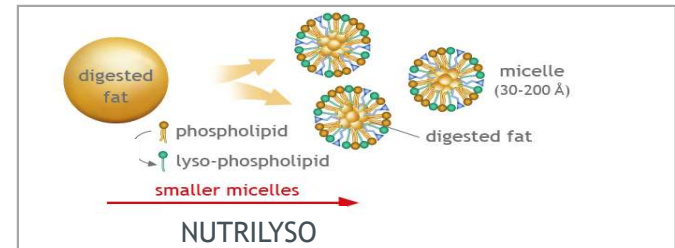
Improve the emulsification of fat in the digestive tract resulting in **more active surface for the lipase to act**



2

MICELLE FORMATION

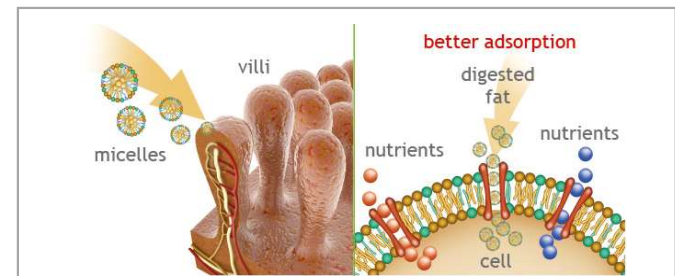
Facilitate the **formation of water-soluble and smaller micelles** which are more easily absorbed by the gut epithelium



3

NUTRIENT ABSORPTION / TRANSPORT

Optimize membrane permeability and **fluidity**, achieving a better absorption of fat soluble and small molecular weight nutrients



4

METABOLIC ENHANCEMENT

Optimize intestine and liver functionality



FISH

- *Feed cost reduction*
- *Growth performance*
- *Liver health*



LPL TO PARTIALLY REPLACE DIETARY OIL IN PANGASIVUS FEEDS



	31%CP 7% FAT	31%CP 6,5% FAT 0,05% NTL	31%CP 6% FAT 0,05% NTL	31%CP 5,5% FAT 0,05% NTL	31%CP 5% FAT 0,05% NTL	31%CP 5% FAT 0,08% NTL
Soybean meal, Brazil 48%	30,6	30,6	30,6	30,6	30,6	30,6
Cassava chips	15	15	15	15	15	15
Wheat industry	13	13	13	13	13	13
Wheat pollard Indo	10,33	10,33	10,33	10,33	10,33	10,33
Meat and bone meal, 53%CP	10	10	10	10	10	10
Poultry by product meal, feed grade	8	8	8	8	8	8
Blood cell meal, ring dried	4	4	4	4	4	4
DDGS Indo	3,5	3,5	3,5	3,5	3,5	3,5
Palm oil	2,5	2,25	2	1,75	1,5	1,5
Fish oil	1,2	0,95	0,7	0,45	0,2	0,2
Premix Indo	1	1	1	1	1	1
Salt, NaCl	0,5	0,5	0,5	0,5	0,5	0,5
NUTRILYSO	0	0,05	0,05	0,05	0,05	0,075
Limestone	0	0,4	0,9	1,4	1,9	1,85
DL_Met	0,1	0,1	0,1	0,1	0,1	0,1
Choline choride, 60% choline	0,1	0,1	0,1	0,1	0,1	0,1
Toxin binder	0,1	0,1	0,1	0,1	0,1	0,1
Aquavit stable C	0,05	0,05	0,05	0,05	0,05	0,05
Antioxidant	0,01	0,01	0,01	0,01	0,01	0,01
Antimold	0,01	0,01	0,01	0,01	0,01	0,01
	100	100	100	100	100	100
USD/MT (2020)	399,75	400,74	396,64	392,53	388,43	390,97
<i>FO: USD 1236 / PO: USD 515</i>			<i>(- USD 3)</i>	<i>(- USD 7)</i>	<i>(- USD 11)</i>	<i>(- USD 10)</i>



Pangasius

12-100 g

62 days

n = 5

20 fish/cage (2x1x1.5m)

