

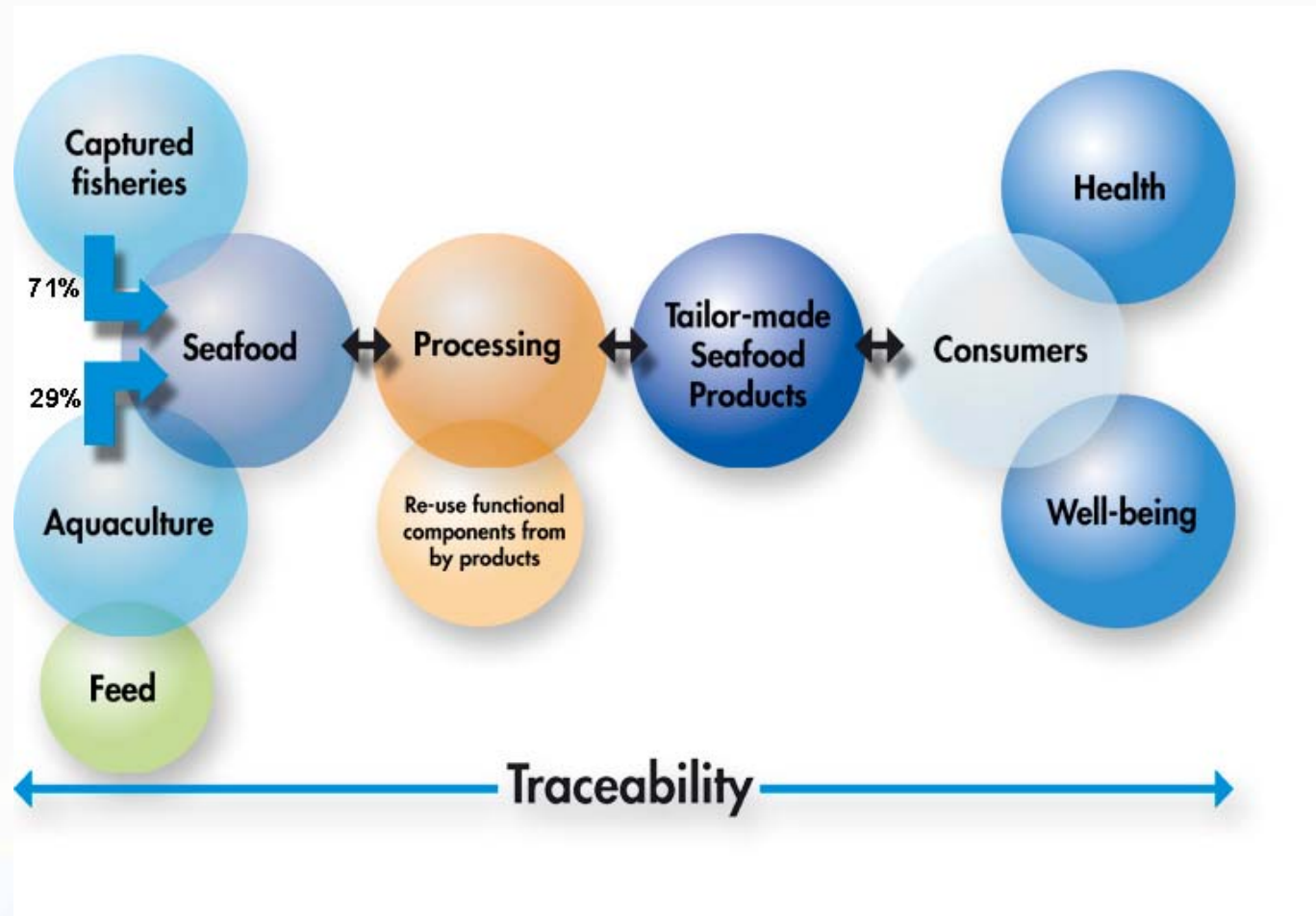
New sustainable feed resources and impact of nitrogen extractives in farmed rainbow trout.

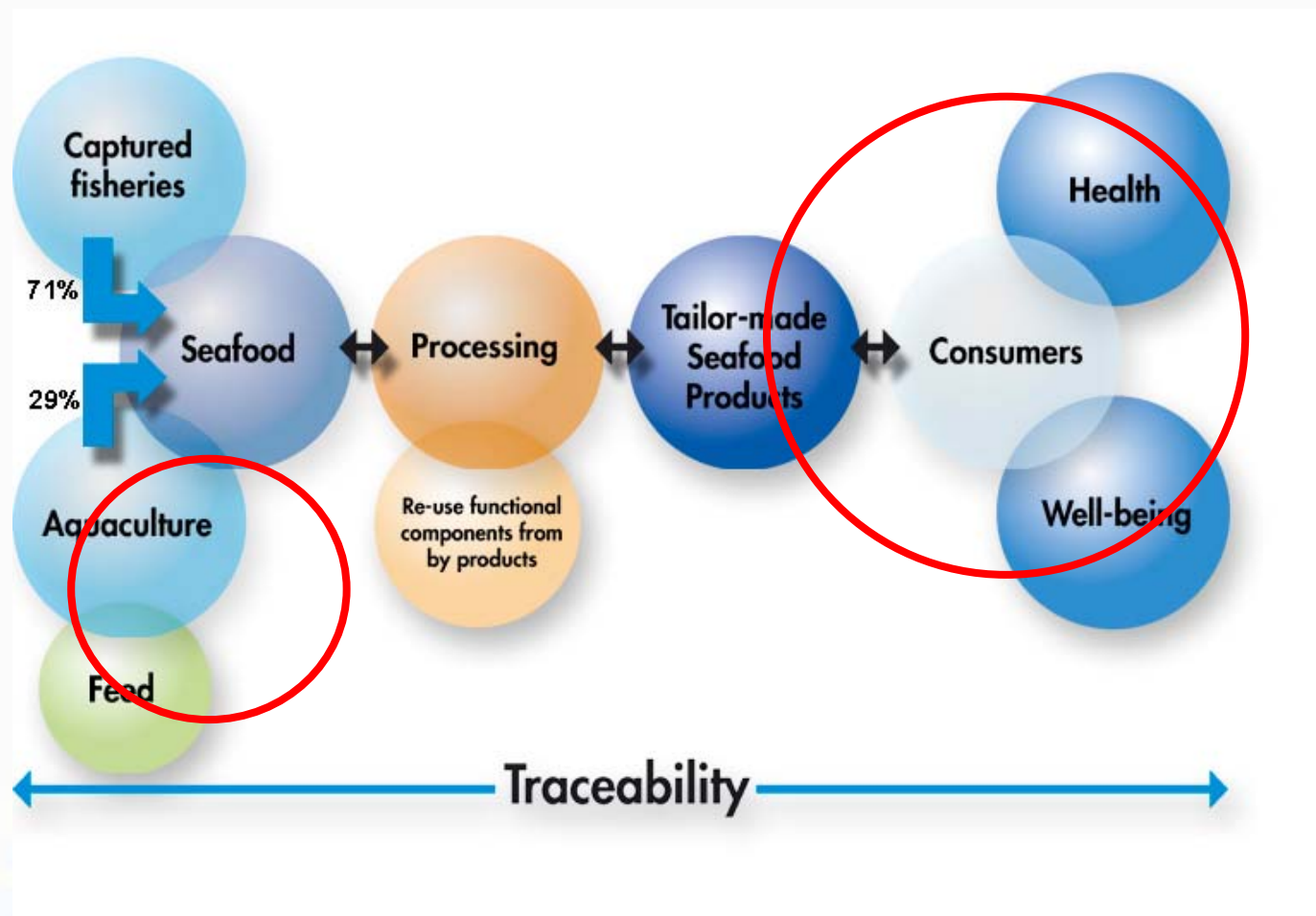
Fiskeriforskning, Bergen, Norway.

