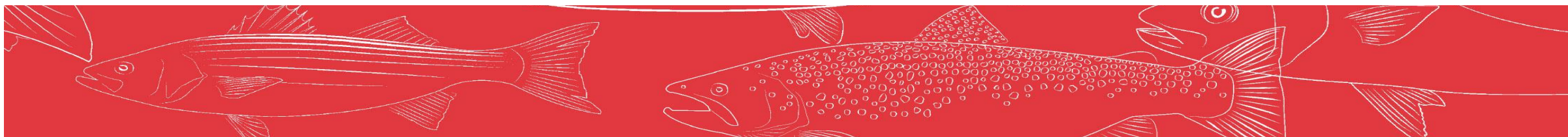




Hva gjør Skretting med overgangsfôr for å sikre robust fisk?



Fremtidens smoltproduksjon, Sunndalsøra

27 October 2022

M. Naveed Yousaf, Ingunn Stubhaug & Vibeke Vikeså

Skretting Aquaculture Innovation (SK AI)

Established

1989 

Collaborations with

>50 

research
organisations

>100

Employees



>25

Nationalities

40

Researchers

23

PhDs



Core competencies

Nutrition

Feed Production

Health

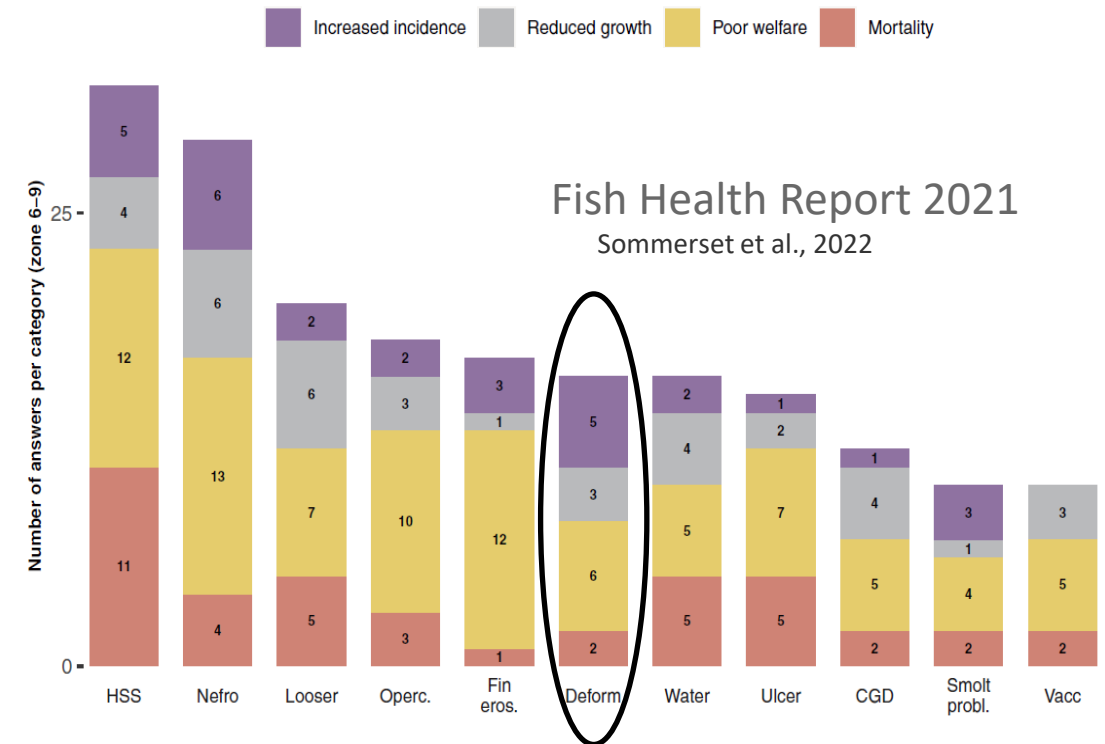
Research on
9 key species



