The true contribution of marine ingredients: **optimising human nutrition within global constraints**

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A secure future relies on both nutritious and sustainable foods

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Climate friendly

Nutrient rich

Small pelagic species are top performers in both dimensions: climate and nutrition

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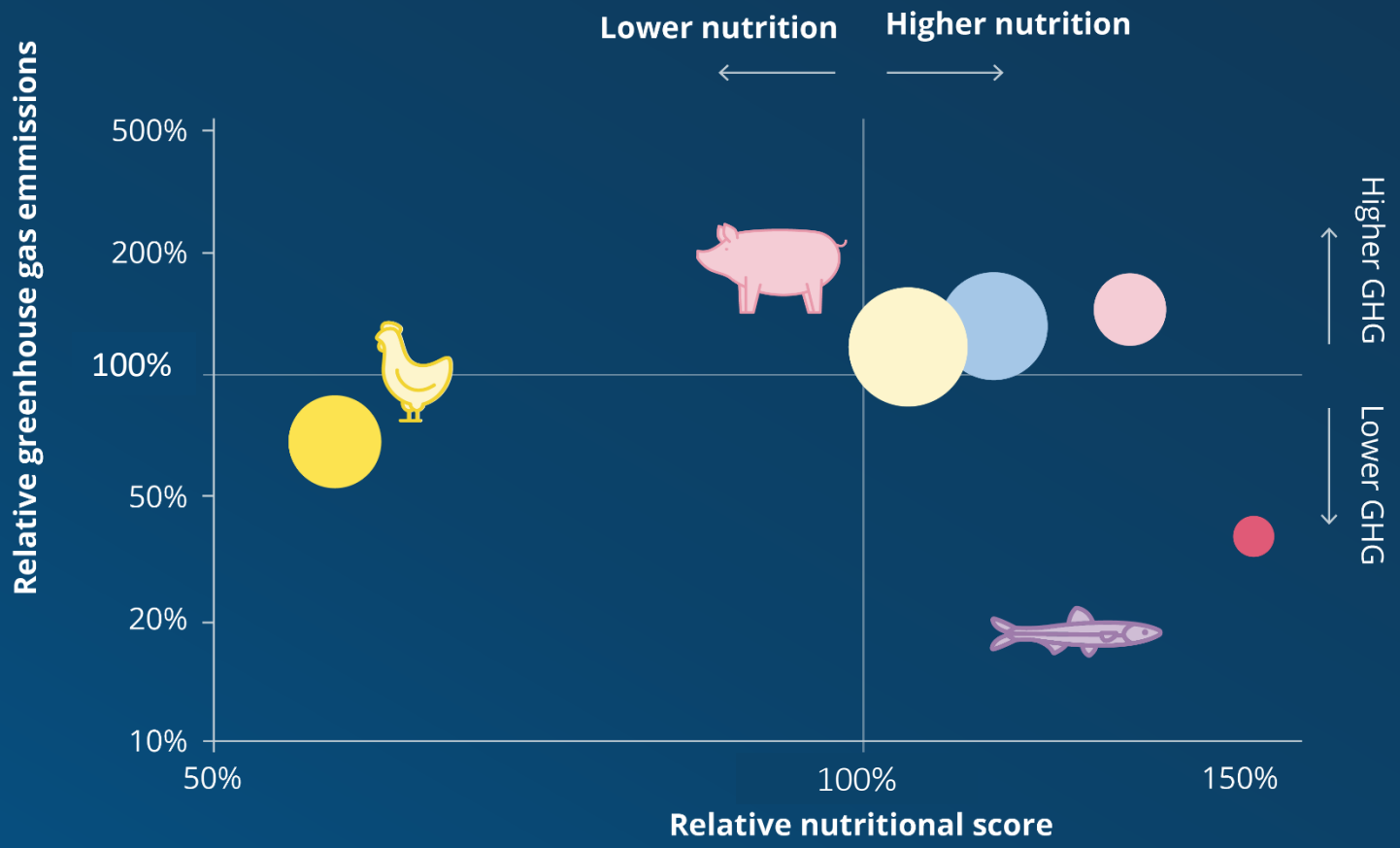

- Farmed salmon
- Wild caught salmon
- Farmed whitefish
- Wild caught whitefish
- Large pelagics
- Small pelagics

Relative size of seafood group bubbles is proportionate to 2015 global edible weight production volumes

Source: Bianchi, M., Hallström, E., Parker, R.W.R. et al. Assessing seafood nutritional diversity together with climate impacts informs more comprehensive dietary advice. Commun Earth Environ 3, 188 (2022). https://doi.org/10.1038/s43247-022-00516-4)