Senior scient. Anders Aksnes

BioMar, Trondheim, Norway

Ellinor Helland

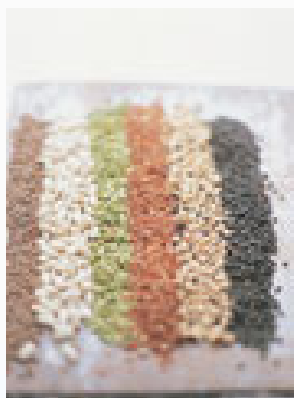






Availability of marine
sources is
questioned.

New STRATEGY
Upgrading of marine sources

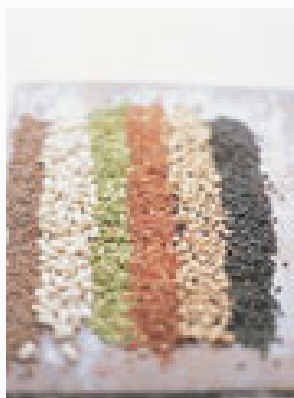
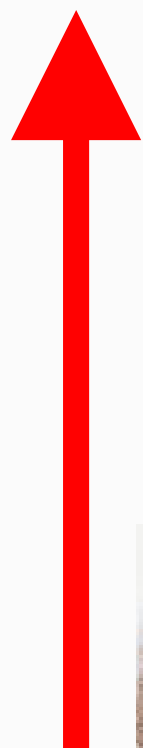


Plant sources

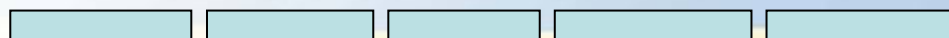


Marine sources





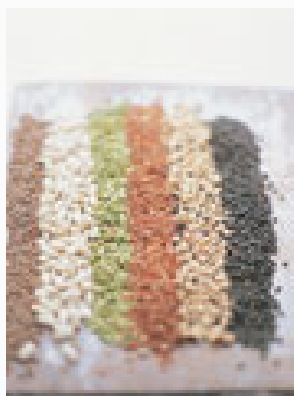
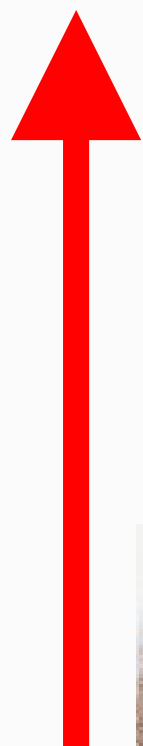
Plant sources



Marine sources

**1. Identify
critical factors
(CF)**





Plant sources

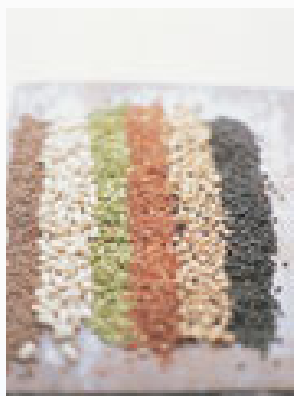
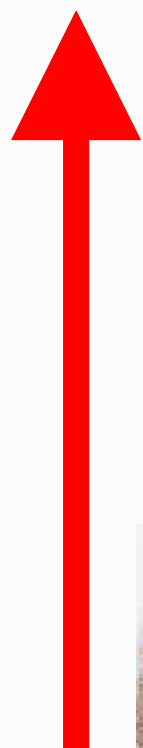