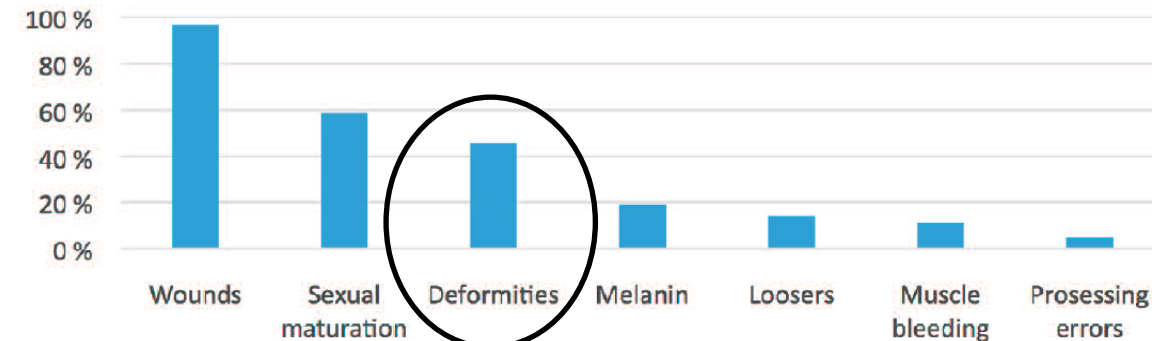
Smoltification challenges

- Smoltification strategies:
 - Light, temperature, smolt size, intensification
 - RAS vs Flow-through
- Spinal Deformities
 - 22-24% prevalence (Fraser et al., 2013)
 - Early life stages are sensitive to high temperature/heat shock, and can lead to deformities

The 10 diseases or welfare problems in salmon hatcheries



Most common causes of downgrading salmon, slaughterhouse

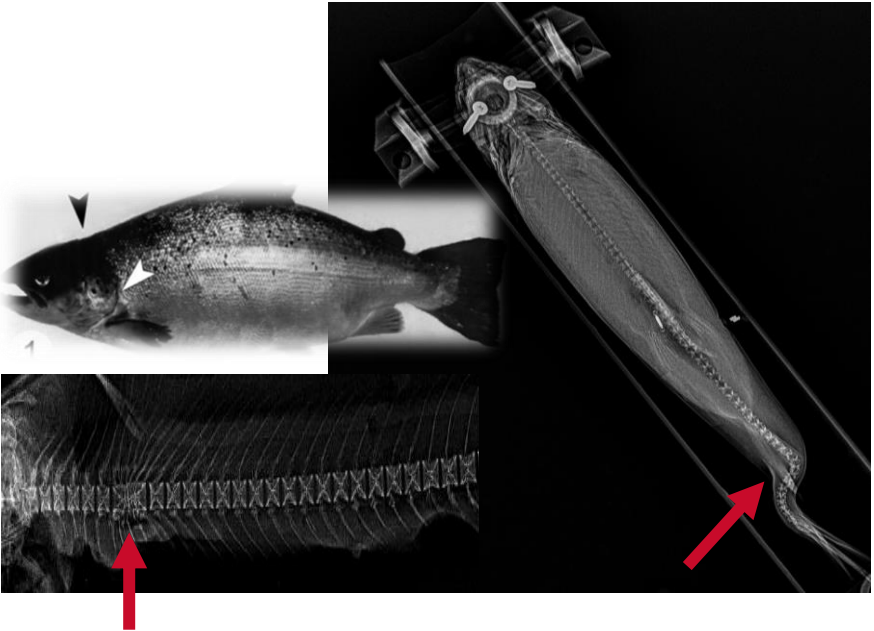
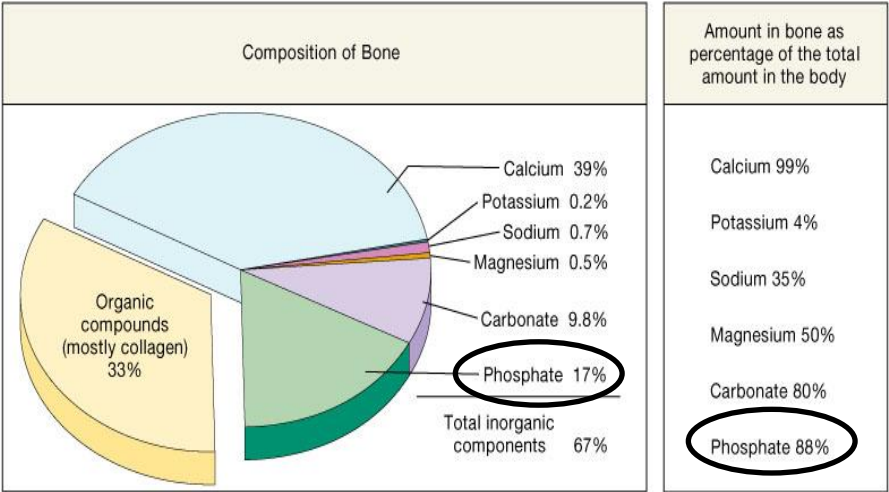


