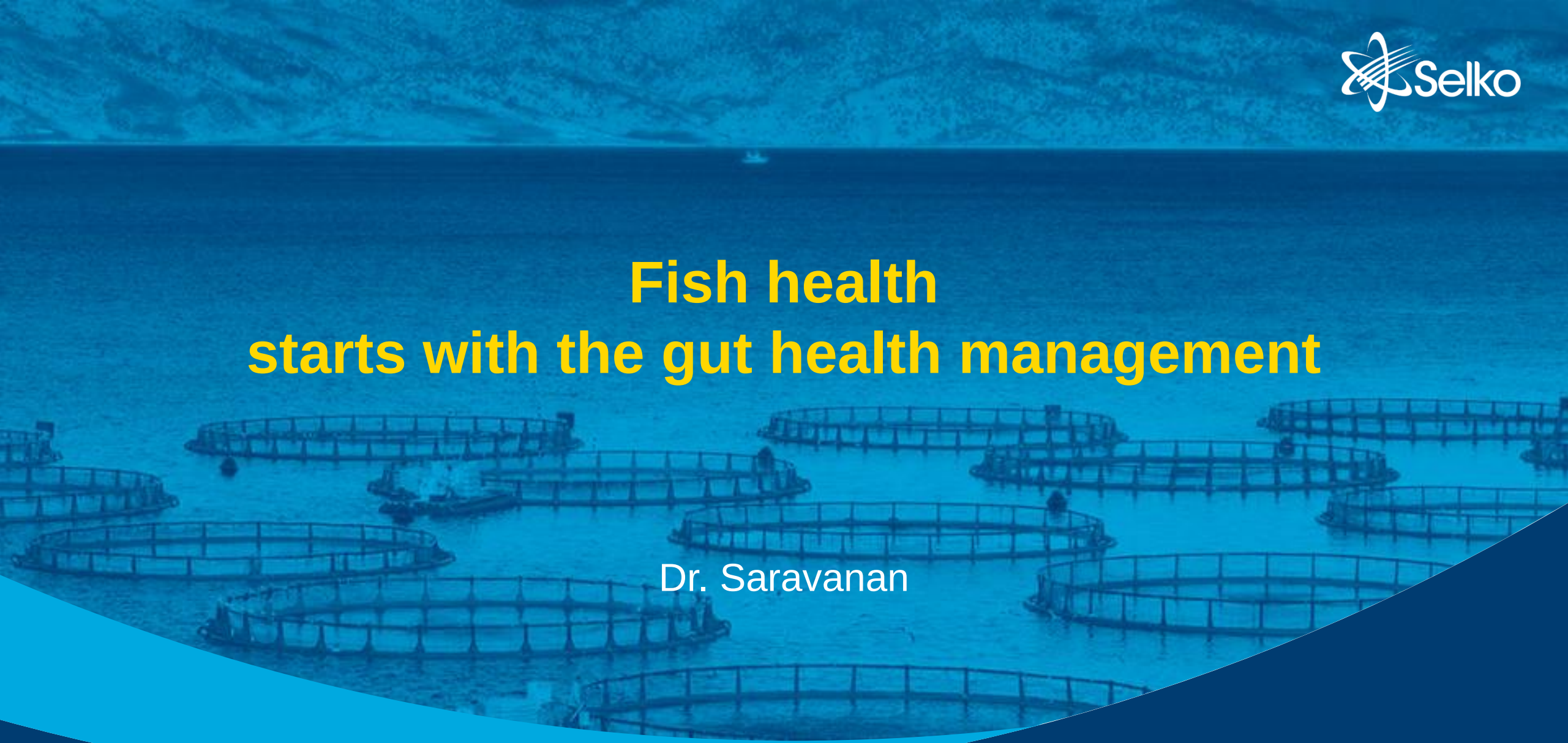


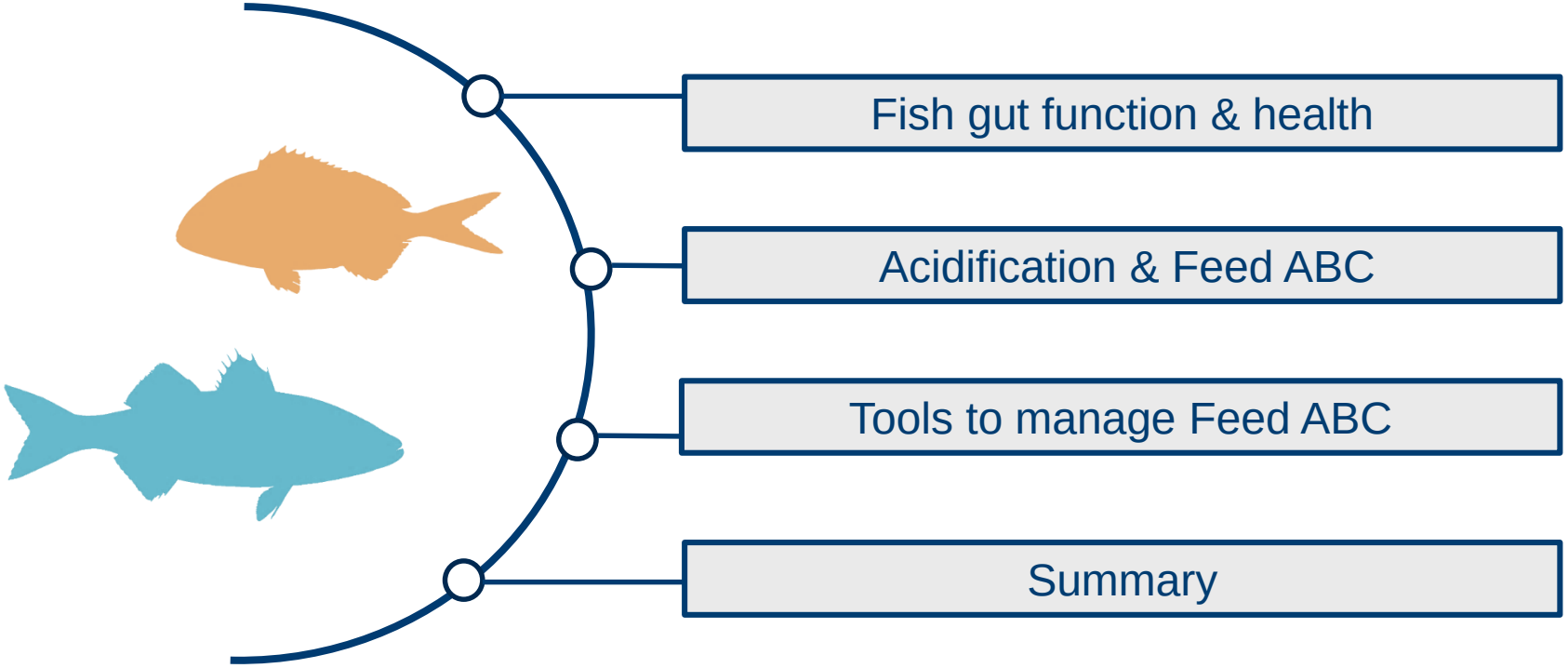
Fish health
starts with the gut health management

Dr. Saravanan

Selko

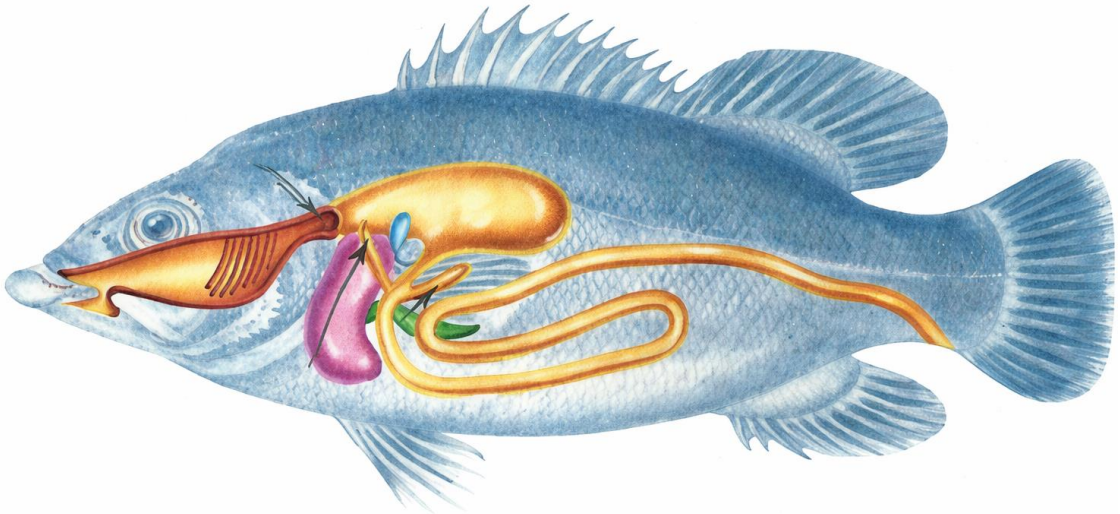
trouw nutrition
a Nutreco company

Content overview



- Fish gut function & health
- Acidification & Feed ABC
- Tools to manage Feed ABC
- Summary

Why it is important to manage gut health in fish?



Fish gut function and health is continuously challenged by feed composition and microbes from water