Marine sources

2. Optimize CF

**1. Identify
critical factors
(CF)**





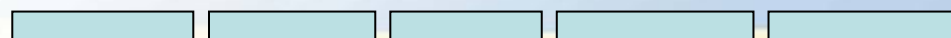
Plant sources



3. Alternative sources for CF



2. Optimize CF



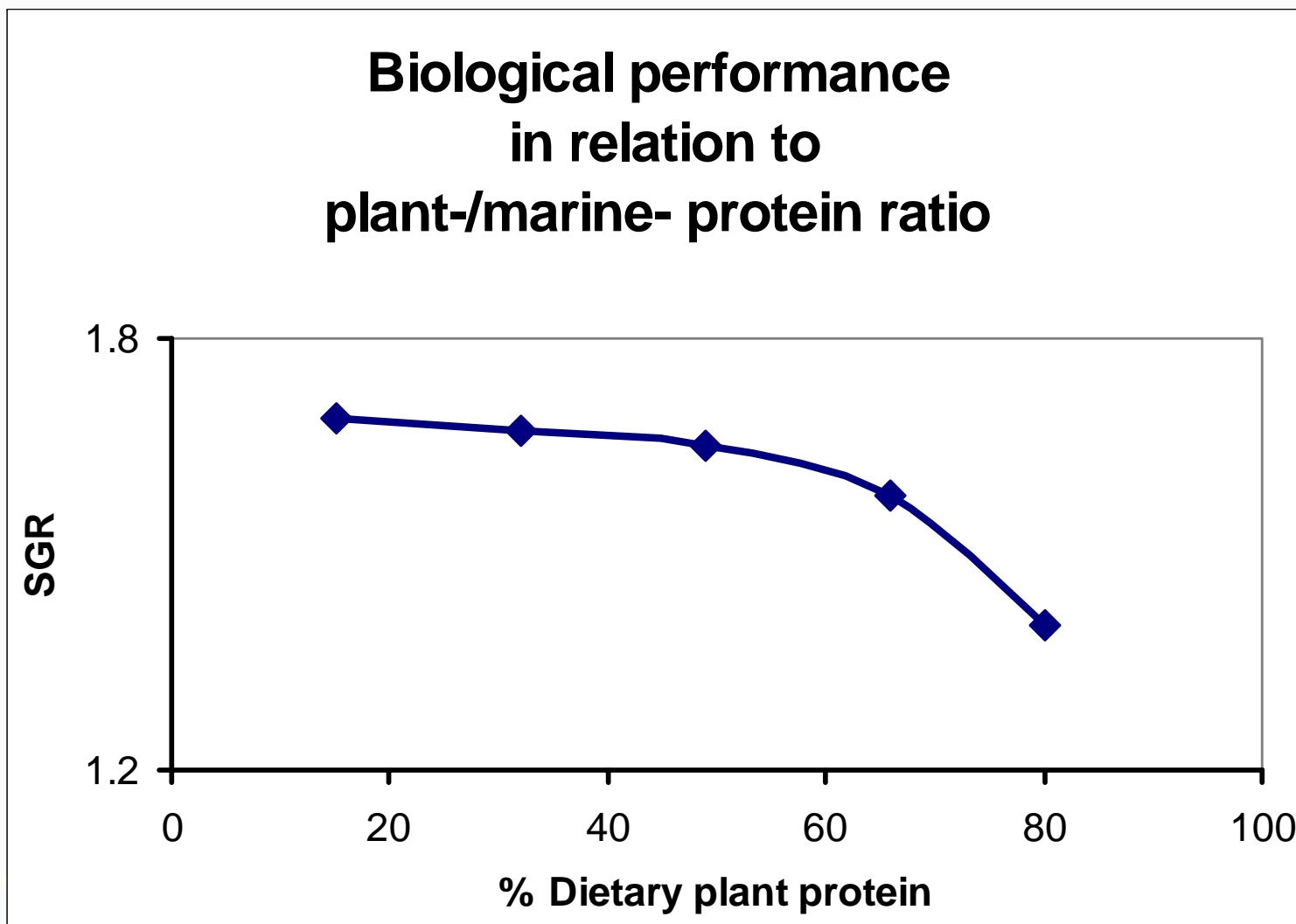
1. Identify critical factors (CF)



Marine sources



Biological performance in relation to plant-/marine- protein ratio



**In the important work to find replacement
of fish meal - - - - ,**

**detailed information of the fish meal to be
replaced is needed.**

Water-soluble feed components

Focus on water soluble nitrogen compounds in feed ingredients with potential health promoting effect.

A larger version of the SEAFOOD plus logo, with "SEAFOOD" in blue and "plus" in yellow, and three yellow horizontal lines below.

Marine Components

- **Main focus on**
 - Free amino acids
 - Taurine
 - Anserine / Carnosine
 - Nucleotides
 - Polyamines
 - Peptides
 - Glutamine



Photo by Gregersen, Fiskeriforskning

Healthier fish can give you better health

We humans can reap health benefits by eating extra-healthy farmed fish. But for the good properties of the fish to be even better, it is crucial that the feed it eats is composed of health-promoting ingredients. Since it is not only marine fat that makes seafood healthy, Fiskeriforskning is studying the content of other components in fish feed that have positive health effects. By increasing the amount of these natural components in the feed, this can have positive health effects for fish consumers.

The healthy properties of fish and other seafood are generally associated with polyunsaturated fatty acids, particularly Omega 3. While for many years there has been much research activity around marine fat and its effect on our health, little has been done to study the importance of other components in seafood. Now scientists are working to discover which substances in salmon feed have positive health effects. The feed consists mainly of oil and meal, which are again based on various types of fish like sandeel and blue whiting, as well as vegetable raw materials such as corn and soy.

"We know that there are other components than the fat in marine raw materials that explain why this is healthy food, such as minerals and sub-



Scientist Anders Aksnes looking for components in fish feed that can give us better health. These are some of the more than 30 different substances that are being analysed.

stances that contain nitrogen", explains Senior Scientist Anders Aksnes.

Fiskeriforskning is currently analysing the levels of more than 30 different components in the feed, the majority of which are of marine origin.

"We believe there are many components that have a positive effect, and which we will continue working with. These are components that we know from other studies have a wide range of effects on people's health, including substances that are favourable for the cardiovascular system, prevent cancer, stimulate the immune system and contribute to improved restoration of health after illness.

Components that appear to be promising will be tested in various diets with several different groups of fish.

"In the final phase, we are planning a study where people will eat fish that is raised on the different feed varieties, thereafter to measure the health-related effect on the human body", says Aksnes.