Small pelagic species have a low carbon footprint

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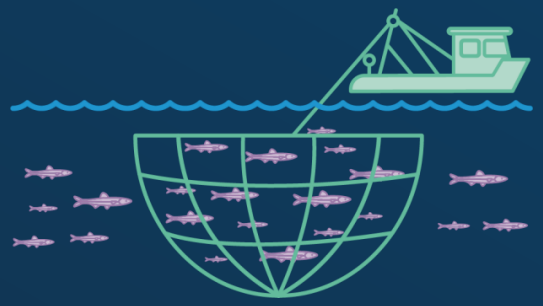
Low carbon footprint fishing methods are used to catch small pelagic species



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Small pelagic by-products are a low carbon footprint resource and reduce waste

=

Low carbon footprint resource

Source: Angel Avadi et al., Life cycle assessment of fisheries: A review for fisheries scientists and managers, in Fisheries Research 143 (2013) 21-38

Small pelagic species are one of Nature's best nutrient sources

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Digestibility

Immune Function

Fertility

Vision

Meat Quality

Growth

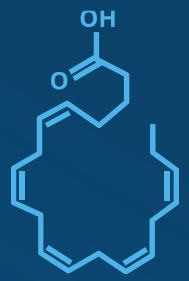
Welfare

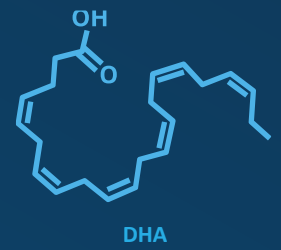
Egg Quality

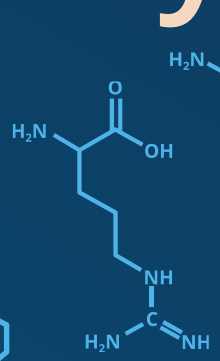
Osmoregulation

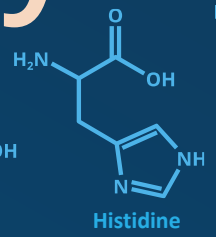
Palatability

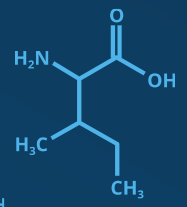
Disease Resistance

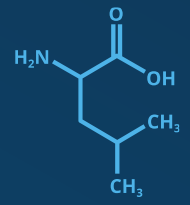


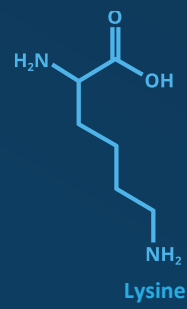


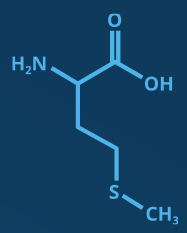


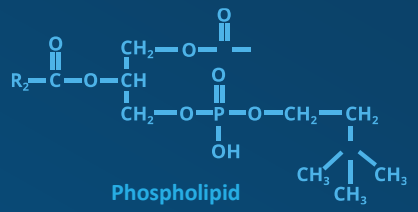


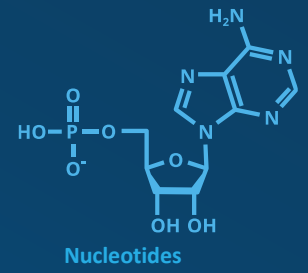


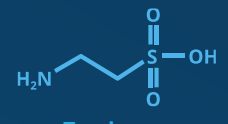












Where do we get small pelagic species from in our diets?