Multi-functional gut

Nutritional functions

- Feed digestion
- Nutrient uptake
- Excretion
- Drinking - Osmoregulation

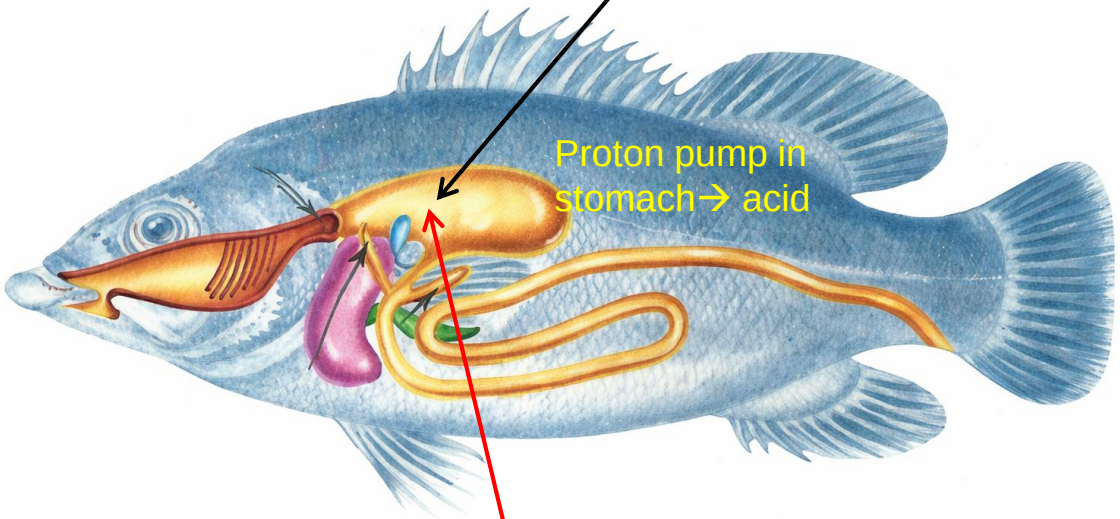
Health functions

- Kill pathogen at entry
- Physical barrier to pathogen
- Immunity
- Gut microbes

Achieving optimal acidification (pH) in stomach

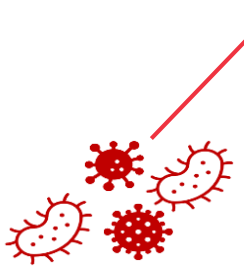
- Acid hydrolysis
- Protein digestion by enzyme Pepsin

Feed



Better FCR
Better Growth

Better gut health
Lower mortality

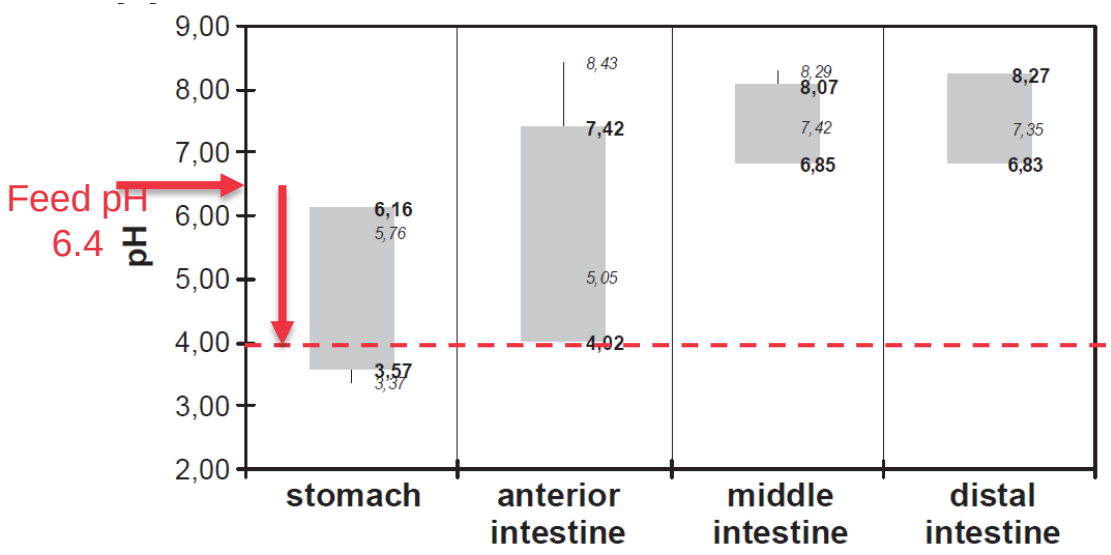


Microbes
in water

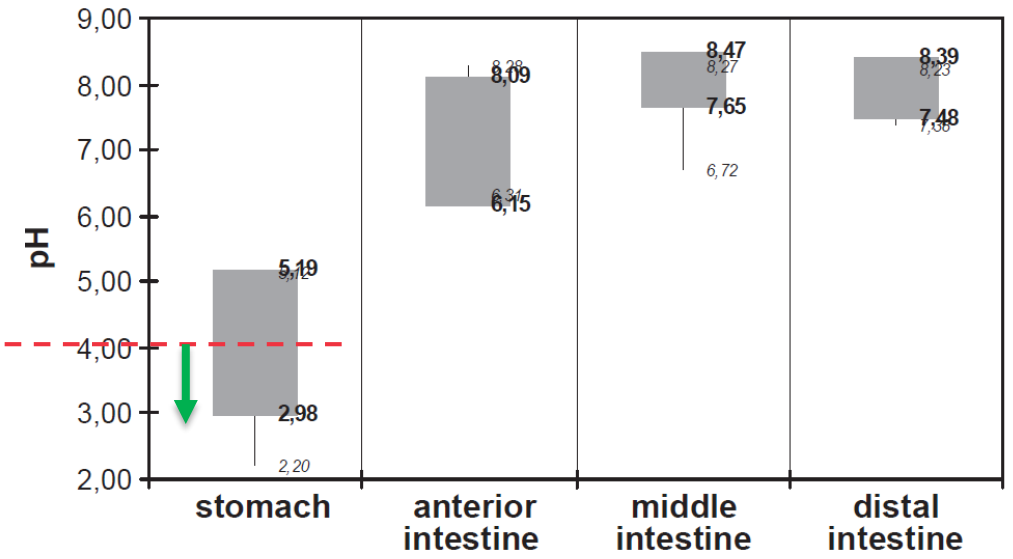
- Low gastric pH is critical to kills microbes
- Deny opportunity to colonize in intestine