Extensive research on seafood

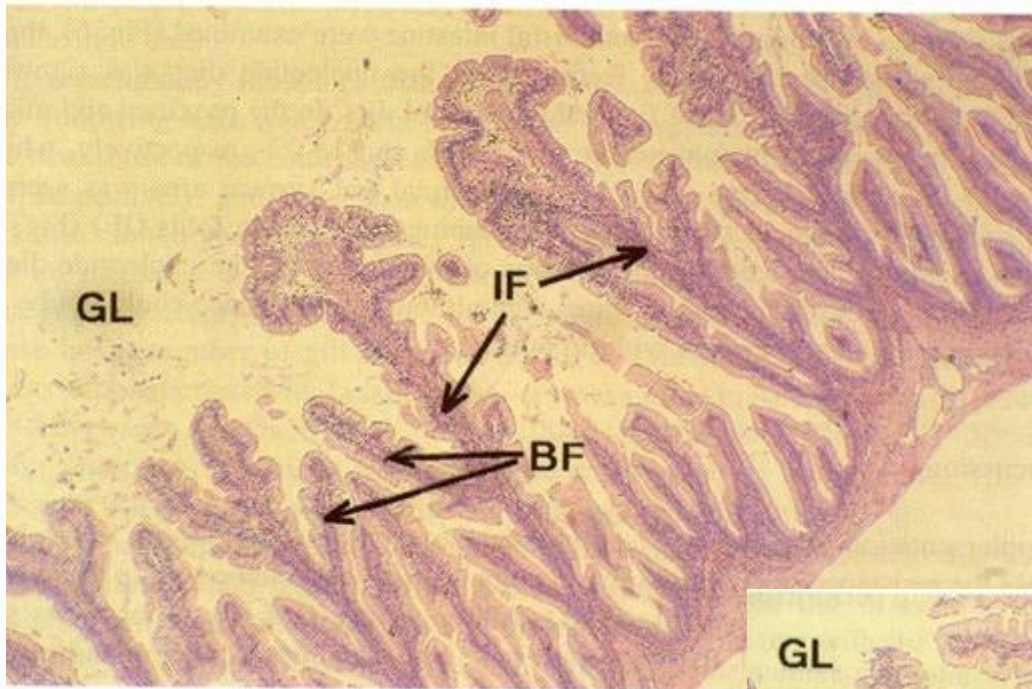
The research on health-promoting components in fish feed is being conducted in collaboration with feed manufacturer Biomar. The project is a part of the research programme SEAFOODplus, which has been started up by the EU and has a total budget of 200 MNOK. Fiskeriforskning is the second largest partner in the programme, where a number of European business institutes will contribute to ensure that European consumers get safe seafood products of high eating quality. It will also result in environmentally friendly and ethically sound aquaculture production methods.