The importance of dietary phosphorous

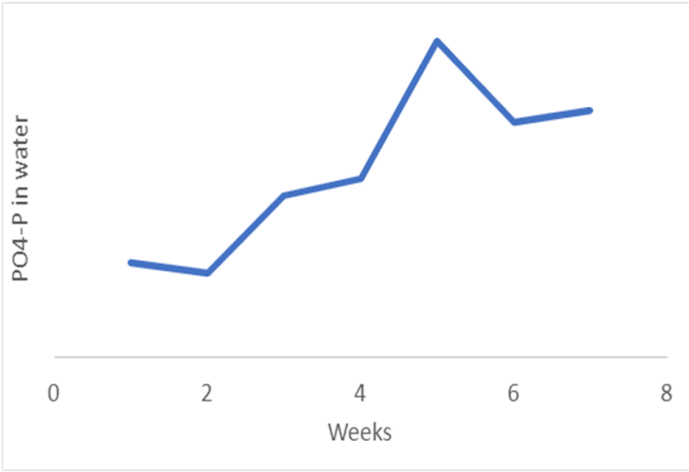
Limited resource,
in all animal species

Risk factor for deformities.

Build-up in water;
eutrophication,
flow-through vs RAS



Spinal deformities



Dissolved phosphate in
water in RAS tanks

Skretting Trial

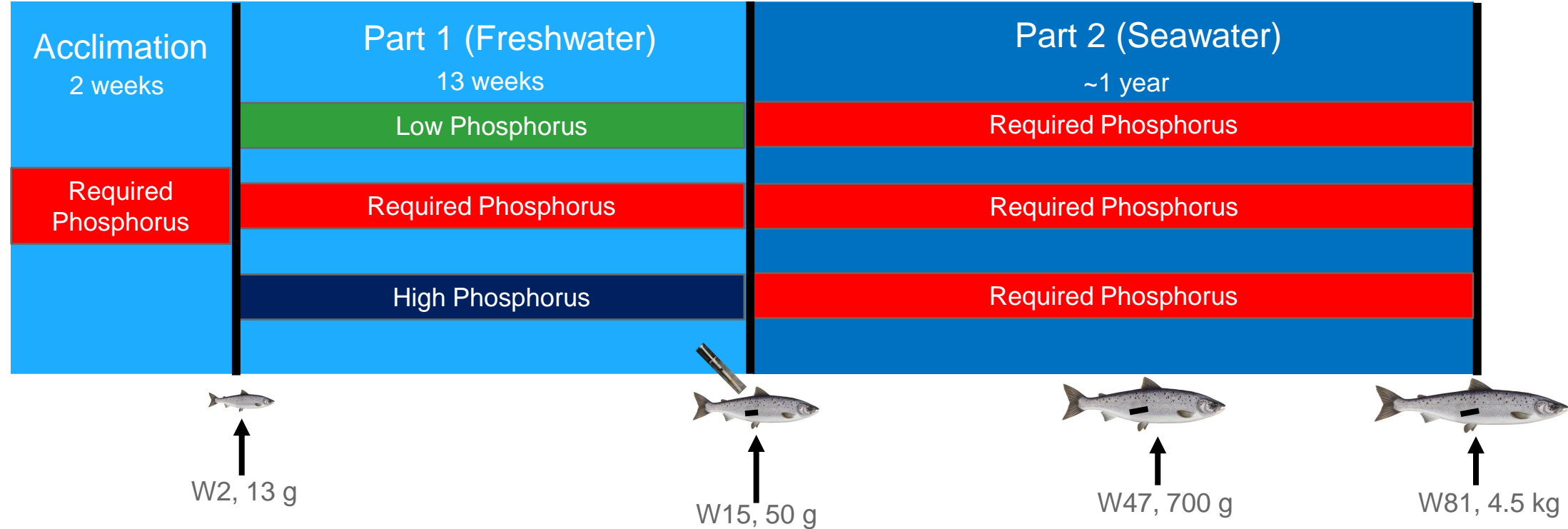
Optimal dietary Phosphorus for bone health

Team 😊

Lucia Drabikova (Ghent University)
P. Eckhard Witten (Ghent University)
M. Naveed Yousaf (Skretting AI)
Charles McGurk (Skretting AI)
Thea Morken (Skretting AI)
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Complete life cycle phosphorus study