Gastrointestinal pH profile

Gilthead Sea Bream



European Sea Bass

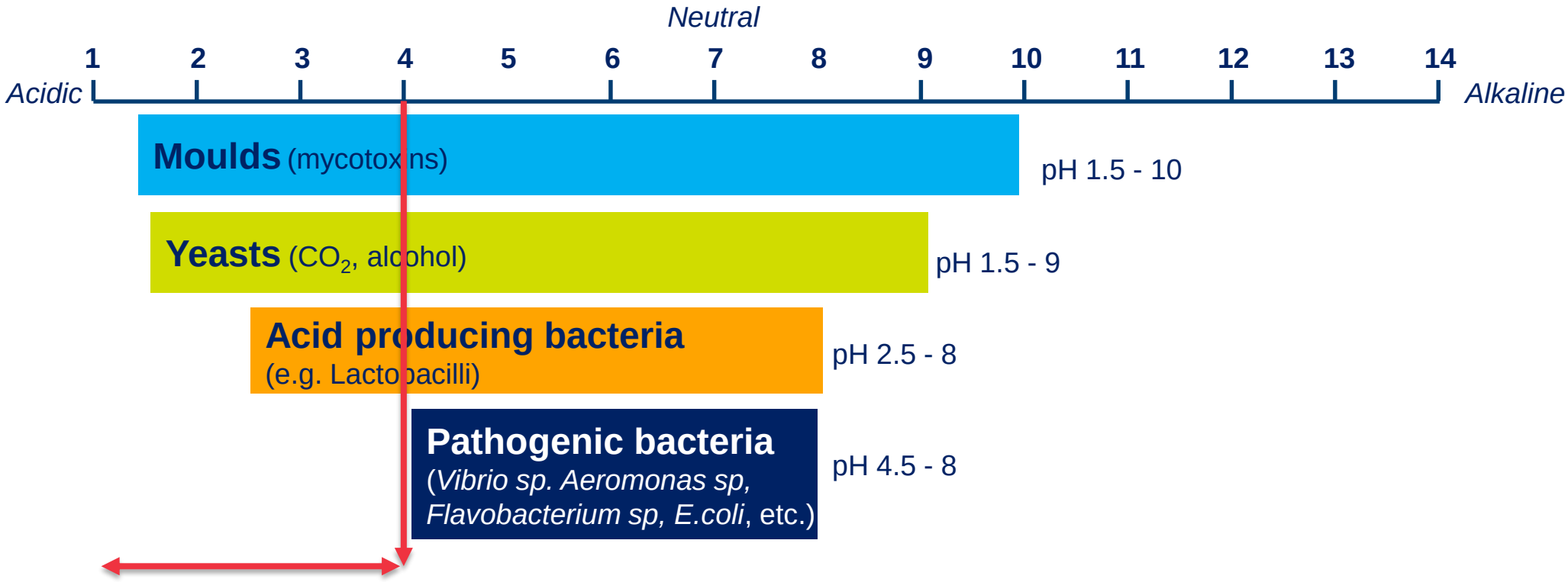


Lower stomach pH <4.0 could results

- In better digestion
- Less pathogen entry to intestine

Nikolopoulou et al., 2011

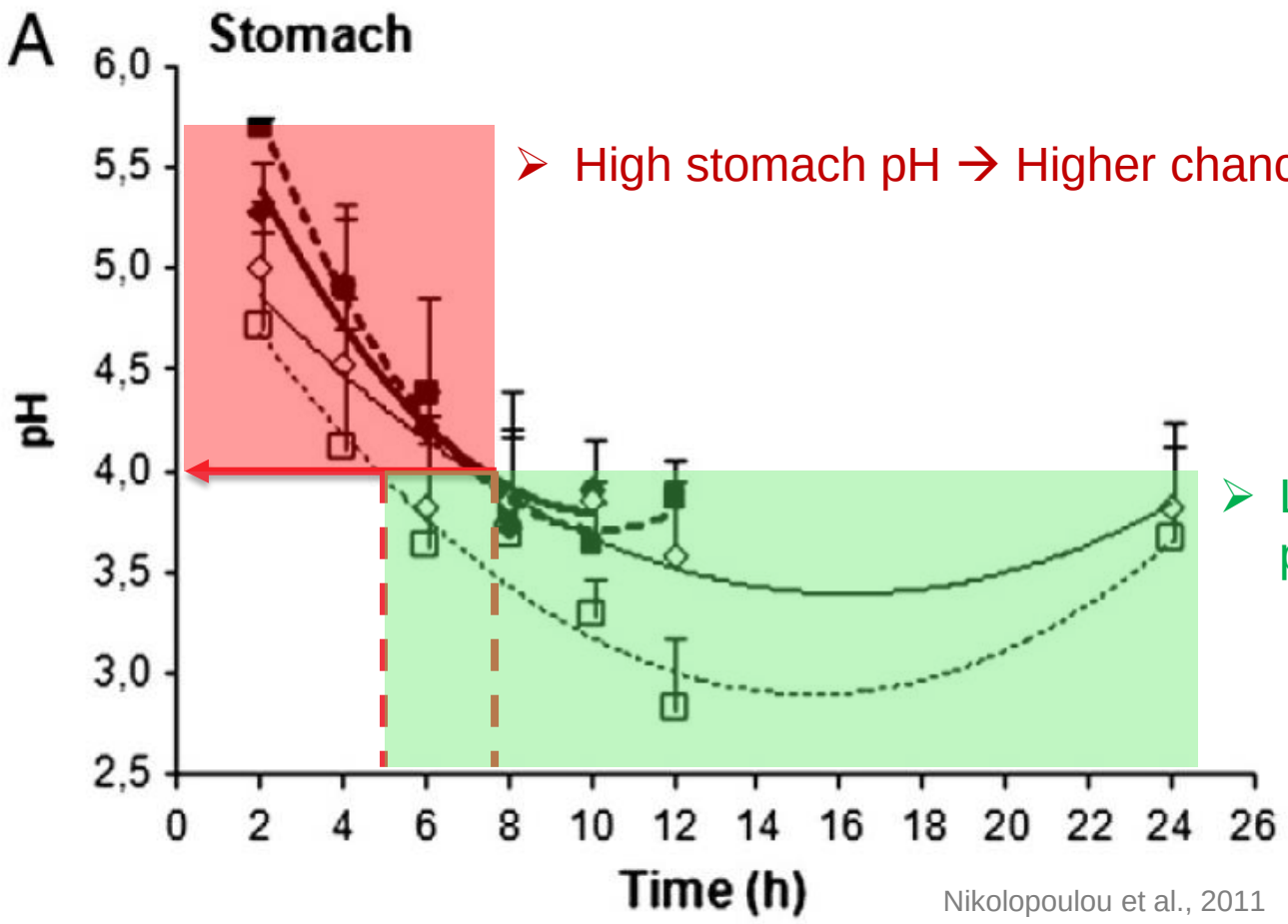
Relation between pH & microorganisms' survival