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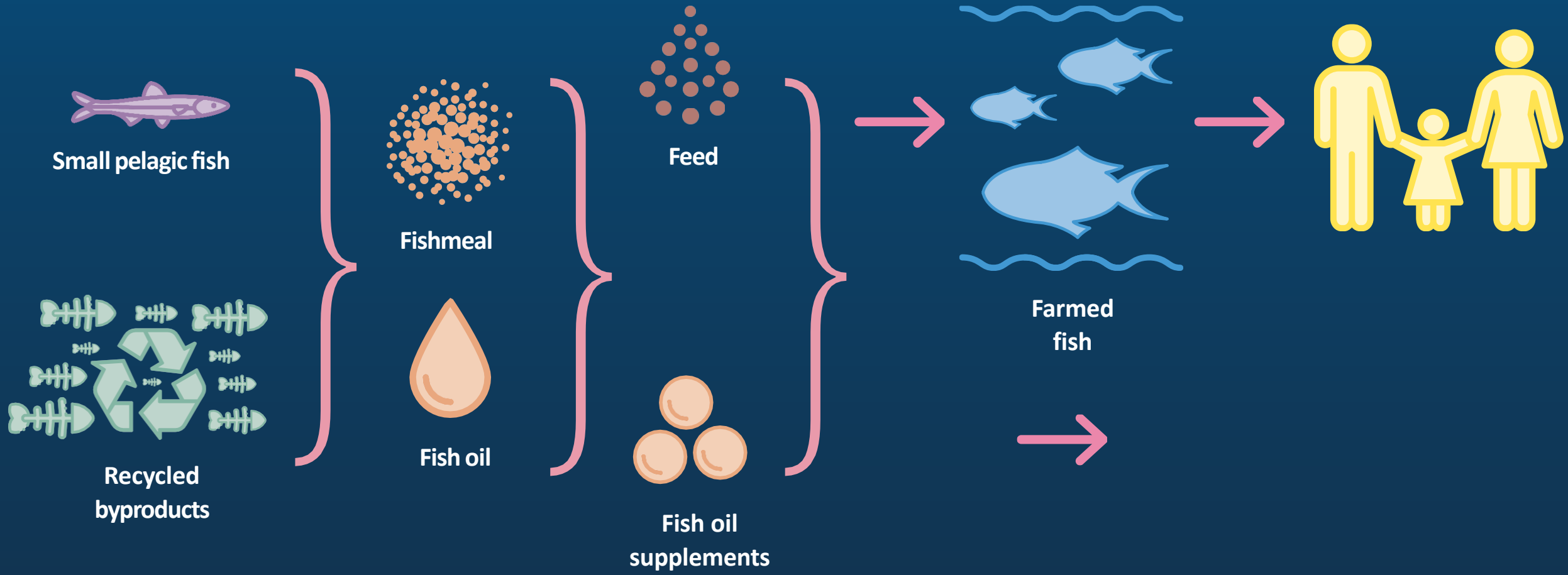

Farmed fish is the most resource-efficient animal protein on the planet

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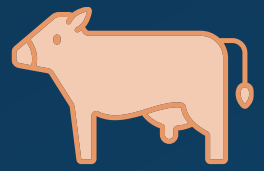
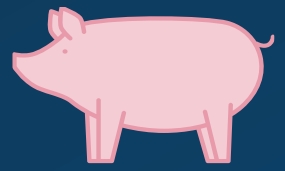

Feed Conversion Ratio	6–10	2.7–5	1.7–2	1.2–1.5
Fresh Water in litre	9,463	13,249	7,570	1
Carbon Footprint g of CO_2 eq per g of edible protein	5.9	1.3	0.9	0.6

Source: Global Salmon Initiative, 2019 Sustainability Report

Fishmeal and fish oil's most strategic use in food production is in aquaculture

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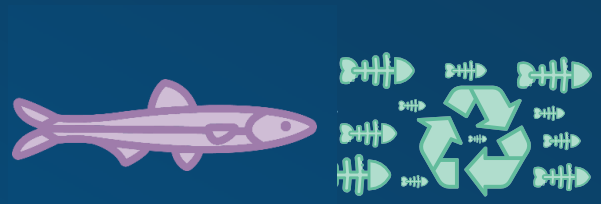
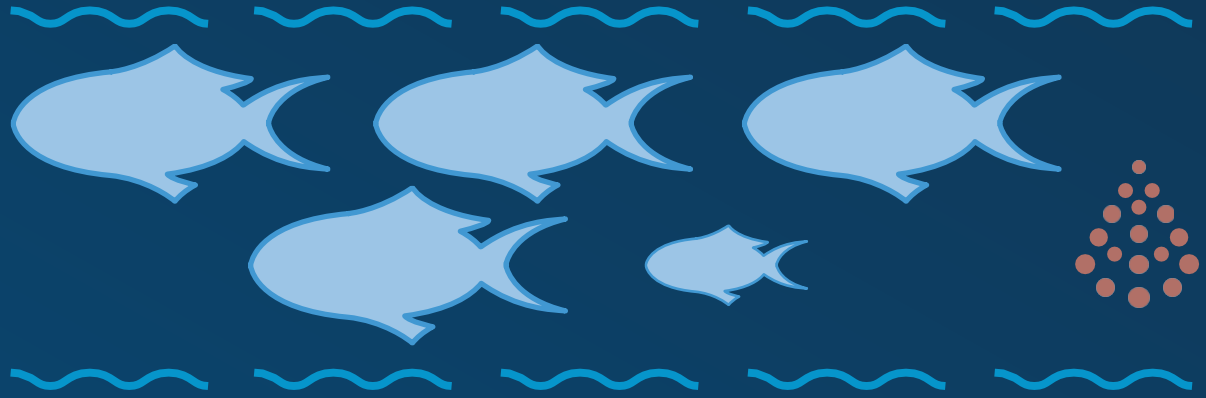
1kg



Raw material used to produce fishmeal and fish oil

5kg



Farmed fish

Source: Kick et al, 2020

Aquaculture is the most effective way to use the nutrients that small pelagic species contain

