“Wageningen Aquaculture”

Nutrition

Johan Schrama, Jeroen Kals,
Leon Heinsbroek, Pauline Kamermans





WAGENINGEN UNIVERSITY
WAGENINGEN UR
AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY
IMARES
WAGENINGEN UR

Who are we?

- Fish nutrition:
  - Johan Schrama
  - Jeroen Kals
  - Leon Heinsbroek
  - 6 PhDs & 1 Post Doc: (3 in collaboration with INRA)



- Shellfish nutrition:
  - Pauline Kamermans
  - 1 PhD

WAGENINGEN UNIVERSITY
WAGENINGEN UR

AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR

Our Mission:

"Sustainable aquaculture by good (shell)fish nutrition"

What/how to feed (Shell)fish for:

- Good productivity/economics:
  Feeding for "good profit"
- Minimal waste output:
  Feeding for "clean water"
- Health/welfare of fish:
  Feeding for "happy & healthy fish"
- Good product quality/safety:
  Feeding for "a healthy/tasty/safe product"

WAGENINGEN UNIVERSITY
WAGENINGEN UR

AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR

Our focus:

Shellfish **Fish**

feeding for:

1 – "good profit"

– "clean water" 1

2 – "happy & healthy (shell)fish" 2

– "a healthy/tasty/safe product"

Species @ Wageningen Aquaculture

- Freshwater & marine fish
  (Turbot, Sole, Cobia, Yellowtail Kingfish, Sea bass, Carp Pikeperch, Trout, Eel, Tilapia Afr. Catfish, etc.)
  - Focus on-growing
- Shellfish
  (Mussel, European oyster, Cockle, Manilla Clam)
  - Focus on-growing & larvea/seed nutrition
  - Algae (5 flagellates & 5 diatoms)










WAGENINGEN UNIVERSITY
WAGENINGEN UR

AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR

Fish Nutrition: which type of research

Market related topics (short term):

- Fishmeal & fish oil replacement
  - Feed evaluation/testing of feed ingredients
  - Feed processing
- "New" species (e.g., Pangasius, sole, cockle...):
  - Digestibility & Nutrient requirements
- Testing of additives
- Natural versus commercial feeds