Pathogenic bacteria struggle to survive at a pH < 4.5

Stomach acidification (pH) dynamics

(BrFM ♦ ——, BrCSGM ■ – –, BsFM ◊ –, BsCSGM □ –).



Nikolopoulou et al., 2011

- High stomach pH → Higher chance for pathogen entry to intestine
- Low stomach pH → Lower chance for pathogen entry to intestine

What affects stomach acidification in fish?

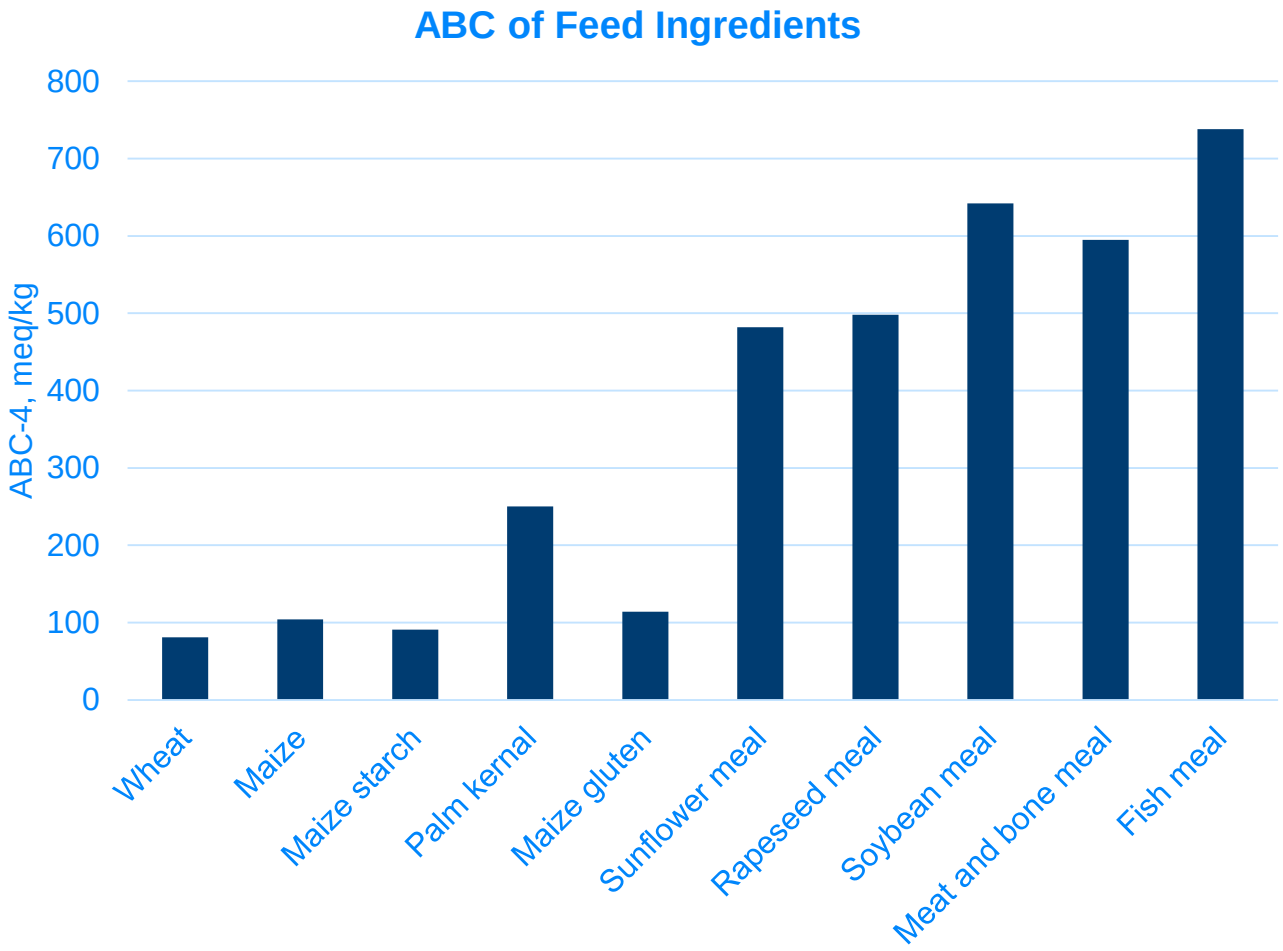
Feed ABC?