o 40 feed ingredients are analysed

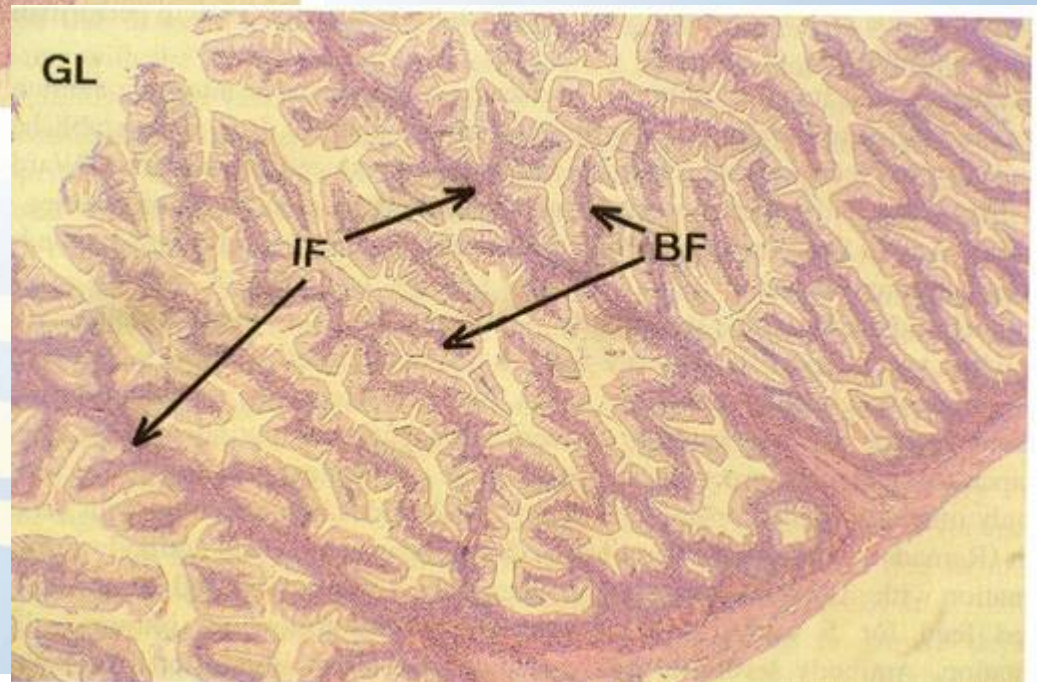
o > 30 components

Nucleotides

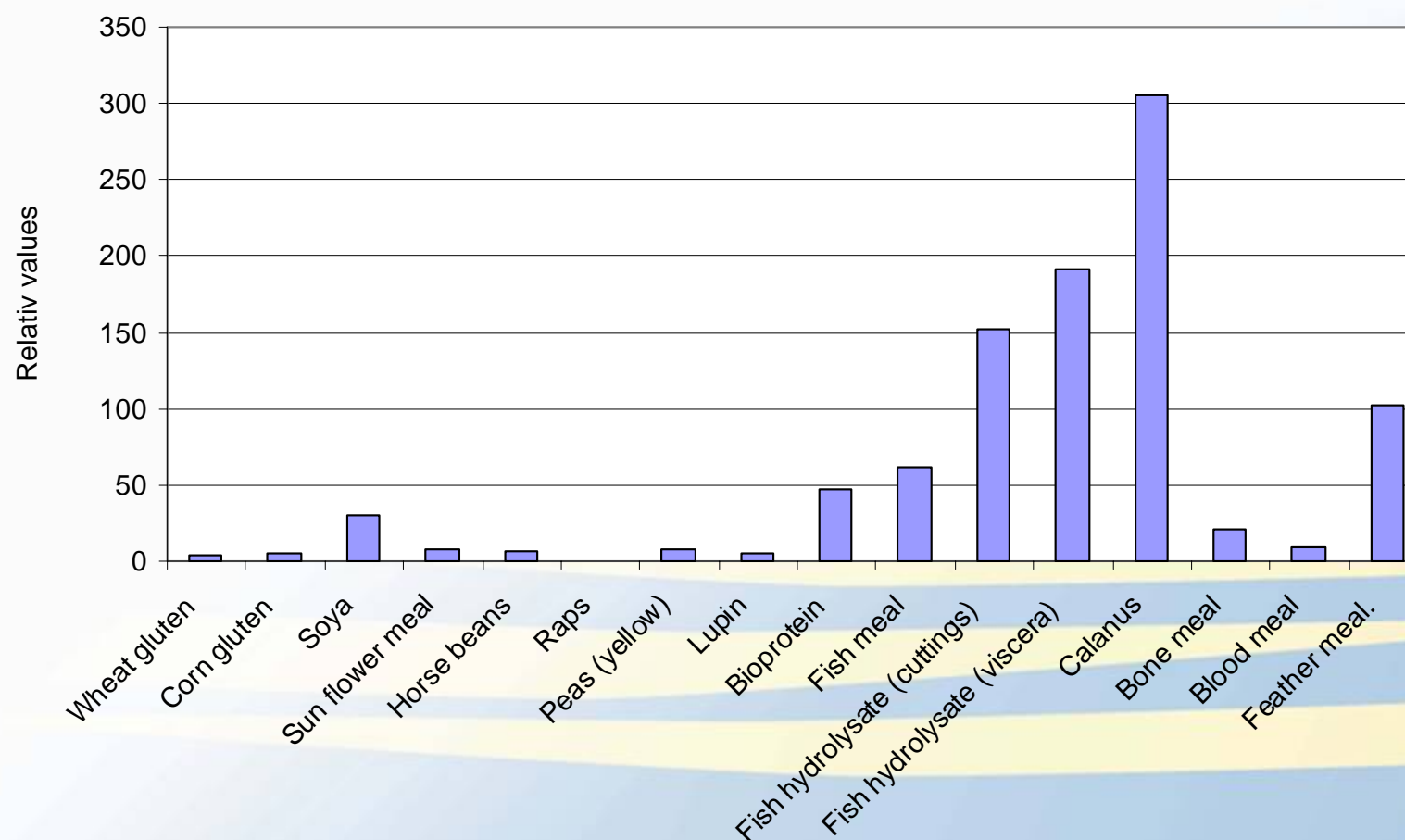
- **Important in stressed situations**
 - Disease
 - Quick growth
 - Young individuals with poorly developed intestinal- and immune- systems
 - Vegetarian diets
 - Needs balanced composition of nucleotides in a free form.



From Burrells et al, Aquaculture 2001.



Sum Free Nucleotides in feed ingredients



TAURINE

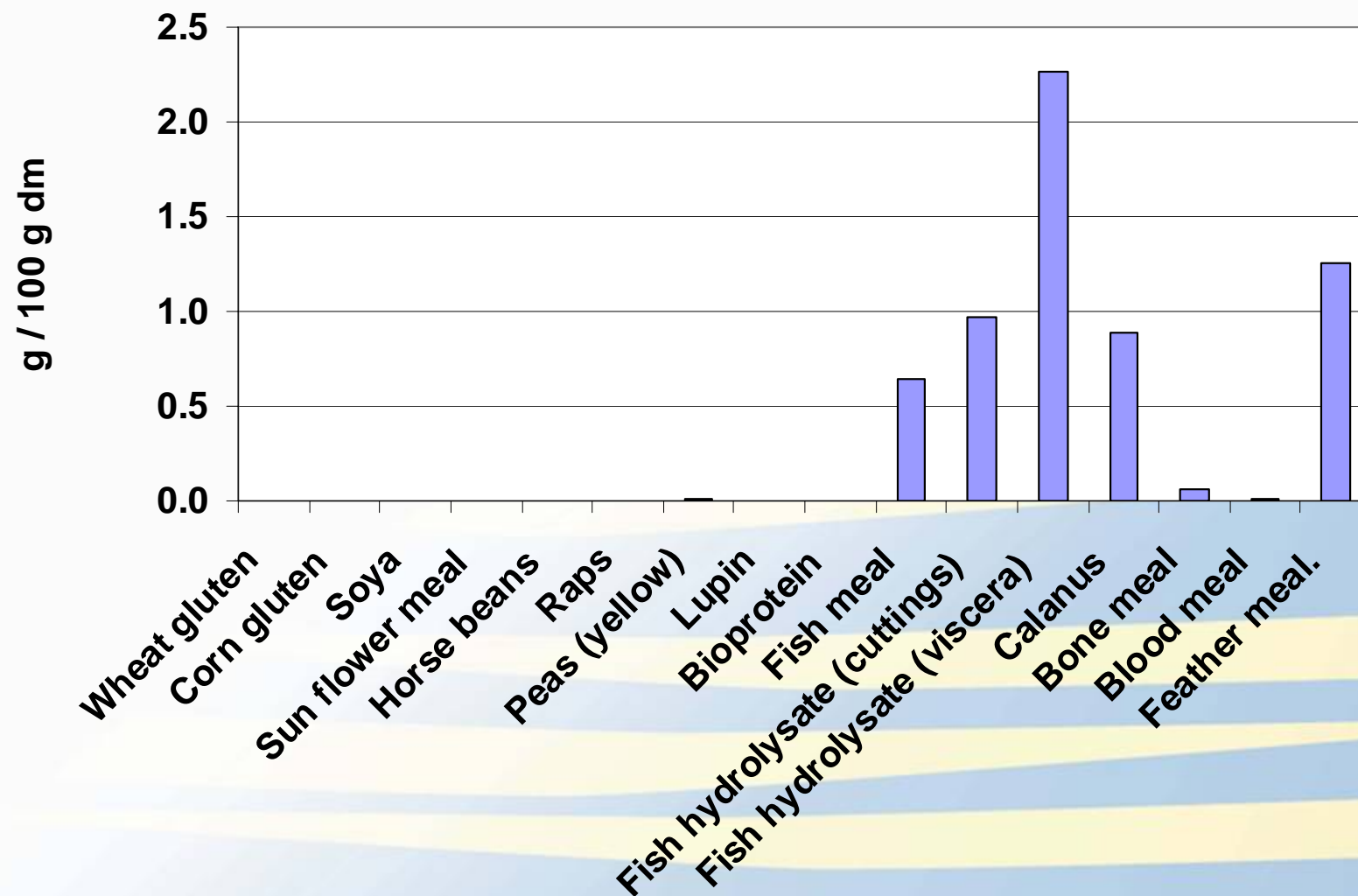
- **Main biological effects**
 - **Osmoregulation / transport**
 - **Immune stimulation**