FO: USD 2090
PO: USD 1670

- USD 5

- USD 14

- USD 20

- USD 33

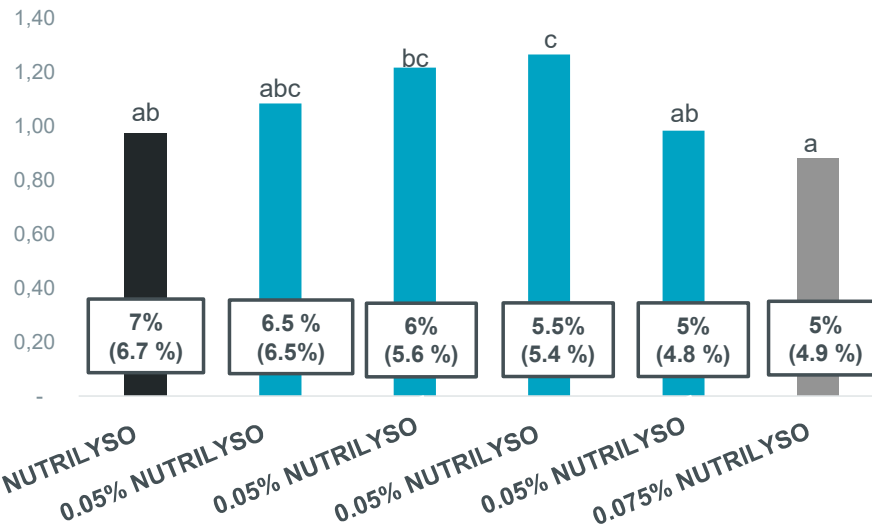
- USD 31



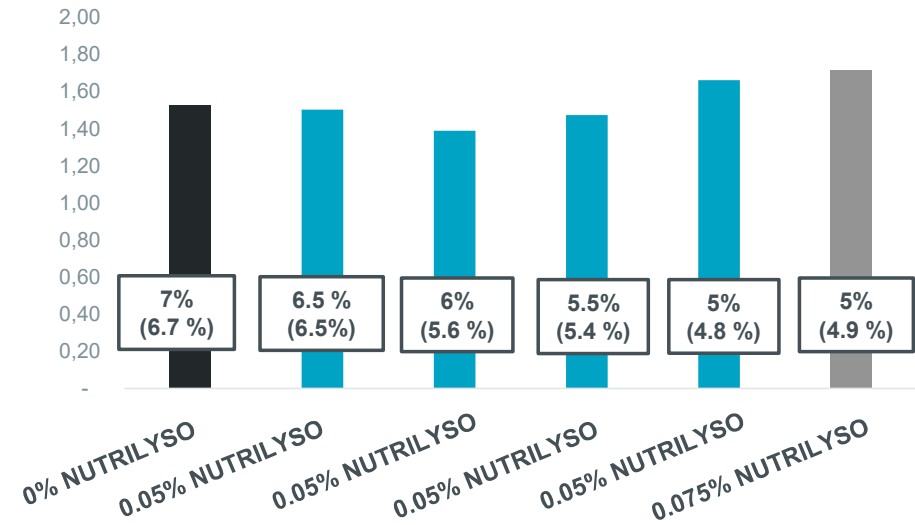
LPL TO PARTIALLY REPLACE DIETARY OIL IN PANGASIIUS FEEDS



Average Daily Gain (g)