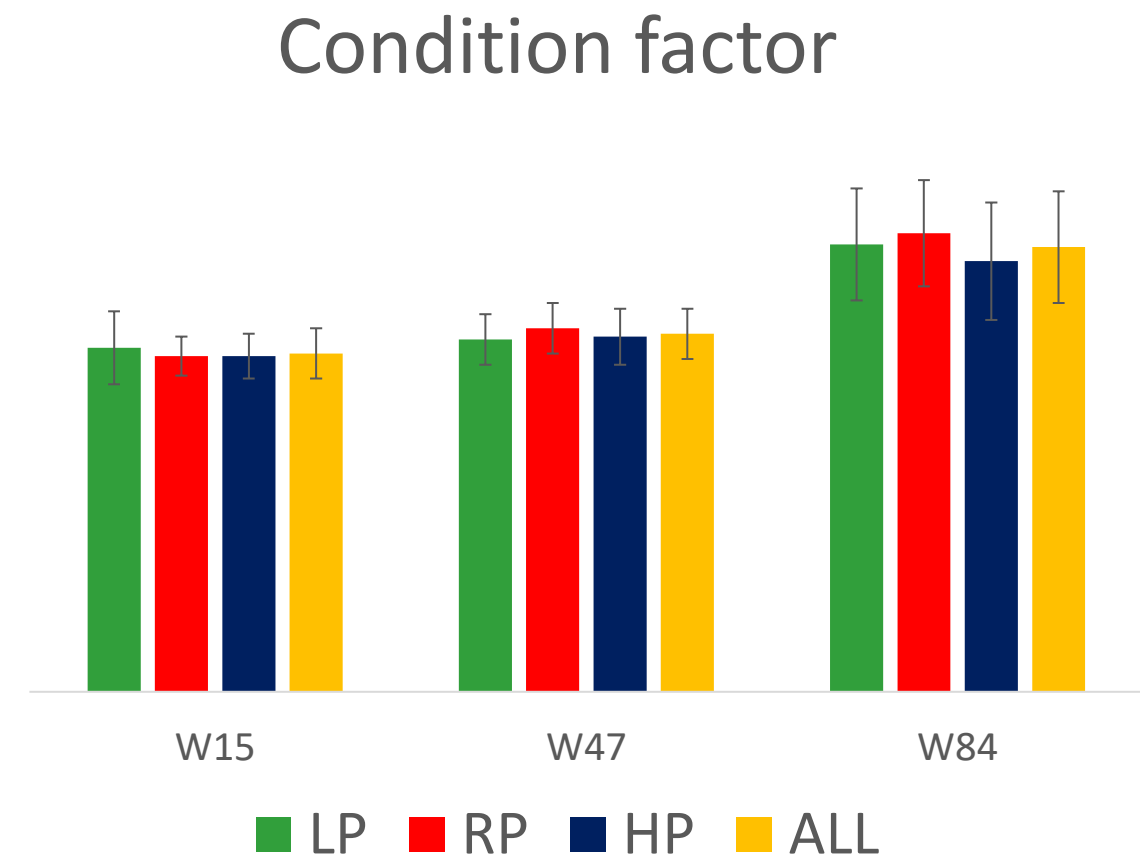
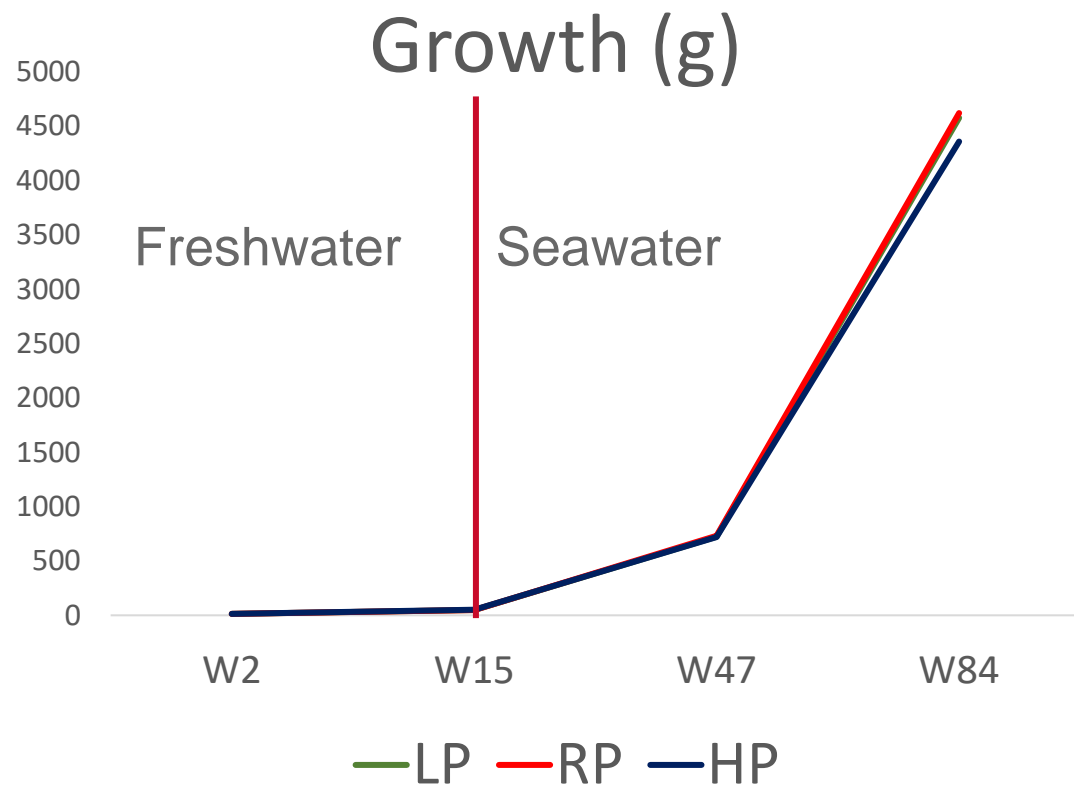
Low Phosphorus (LP) = 50% less than required P