Taurine

Osmoregulation - transport

- **Contractility**
- **Blood pressure**
- **Heart rhythm**
- **Motor activity**
- **Platelet aggregation**
- **Neuronal activity**
- **Body temperature**
- **Learning**
- **Feed intake**
- **Sight**
- **Sperm mobility**
- **Mitosis and survival of cells**
- **Energy metabolism**
- **Protein phosphorylations**

TAURINE in feed ingredients



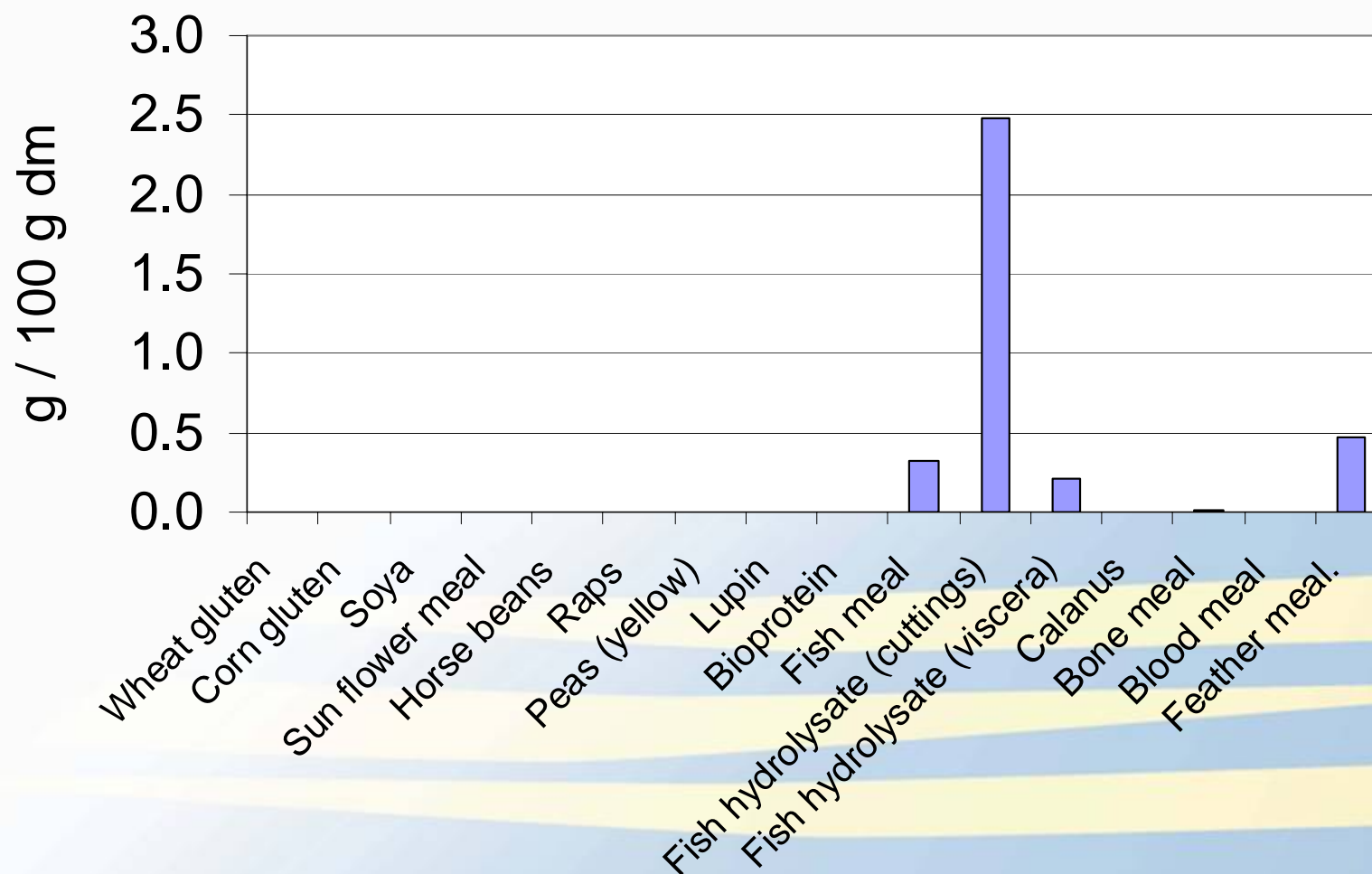
Anserine / Carnosine

- **Important buffer components**
- **Effective antioxidants**

Anserine / Carnosine

- **Energy metabolism**
- **Water balance / Neural impacts**
- **Cardiovascular impact**
- **Immune stimulation**
- **Oxidation**
- **Aging**
- **Organoleptic**