FCR

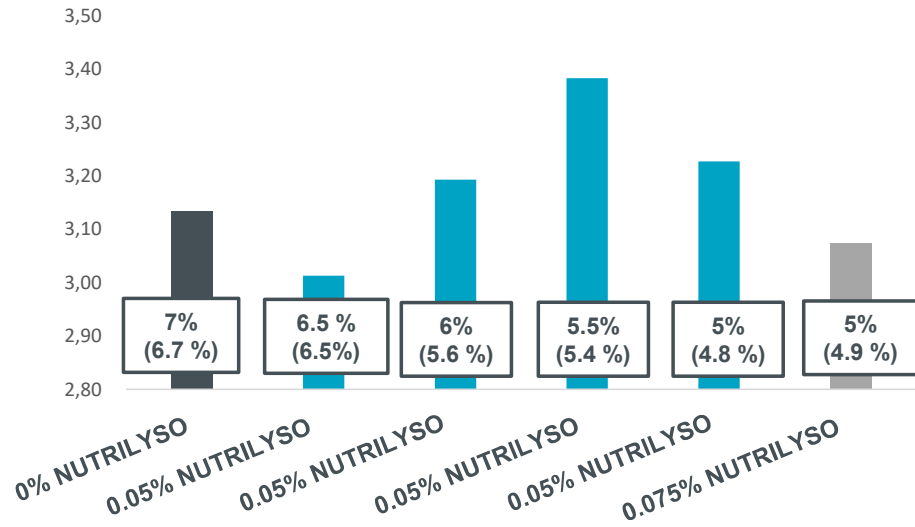


↑ ↑ ↑ **0.05% NUTRILYSO = 0.5 - 1.5% FAT** ↓ **5-20 USD/ton feed** ↑ ↑ ↑

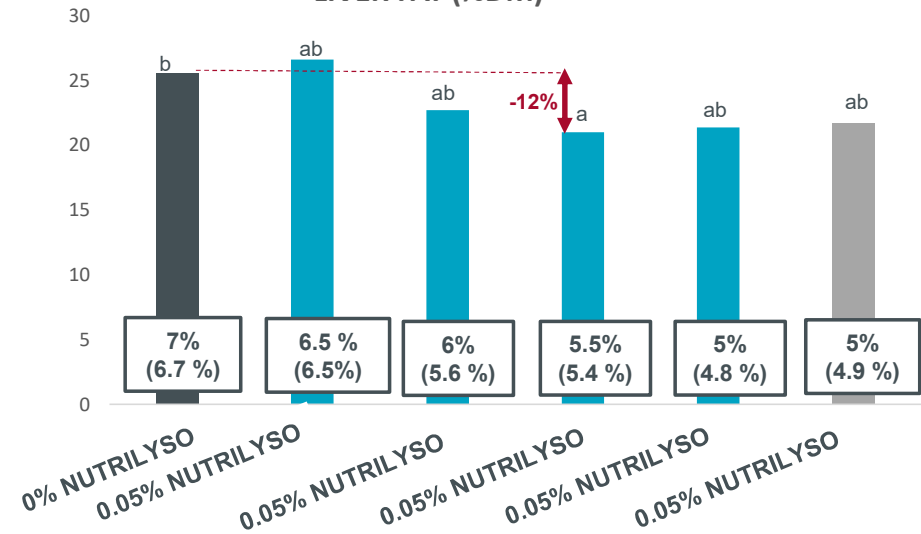


LPL REDUCES FAT DEPOSITION IN LIVER

HIS

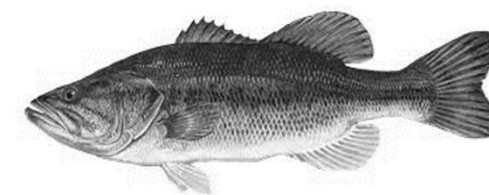


LIVER FAT (%DM)



LPL TO BOOST PERFORMANCE AND LIVER HEALTH OF LARGEMOUTH BASS

	CON	LPL NUTRILYSO	BILE ACIDS
Fish meal-imported	45	45	45
Poultry by meal	5	5	5
Soybean meal-cp46	9.5	9.5	9.5
Flour	10	10	10
Wheat gluten meal	5	5	5
Tapioca starch	3	3	3
Soybean oil	6	6	6
Fish hydrolysis	5	5	5
Spray-dried animal blood cells	3	3	3
Monocalcium phosphate	1.5	1.5	1.5
Premix	1	1	1
Cellulose microcrystalline	6	5.97	5.97
LPL-based Nutrilysso	/	0.03	/
Bile acids (BA)	/	/	0.03
Crude protein	48	48	48
Crude lipids	11	11	11
Starch	10.5	10.5	10.5



Largemouth bass

(*Micropterus salmoides*)