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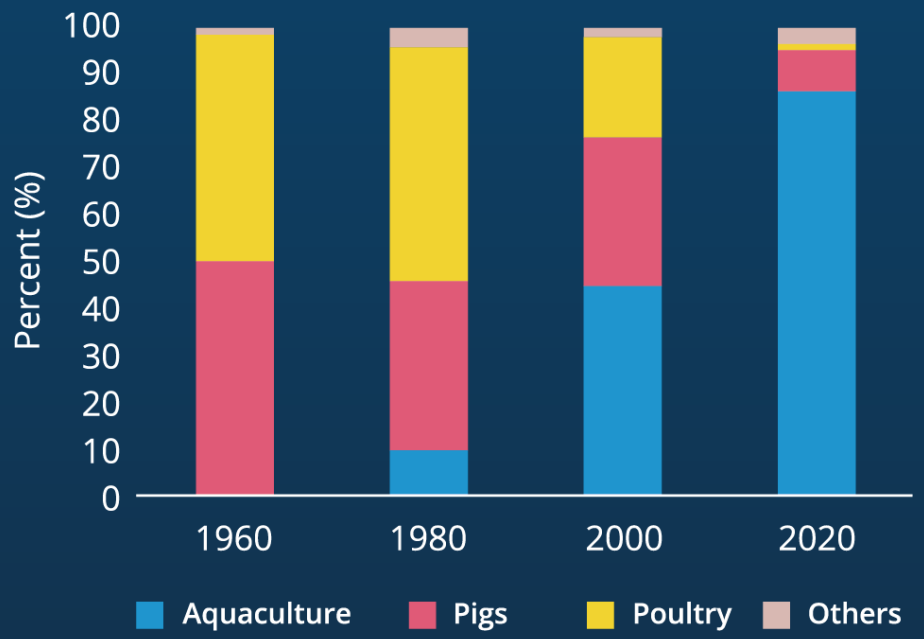
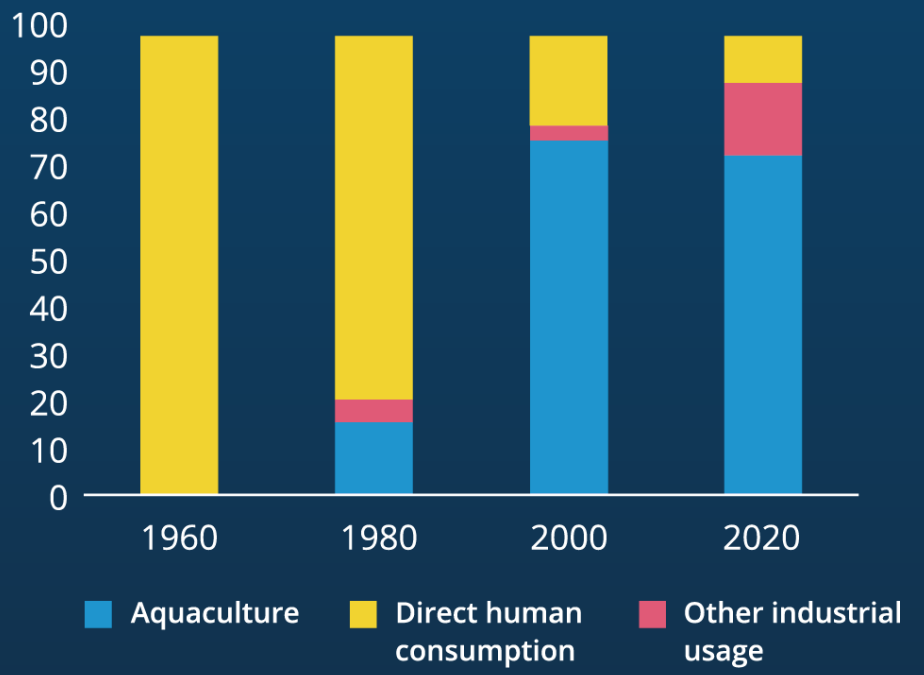
Fishmeal

From pigs and chicken feed to aquafeed



Fish oil

From discard to aquafeed and human health



Small pelagic species have specific features...

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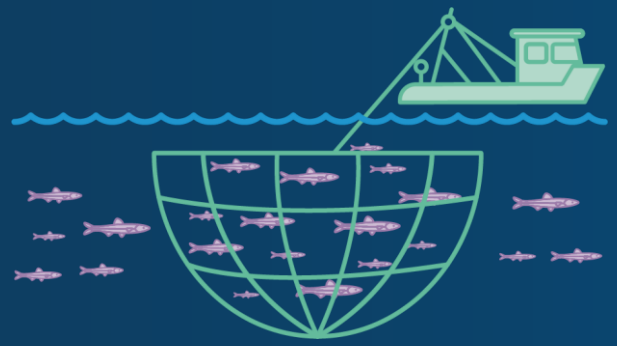
Short life