Required Phosphorus (RP) = NRC levels P

High Phosphorus (HP) = 50% more than required P

Smoltification
Vaccinated
Pit tagged

Results - Growth



LP = Low Phosphorus

ALL = Average of all animals

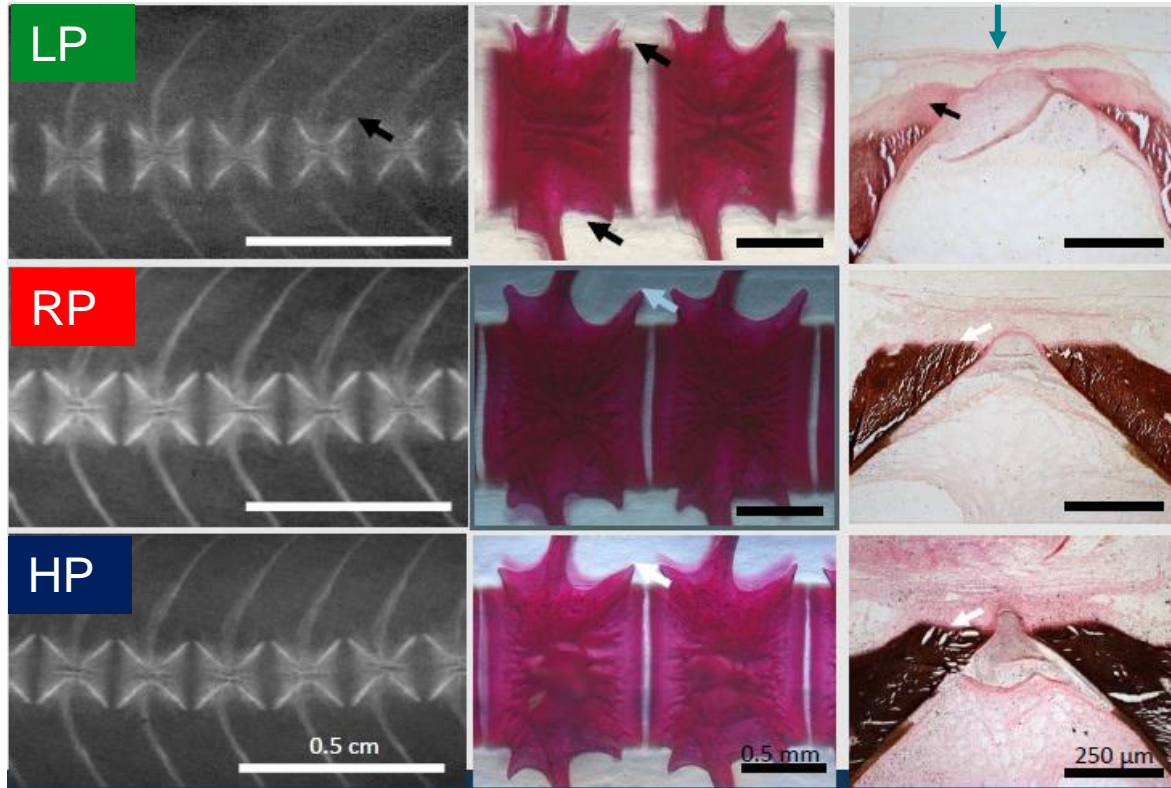
RP = Required Phosphorus

HP = High Phosphorus

Results - Bone mineralization

Week 15

Freshwater



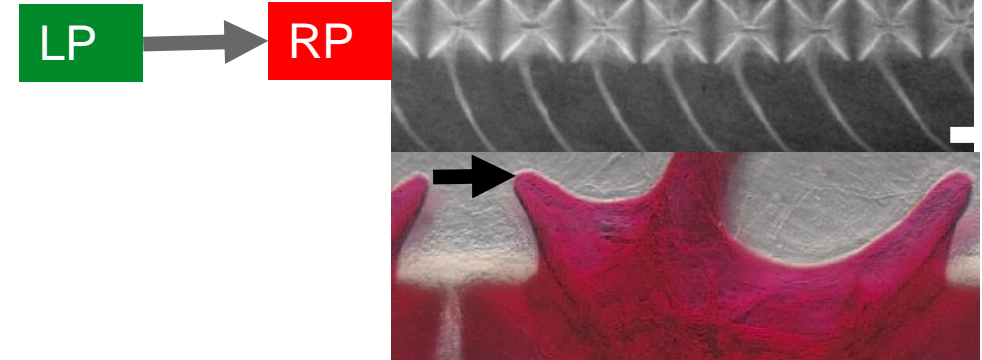