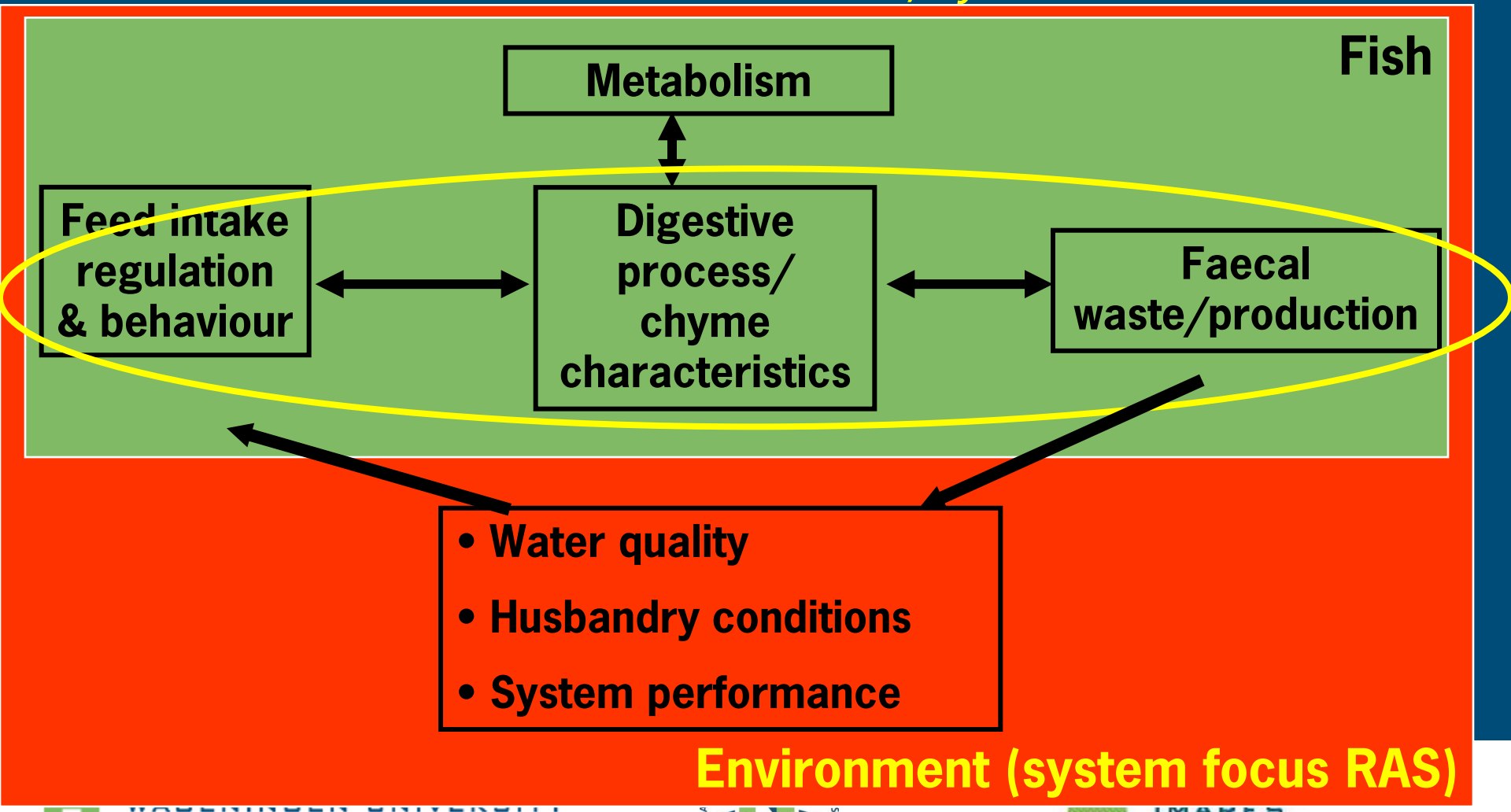
Fish Nutrition: which type of research

Market related topics (long term):

- Impact fish feeds → environment
- Interaction fish feeds ←→ husbandry condition (RAS vs. cages vs. ponds). For RAS:
- Risk/potential of new feed ingredients for product safety/quality:
- Global shortage of Phosphorous.
- .....

Nutrition research

- From feed-fish axis → feed-fish-waste/system axis



Nutrition research

Themes:

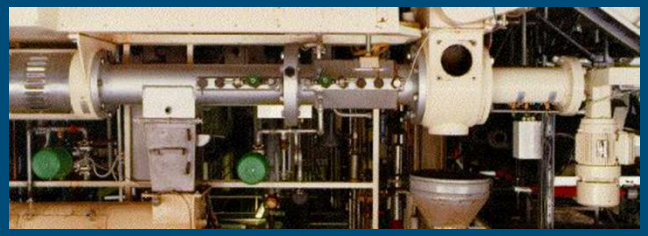
- Feed ←→ Fish axis
- Feed ←→ Fish ←→ Waste/System axis

Domains	Feed←→ Fish	Feed←→ Fish ←→ System	Current PhD & PostDoc
Feed intake (regulation/feeding behav.):	X	X	4
Digestive physiology	X	X	1
Gut health	X		0
Nutrient requirements	X	X	2+1
Feed/ingredient evaluation	X	X	1

Nutrition research

Our infrastructure:

- Fish facilities (Yerseke, Wageningen):
  - RAS (small, large scale); mesocosms, flow-trough…
- Energy metabolism unit (respiration chambers)
- Equipment for digestibility measurements
- Feed processing facilities
- Laboratory facilities:
  - Standard nutritional lab (Weender analysis etc.)
  - IRMS for stable isotopes analysis
  - -omics labs (gene expression, proteomics,…)
  - Histology
  - Microbiology,
  - ….



Nutrition research

Some examples of research (running and past):

1) Digestibility of alternative ingredients for fish meal
2) Gut health: soya bean meal induced enteritis
3) Low cost diet for bivalve spat

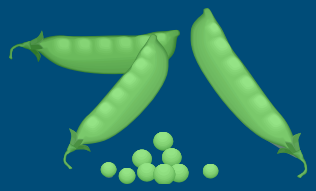
1) Digestibility of alternative ingredients for fish meal

- Facts
  - Fish meal: scarce source, “sustainability issue”, ..
  - Use of alternative protein source required.
  - Diversification of ingredients used in fish feeds.