Finite resource



Seasonal harvesting

Exceptional nutritional properties

… which limit the way they can be used

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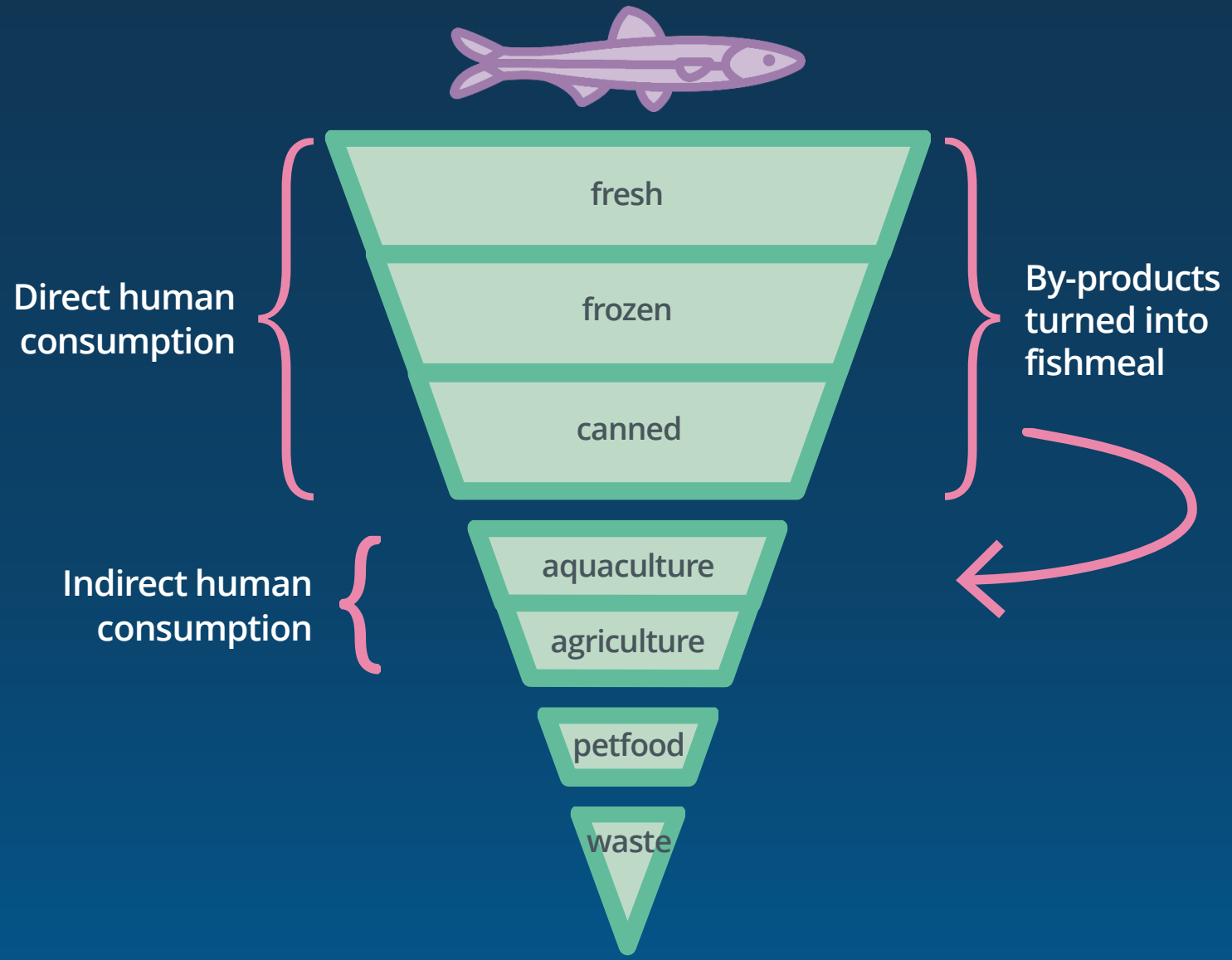

Fishmeal and fish oil accentuate the palatability of feed...