ANSERINE in feed ingredients



Feeding experiment

Goal: Reveal effect of water soluble components in feed ingredients

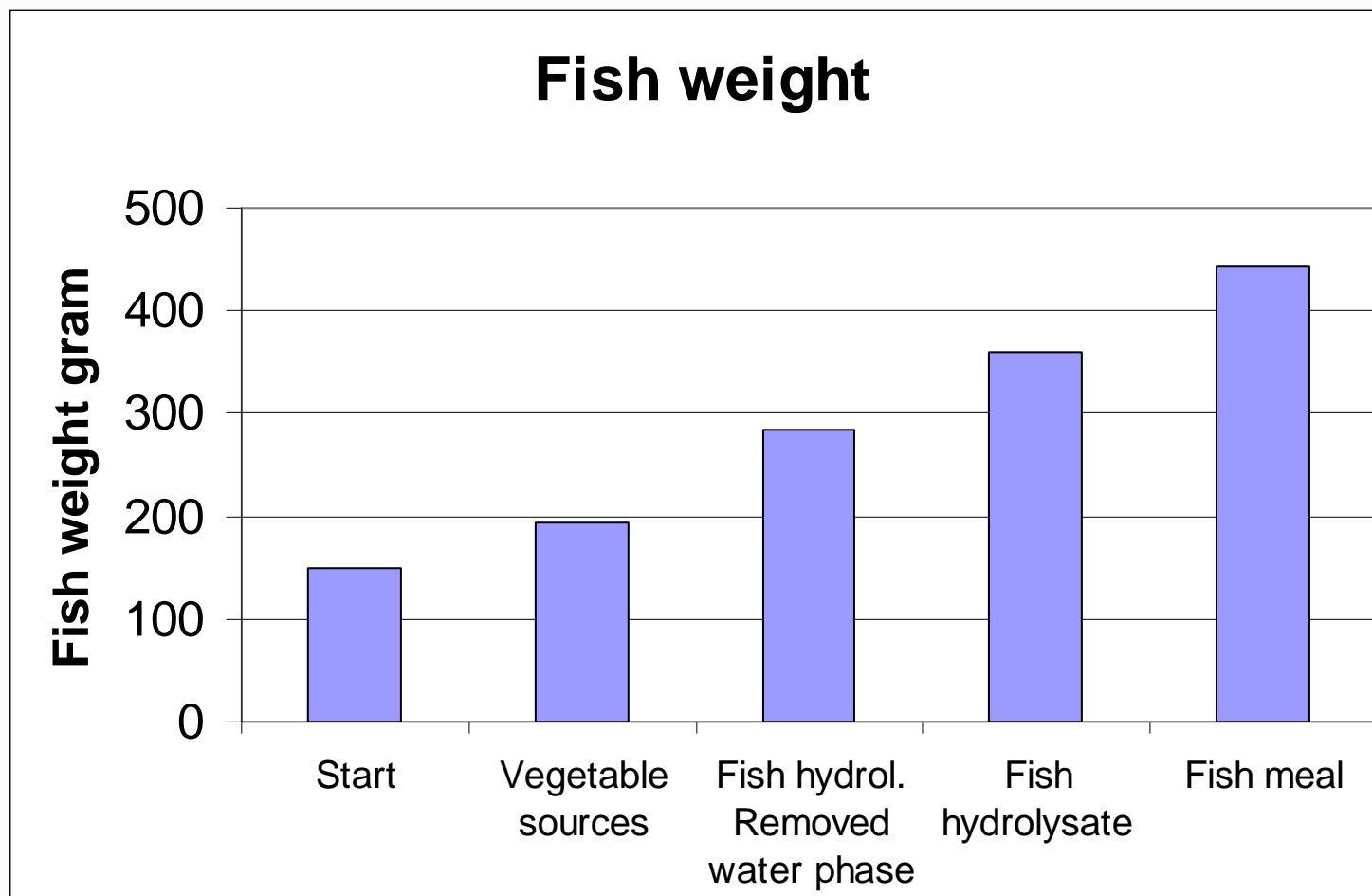
- **Growth**
- **Digestibility and retention**
- **Feed intake and feed efficiency**
- **Health (immune stimulation)**
- **Level of health promoting compounds in filet.**

Fish and Diets

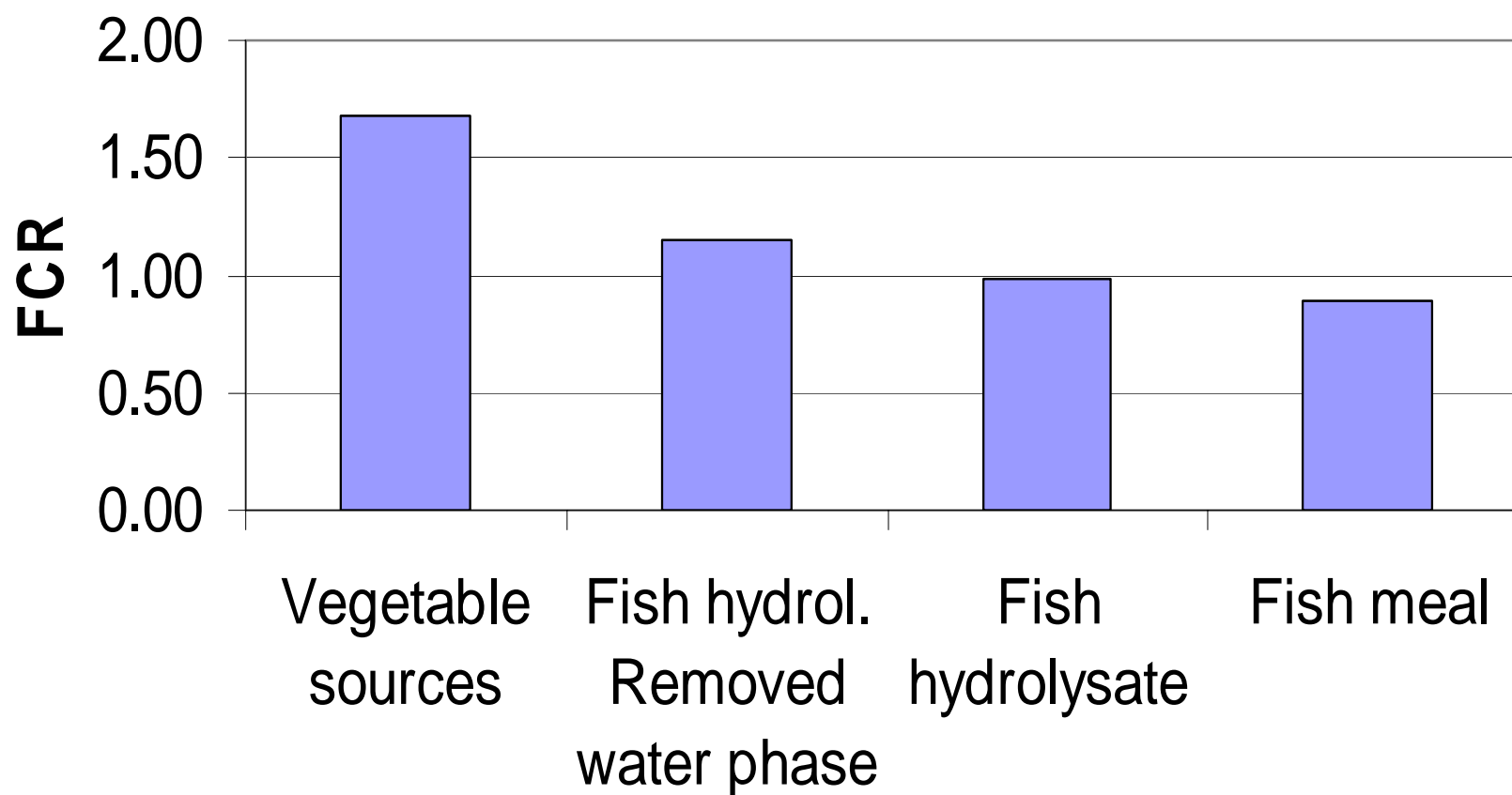
- **Rainbow trout**
- **About 150 g initial to 450 g final weight**
- **12 weeks, 10°C**
- **Iso N and Iso-energetic**
- **Adjusted for limiting amino acids and P.**