- Main question
  - What is the nutritional value of ingredients? →
  - Applied: What is the digestibility of alternative ingredients?
  - Fundamental: What causes differences in digestibility?

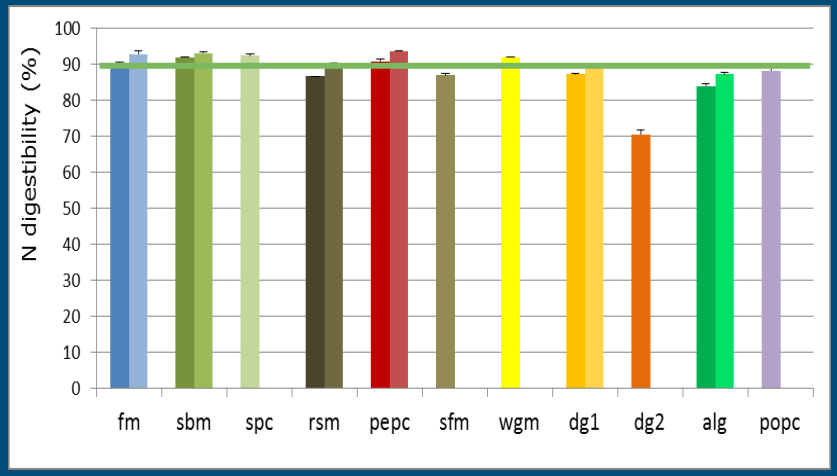
Grains

Soybean

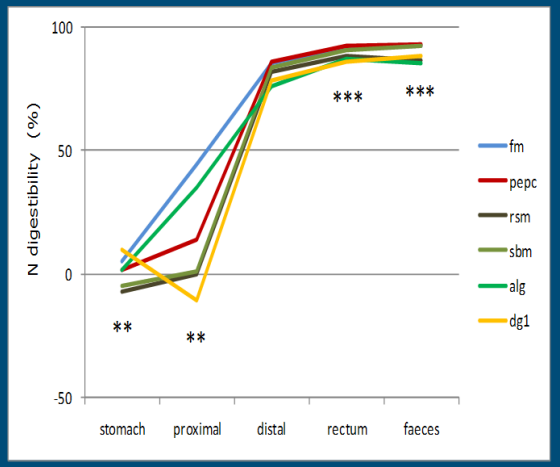


Peas

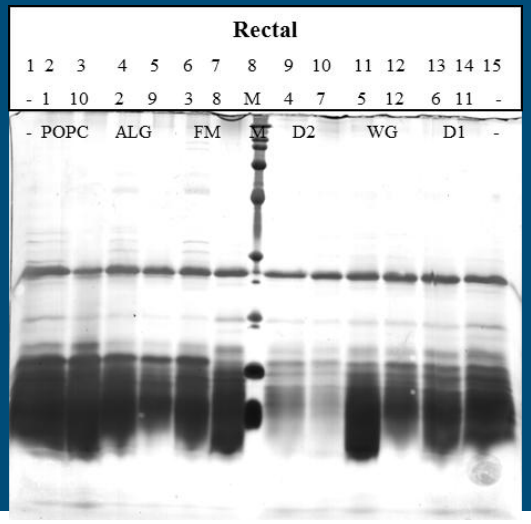
1) Digestibility of alternative ingredients for fish meal