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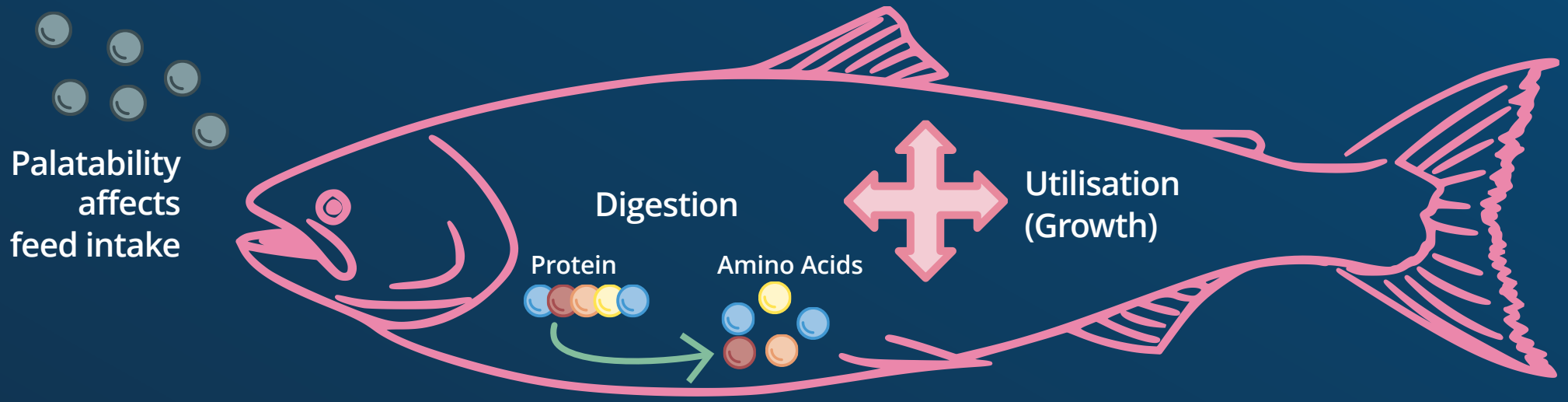
Palatability determines how much the fish eats, the first and most important hurdle for feed.



… and provide well rounded nutrition in aquatic diets

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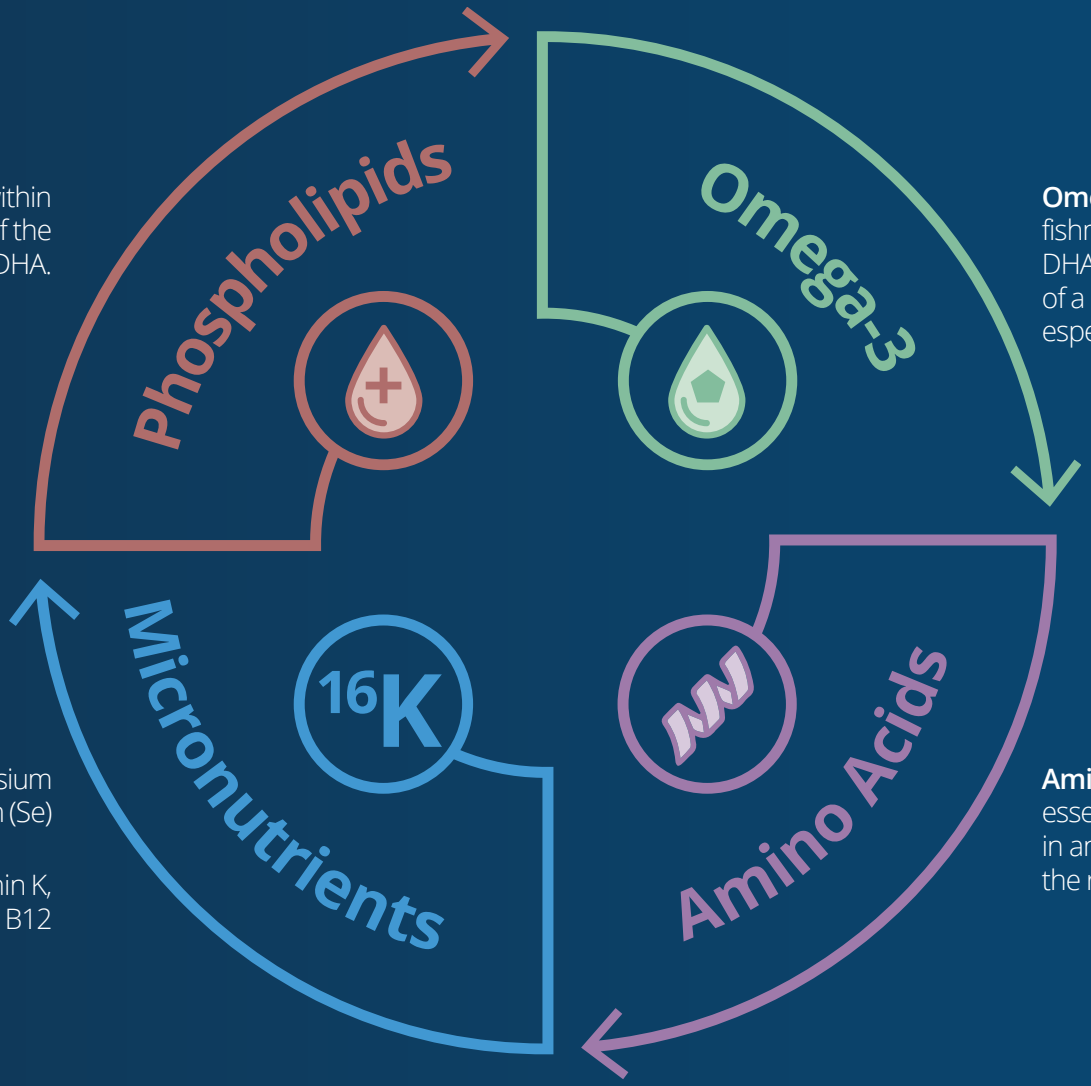
Phospholipids are a type of fat rich within fishmeal. Phospholipids enhance the use of the super-nutrients EPA and DHA.