21.1 ± 1.2g

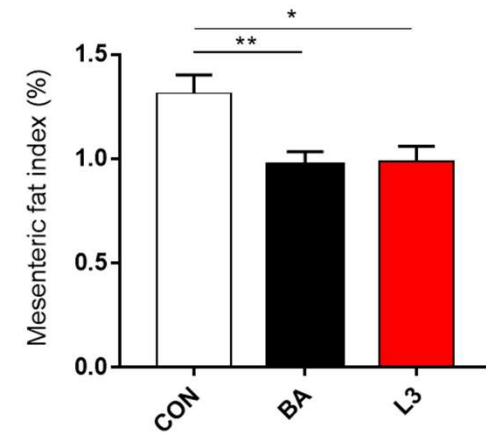
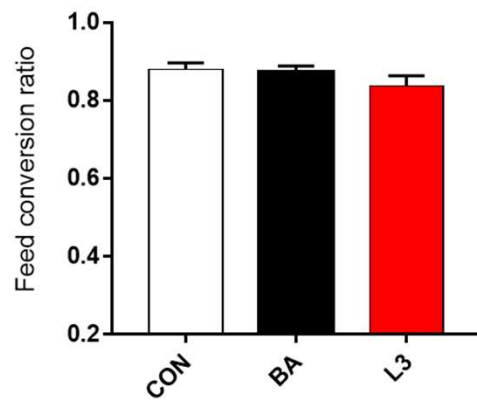
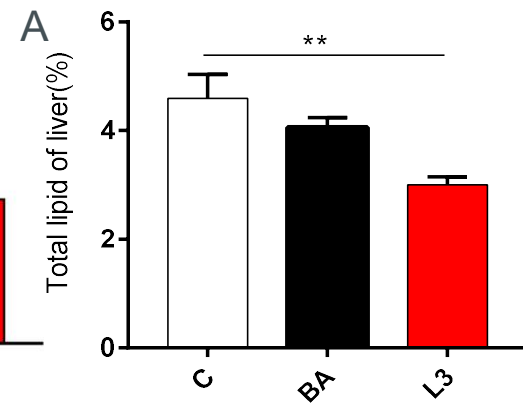
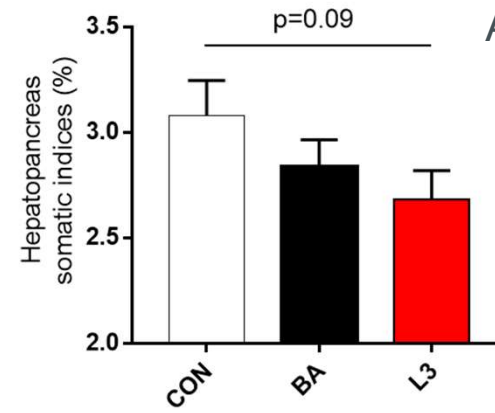
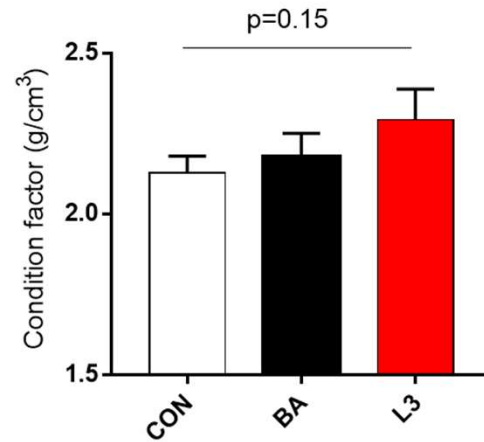
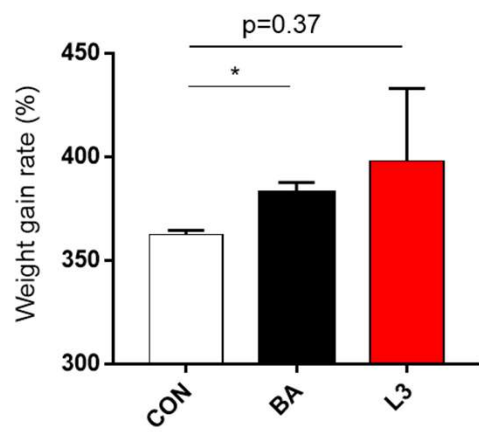
59 days