Claresse



left is turbot, right is Claresse

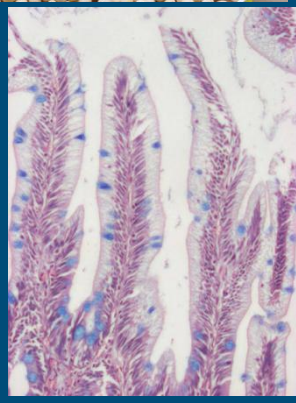


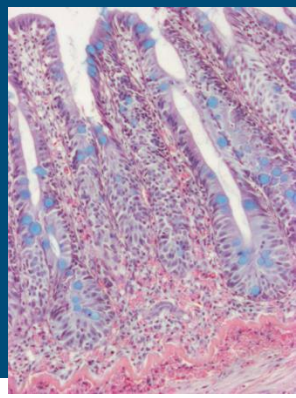
WAGENINGEN UNIVERSITY
WAGENINGEN UR

AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR

2) Gut health: soya bean meal induced enteritis



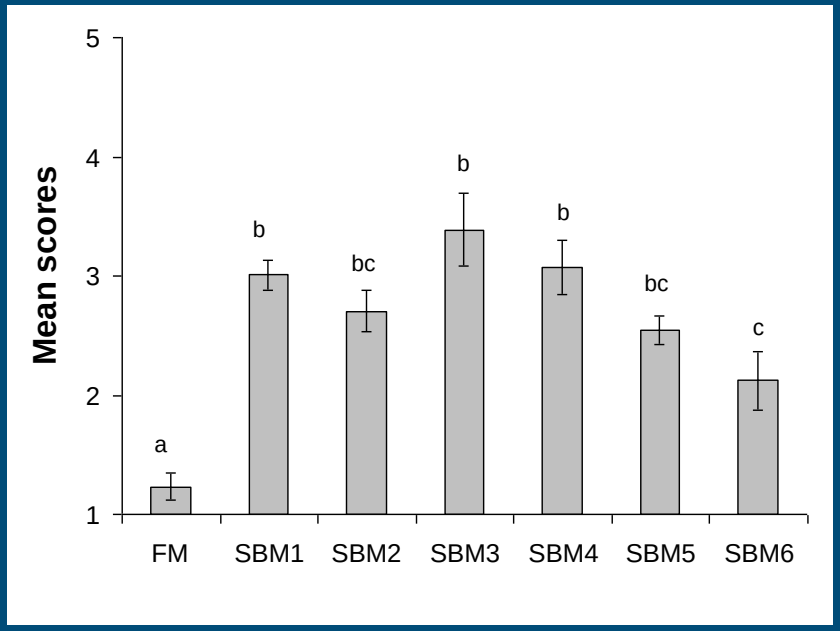


- Facts
  - Fish meal: scarce source, “sustainability issue”, ..
  - Soya bean (meal) potential fishmeal replacer.
  - Salmonids → inflammation second gut segment.

- Main questions
  - To elucidate the mechanism causing inflammation response.
  - Development of scoring system:
    from qualitative to quantitative assessment of enteritis.
  - Is enteritis response depend on source of SBM?
  - Does SBM enteritis occur in other fish species?

2) Gut health: soya bean meal induced enteritis

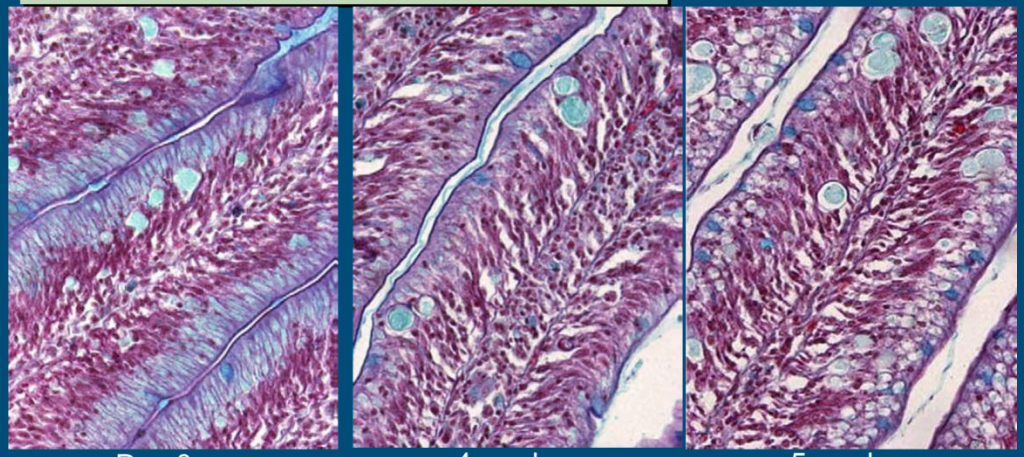
Impact of SBM source on enteritis score



Outcomes:

- Enteritis dependent on SBM source
- Also SBM enteritis in carp → but in carp recovery with time
- Scoring method applied as standard for salmon diets.