Omega-3 are in abundance in the fats within fishmeal, including the super-nutrients EPA and DHA. These nutrients are an essential component of a healthy and balanced diet for all animals, but especially farmed fish.

Minerals: Calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K) , and selenium (Se)

Vitamins: Vitamin A, vitamin D, vitamin E, vitamin K, as well as vitamins B1, B2, B6 and B12

Amino Acids are protein's building blocks and an essential part of the diet. Fishmeal contains them in an abundance and in a balance that fit precisely the requirements for fed aquatic species.

Omega-3s play a specific role but not all of them are equal

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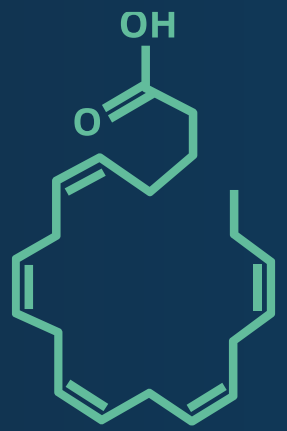
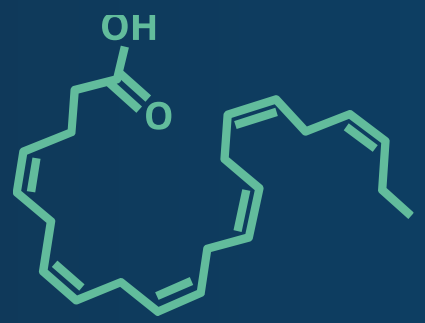
Long-chain omega-3s



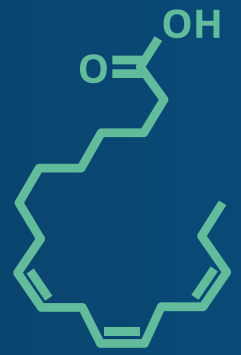
EPA
20 carbon
5 double bonds



DHA
22 carbon
6 double bonds

EPA and DHA work together to support the normal growth and support neurological health, eyes (retina), nervous system, cardiovascular system and maintain normal triglyceride levels.

Short-chain omega-3s



ALA
(Omega 3)

Short-chain omega 3s are found in plant sources. They do not provide the same health benefits and are not efficiently converted by the consumer into essential EPA & DHA.

Among omega-3s, EPA and DHA have the most health benefits

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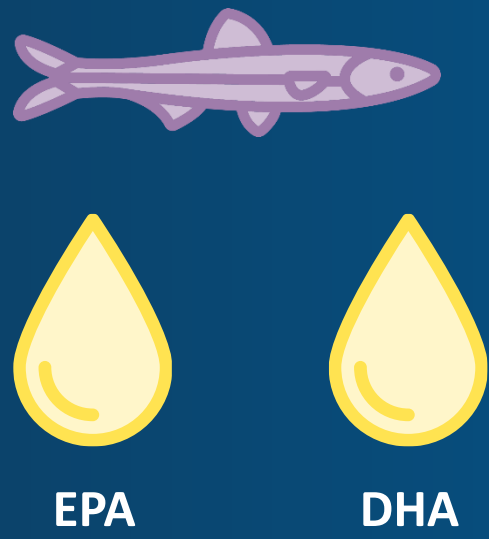
- Fertility
- Heart Health
- Disease Resistance
- Welfare
- Neurological Health
- Growth
- Immune



Fish oils contained in fatty fish are the most effective way to get EPA and DHA...