X-rays

Whole mount
Alizarin red
staining

Histology

Week 84

Seawater



LP = Low Phosphorus

RP = Required Phosphorus

HP = High Phosphorus

Results - Spinal deformities

Four scenarios

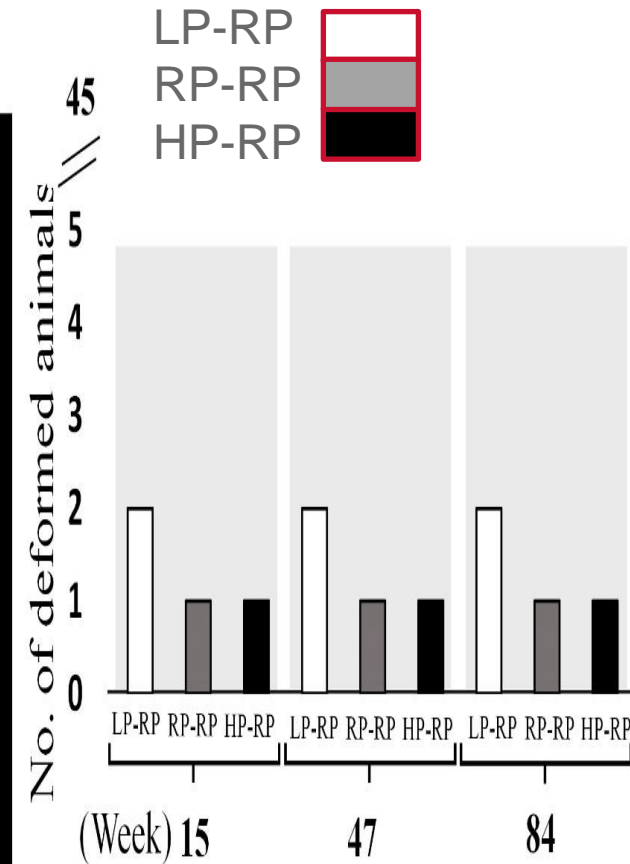
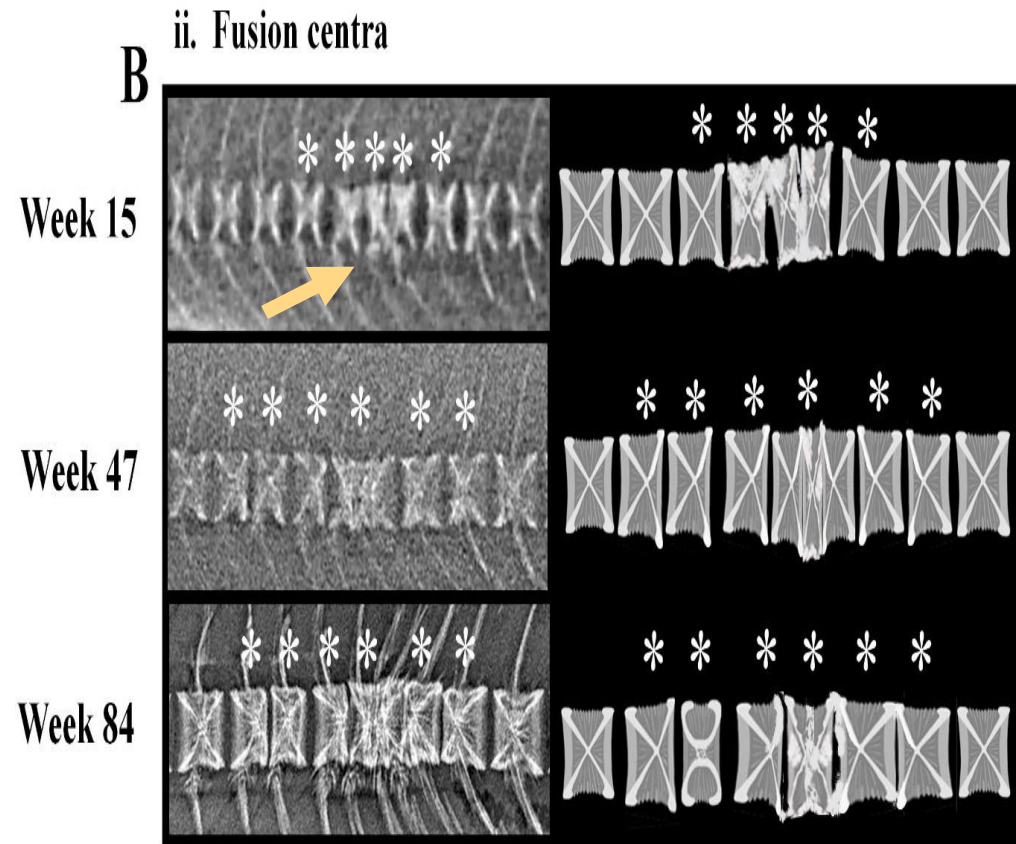
1. Recovery
2. Stable deformities
3. **Progression**
4. Late-onset deformities