Common carp fed 20% SBM

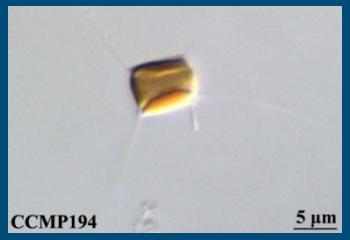


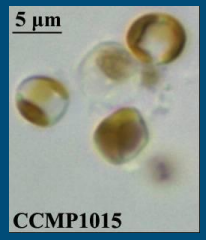
WAGENINGEN UNIVERSITY
WAGENINGEN UR

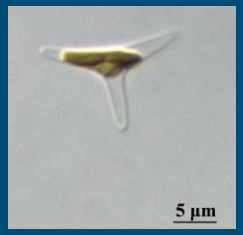
AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR

3) Low cost diet for bivalve spat





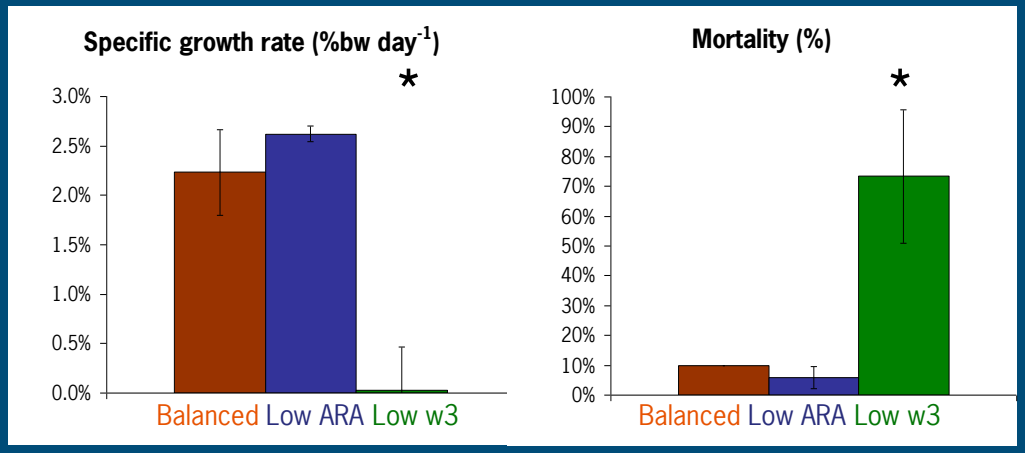


- Facts
  - Production of life phytoplankton is very costly (30% of hatchery costs)
  - Complete replacement by artificial diets has not been achieved yet
  - Each algal species has its own shape and biochemical composition

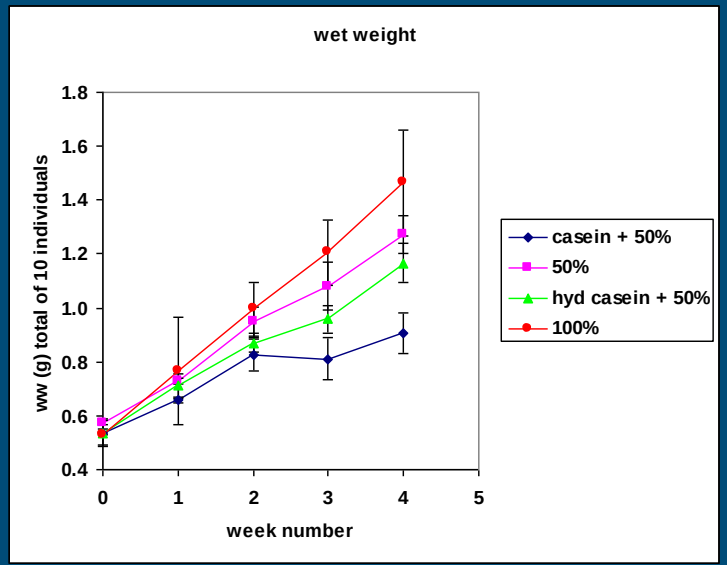
- Main questions
  - What is the right biochemical diet composition for different bivalve species?
  - What component in life algae is responsible for shellfish growth?
  - How can we test the composition independent of shape -> liposomes

3) Low cost diet for bivalve spat

Test system for bivalve diets



High concentrations of EPA and DHA give better growth and reduce mortality
Low concentration of ARA sustains good growth



Liposomes (casein or hydrolysed casein) give lower growth than 50% algae -> detrimental effect on growth?

WAGENINGEN UNIVERSITY
WAGENINGEN UR

AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR

Thank you





WAGENINGEN UNIVERSITY
WAGENINGEN UR

AQUACULTURE AND FISHERIES
WAGENINGEN UNIVERSITY

IMARES
WAGENINGEN UR