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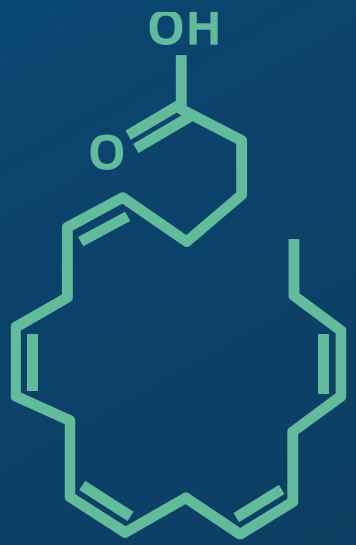
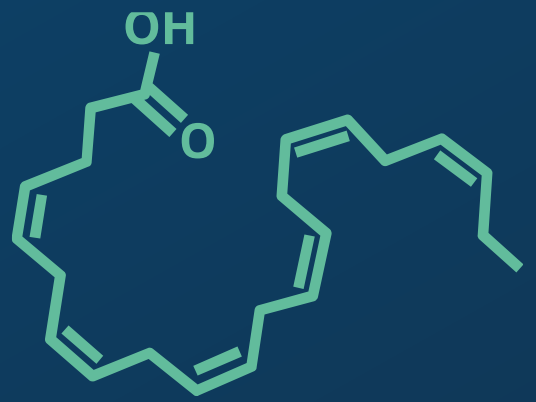


EPA
20 carbon
5 double bonds



DHA
22 carbon
6 double bonds

Up to 1/3 of fish oil is EPA & DHA

All animals (including humans) need EPA & DHA

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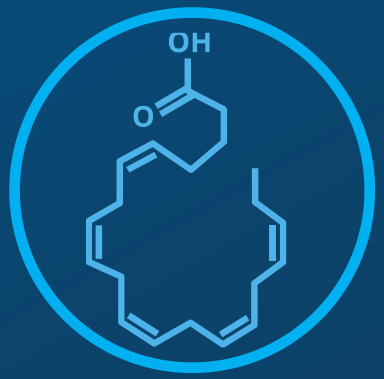
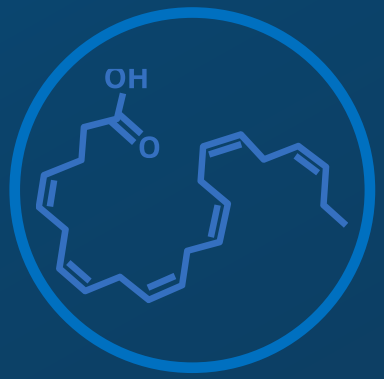
Although we need them to be healthy, our body does not readily produce them at significant levels.

EPA

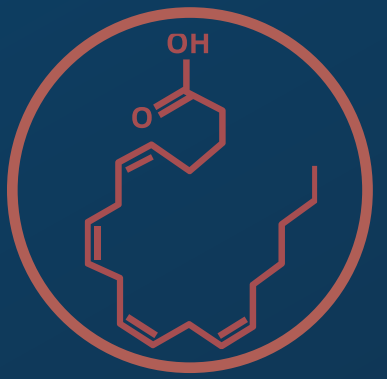


DHA



Omega-3

ARA



Omega-6

Keeping the balance: a key challenge

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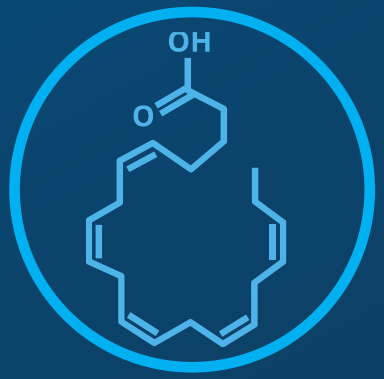
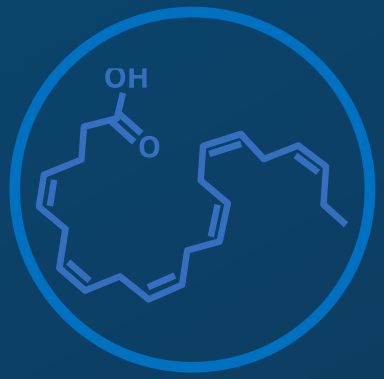
Omega-6 intake now exceeds omega-3 by over 20-fold

EPA

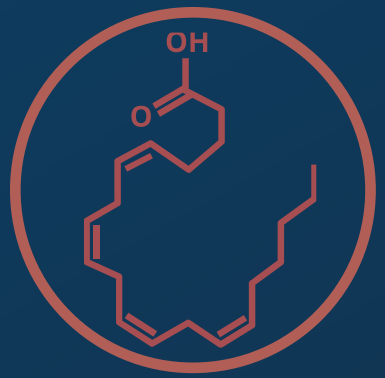


DHA



Omega-3

ARA



Omega-6

Humans benefit directly and indirectly from fishmeal and fish oil

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Nutritional properties

Minerals

Omega 3

Vitamins

Essential Amino Acids/Protein

Health benefits

Prenatal health

Heart Health

Immune health

Neurological Health

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"Fishmeal and fish oil are still considered the most nutritious and most digestible ingredients for farmed fish, as well as the major source of omega-3 fatty acids."

Food and Aquaculture organisation:
State of the World's Fisheries and Aquaculture, 2022

www.iffo.com

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