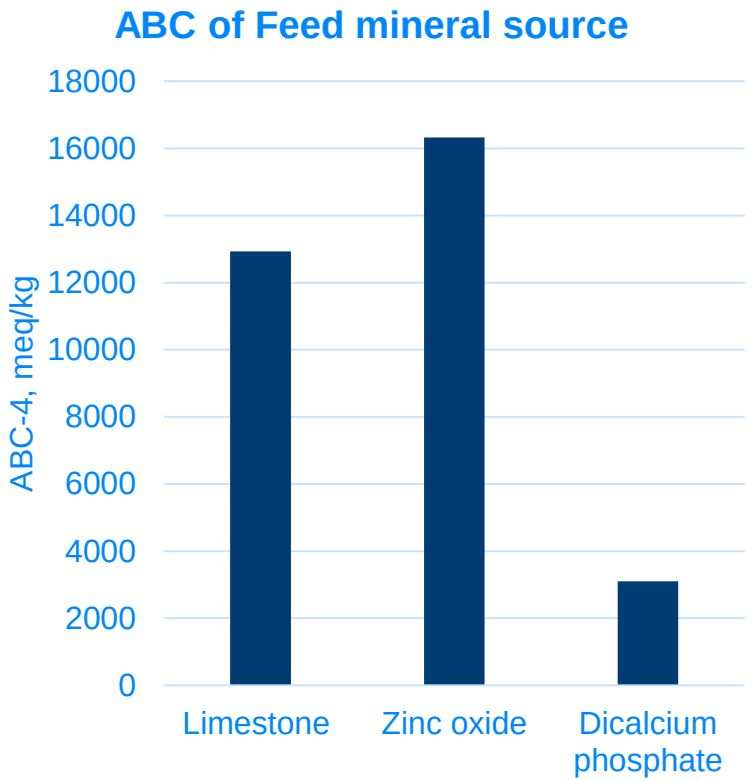
Acid-Binding Capacity (ABC)

The amount of acid required to lower the pH of 1 gram or kg of feed to a specific acidic pH level typically to pH 4.0, ABC-4 or 3.0, ABC-3.

- Commonly applied in terrestrial animal feed
- Type and level of feed ingredients and feed additives largely determines Feed ABC.
- Protein in general has high acid binding capacity, so high protein feeds results → higher Feed ABC
- Feed ABC is quite easy to measure at quality lab in fish feed plants