26-28°C

n=4



LPL TO BOOST PERFORMANCE AND LIVER HEALTH OF LARGEMOUTH BASS



SHRIMP

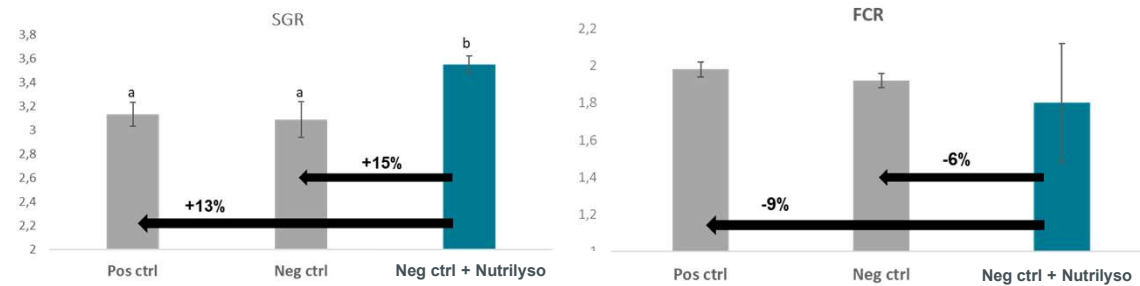
- *Feed cost reduction*
- *Growth performance*



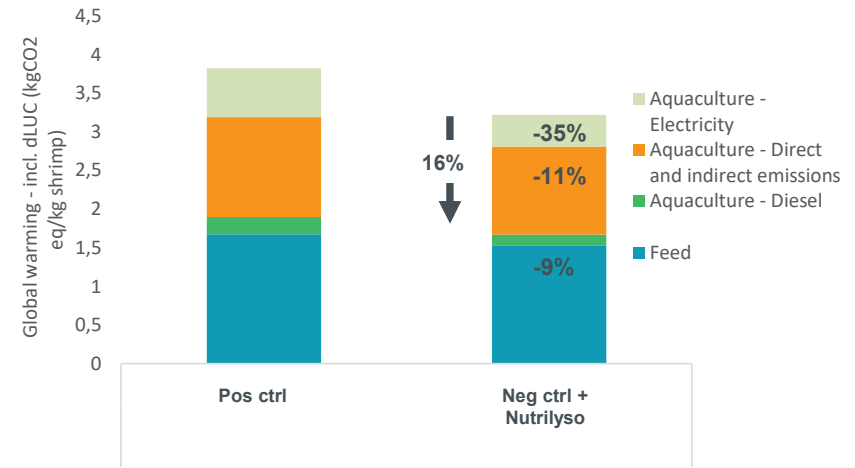
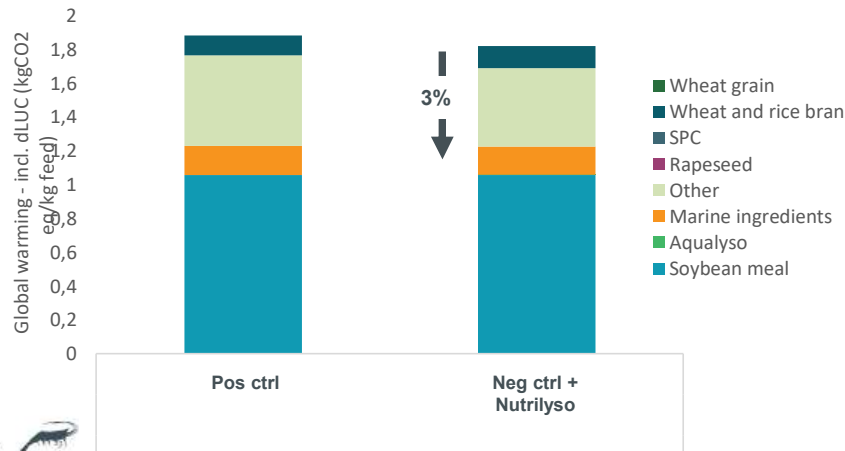


LPL TO PARTIALLY REPLACE LIPID SOURCES IN SHRIMP FEEDS: FEED COST AND CARBON FOOTPRINT

	Pos ctrl	Neg ctrl	Neg ctrl + AQUALYSO
Fishmeal (CP69)	10	10	10
Fishmeal (CP62)	2	2	2
Soybean 48	42	42	42
Wheat Gluten	2	2	1.9
Corn Gluten	6	6	6
Wheat flour (CP 12)	20	20	20
Squid meal	2	2	2
vitamin premix	1	1	1
mineral premix	2	2	2
Mono Ca Phosphate	1	1	1
CMC	0.5	0.5	0.5
Rice bran	7.75	9	9
Lecithin	1.75	1	1
Fish oil	2	1.5	1.5
NUTRILYSO	0	0	0.1