LP = Low Phosphorus

RP = Required Phosphorus

HP = High Phosphorus

Category 3. Progression



Results - Mechanical properties

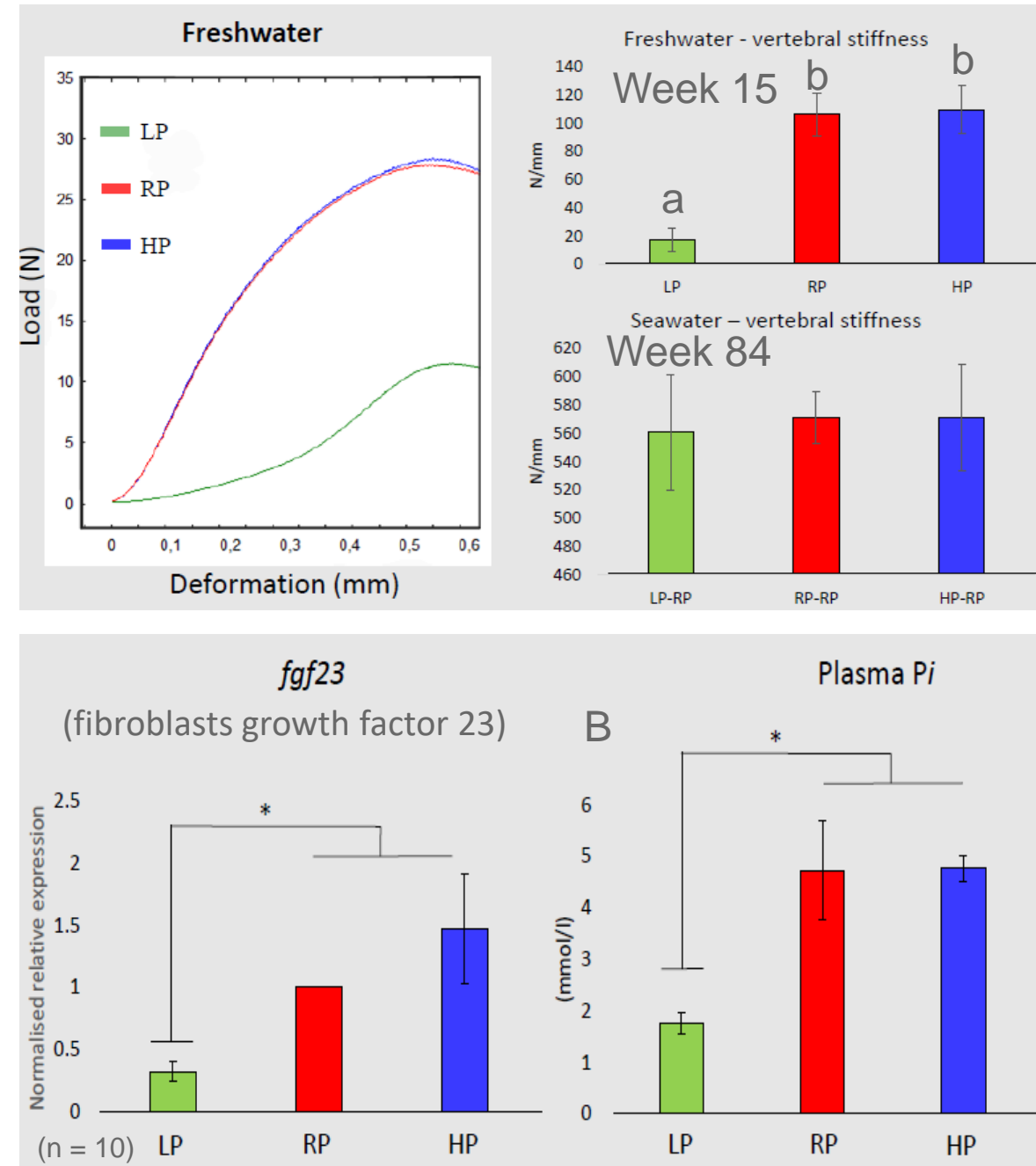
- Low P fish re-mineralized and re-attained vertebral stiffness.

- High P diet leads to more phosphorus excretion in kidneys but not increased P plasma levels as well.

LP = Low Phosphorus

RP = Required Phosphorus

10 HP = High Phosphorus

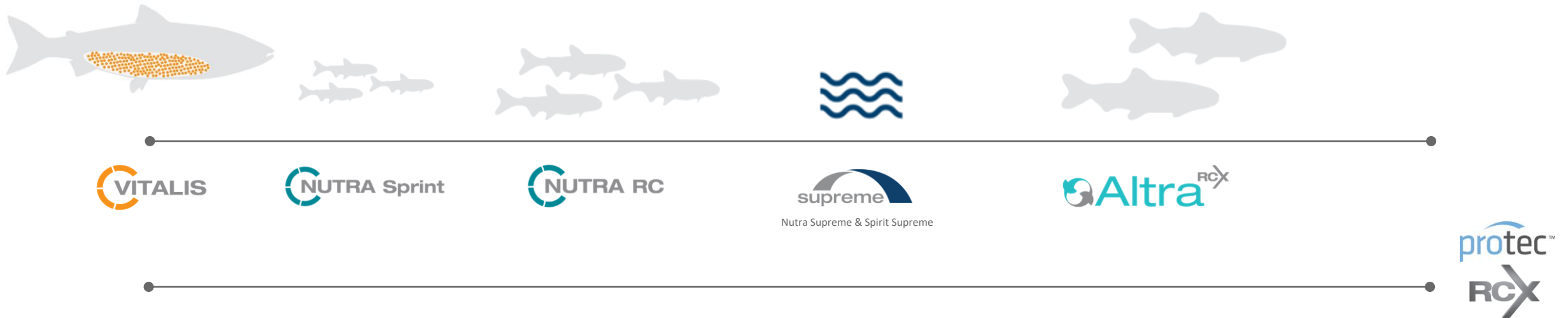


Re-think Phosphorus

- No growth differences identified in all three dietary groups.
- Fish fed experimental low phosphorus diet showed less mineralized spines in freshwater phase.
- Low phosphorus diet alone in freshwater does not increase the incidence of vertebral deformities in seawater.
- High P diet increases P excretion in kidneys and has no additive benefit in bone mineralisation nor deformity prevention.

Phosphorus in diet is not the sole causative factor for spinal deformities.

Thank you for your attention!



Skretting portfolio for fresh water and transfers

Optimal nutrition for each segment 😊