Acid-Binding capacity (ABC) of fish feed ingredients

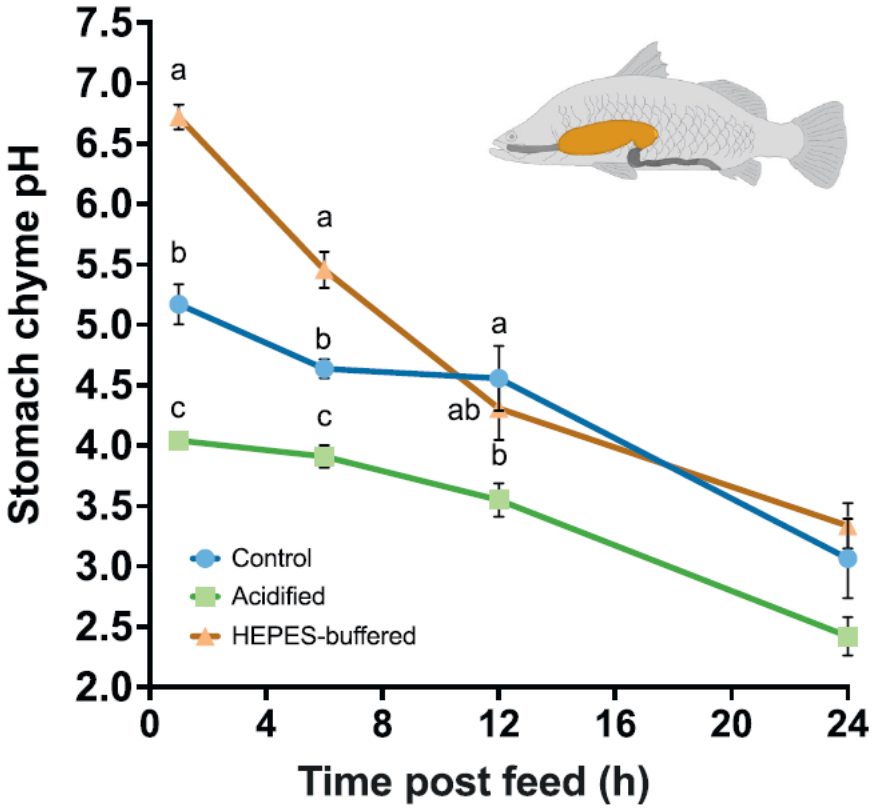




Lawlor et al. 2005

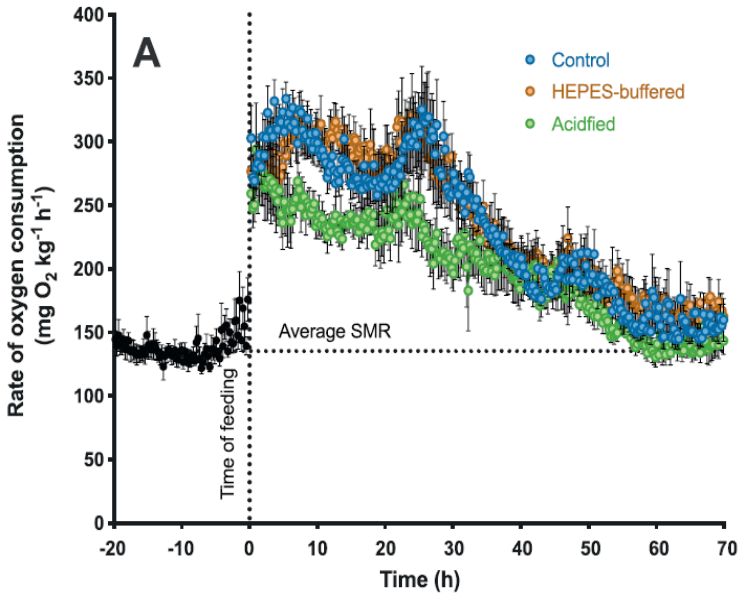
Effect of feed acidifications in Asian sea bass

Can increasing the acidity of pelleted fish diets would reduce gastric acid secretion, and the energetic cost of digestion and improve FCR and growth?

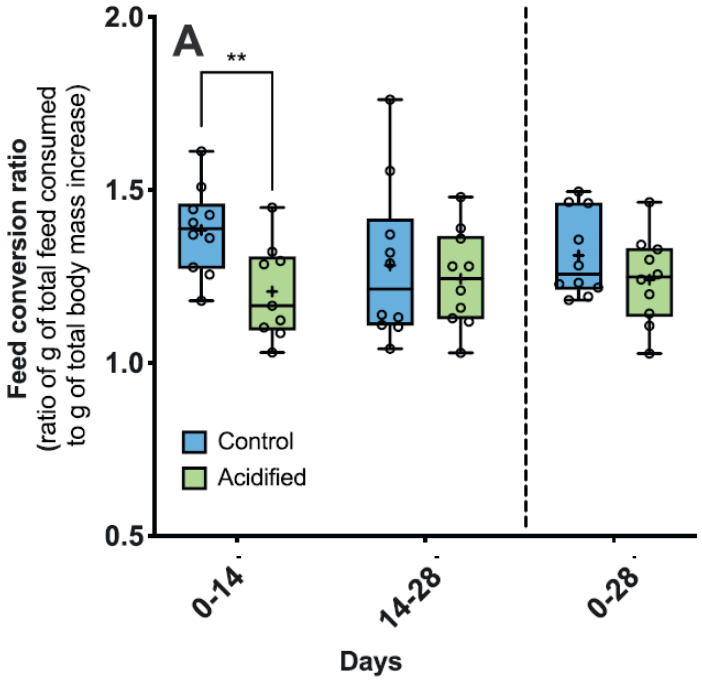


Goodrich et al., 2022

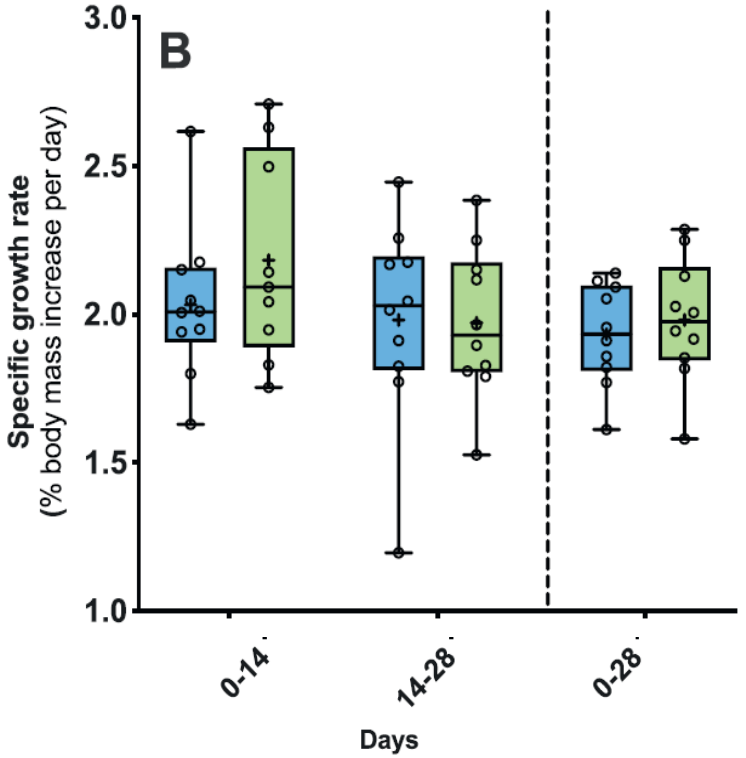
Feed acidifications in sea bass improves performance



Fish fed acidified feed reduced the total energetic cost of digestion by ~45%.