Dietary composition

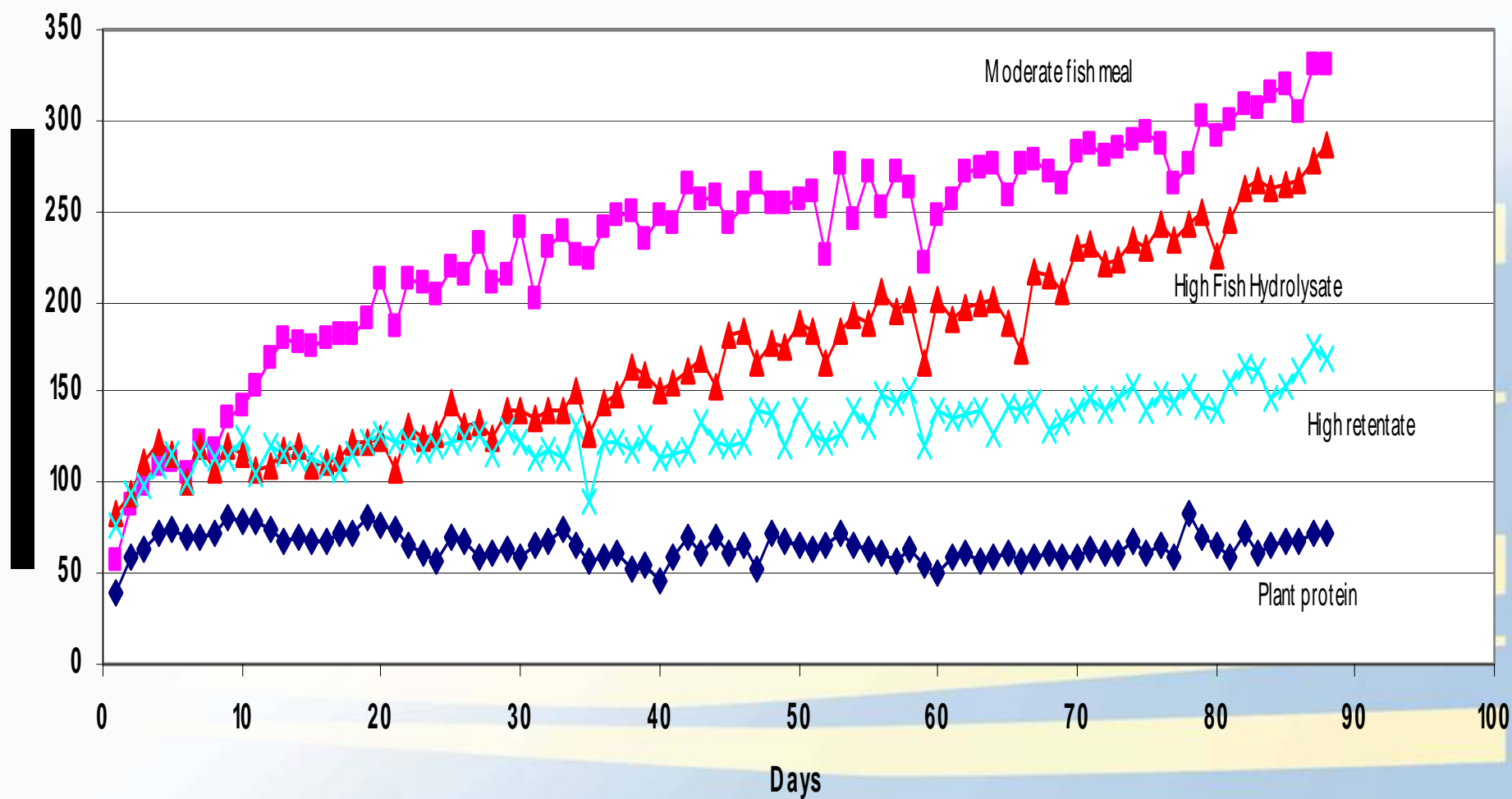
Diets	Vegetable protein	Hydrol. - Wat.sol	Hydrol.	Fish meal
Soya – Corn Wheat	66	41	39	47
Fishmeal	8	8	8	26
Fish hydrolysate - Water soluble	-	-	24	-
Fish hydrolysate	-	22	-	-



Feed Conversion rate - FCR

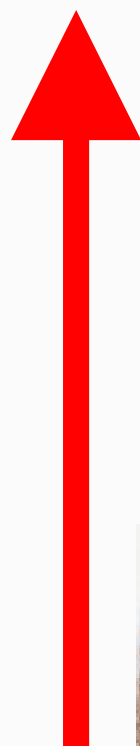


Daily feed intake



Conclusion

- The better performance of marine ingredients (compared to vegetable sources) in fish feed,
 - Is due to some essential small components in marine ingredients.
 - and not due to better taste.



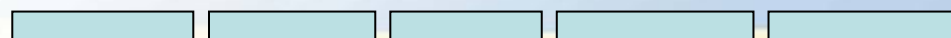
Plant sources



3. Alternative sources for CF



2. Optimize CF



1. Identify critical factors (CF)



Marine sources



A better life with seafood...



www.seafoodplus.org