Survival = 80%



LPL TO BOOST PERFORMANCE OF LOW CHOLESTEROL SHRIMP FEEDS



	HIGH CHOL	HIGH CHOL + 0.1% NUTRILYSO	LOW CHOL	LOW CHOL + 0.1% NUTRILYSO
Fish meal (CP, 67.23%)	200	200	70	70
Soybean meal (CP: 47.68%)	250	250	435	435
DaBomb-P (CP: 51.31%)	150	150	150	150
Fish oil	30	30	10	10
Soybean oil (refined)	0	0	30	30
Soy lecithin	10	10	10	10
Corn starch	80	80	80	80
Alpha-starch	100	100	100	100
Squid liver meal (CP, 42.56%)	70	70	70	70
Choline chloride	15	15	15	15
Vitamin premix	10	10	10	10
Mineral premix	20	20	20	20
NUTRILYSO	0	0.1	0	0.1
Alpha-cellulose	65	65	30	30
Moisture	9.14	8.94	9.64	8.07
Crude protein	37.83	37.40	37.39	37.48
Ether extract	6.76	7.13	6.25	6.86
Crude fiber	7.15	8.17	4.61	3.77
Nitrogen free extract	31.15	30.67	35.49	37.05
Ash	7.67	7.69	6.63	6.78
Cholesterol	0.12	0.12	0.05	0.05



2-11 g

8 wks

n = 3

20 shrimp /tank (300L)