Fish fed acidified feed resulted in lower FCR



Fish fed acidified feed resulted in numerically higher growth

Goodrich et al., 2022

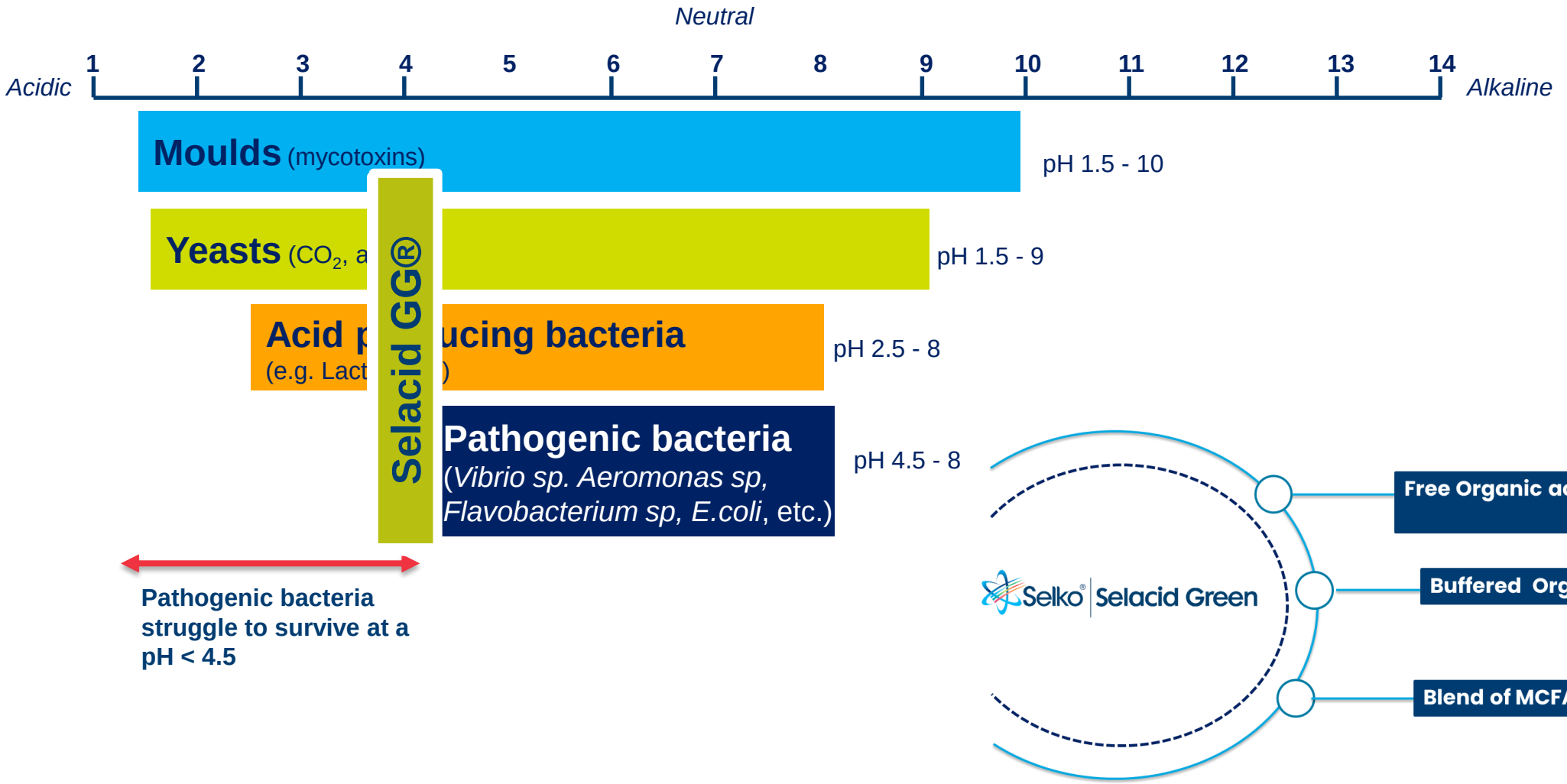
Tools to manage Feed ABC

- Introduce ABC as factor in fish feed formulation
- Formulate fish feed to have lower ABC value
- Incorporate organic acids to lower Feed ABC

Acid binding capacity to pH 4.0		
Organic acid	pH	ABC4, mEq/kg
Formic acid	2.3	-13550
Acetic acid	2.9	-2283
Propionic acid	3.0	-1358
Fumaric acid	2.3	-10862
Citric acid	2.2	-5605
Malic acid	2.2	-7214
Lactic acid	2.4	-5079
Sorbic acid	3.5	-220
Ascorbic acid	2.8	-217
Orthophosphoric acid	1.6	-8858

Lawlor et al. 2005

Tools to manage Feed ABC



Take home message

Remember - Feed ABC

Gut health management is critical to ensure good fish health

Reduce Acid Binding Capacity (ABC) of fish feed with right choice of ingredient sel
and with use of acidifiers/organic acids

- Helps to **lower stomach pH** in fish
- Supports **better FCR and growth**
- Ensures **better gut health** & lower fish mortality

Thank you

More information:

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