6% BW / 4 feedings/day

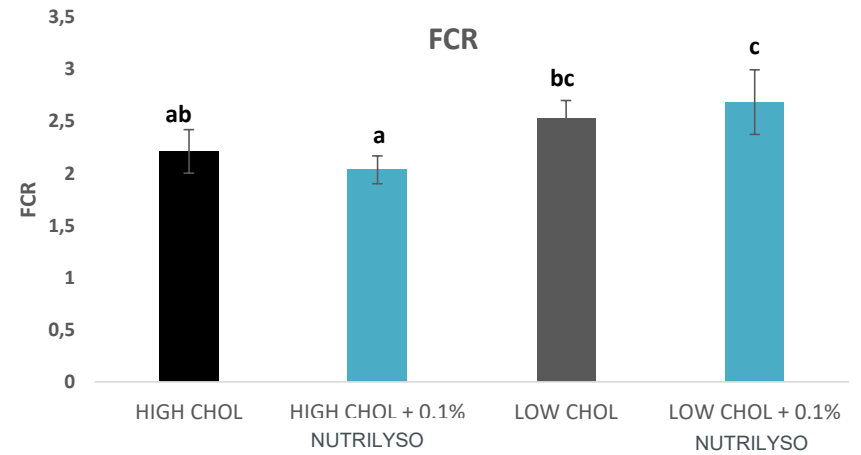
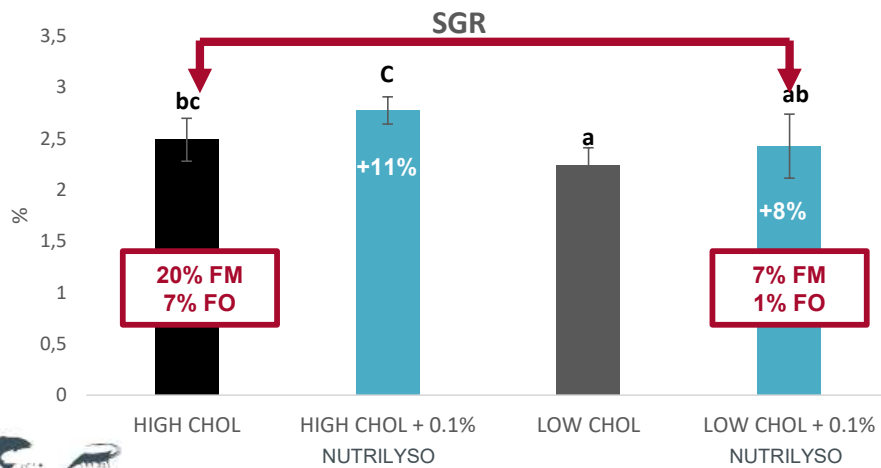
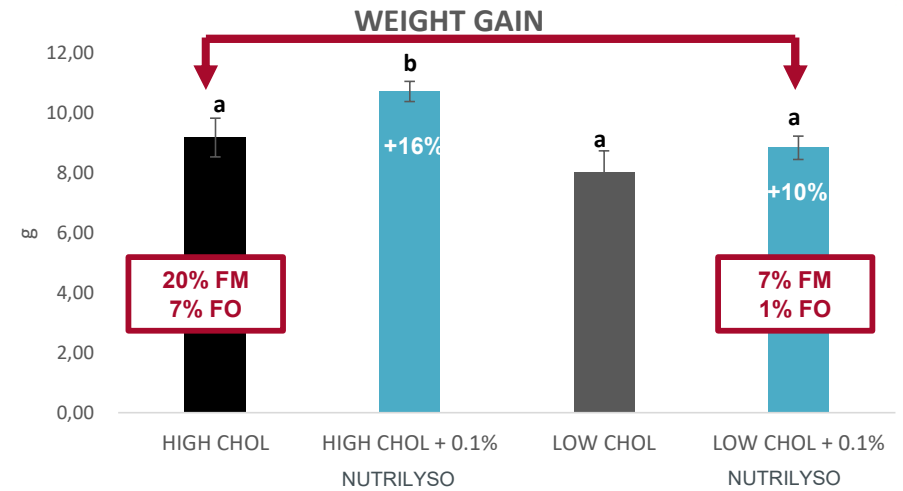
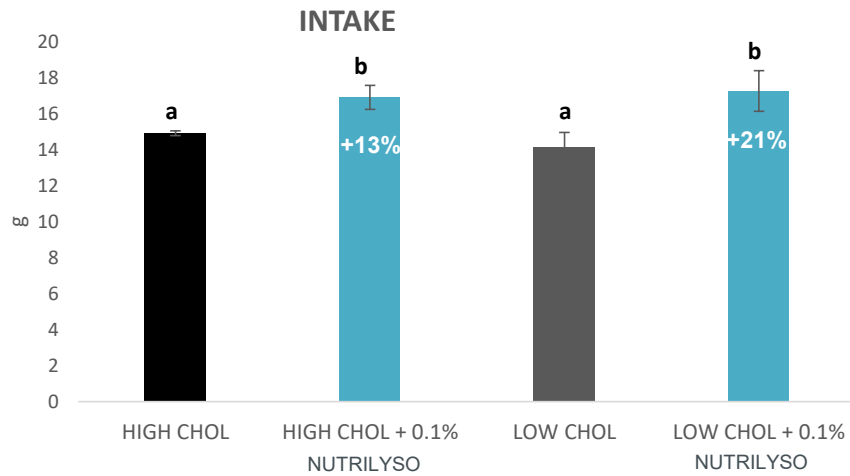
28°C ± 1°C

FM: 1440 USD/ton
SBM: 620 USD/ton
FO: 1670 USD/ton
SBO: 1690 USD/ton

- USD 50/ton
+ 0,1% NUTRILYSO



LPL TO BOOST PERFORMANCE OF LOW CHOLESTEROL SHRIMP FEEDS



DIGESTIVE / METABOLIC ENHANCERS TO REDUCE FEED COST IN A SUSTAINABLE WAY



➤ Lysophospholipids

- More than emulsification
- Feed cost reduction
- Reduced carbon footprint

Species	Nutrilyso	Reduction strategy	Result
Fish (Pangasius)	0.5 kg/ton	0.5-1.5 % oil (FO + PO)	Same growth
Shrimp (Vannamei)	1 kg/ton	1% lecithin	Same growth
Shrimp (Vannamei)	1 kg/ton	0.75% lecithin + 0.5% oil	Same growth
Shrimp (Vannamei)	1 kg/ton	0.07% cholesterol	Same growth





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A Bluestar Company



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