



MUSSELS, STARFISH AND INSECTS AS FEED PROTEIN SOURCES

JAN VÆRUM NØRGAARD
ASSOC. PROFESSOR
DEPARTMENT OF ANIMAL SCIENCE
AARHUS UNIVERSITY, FOULUM, DENMARK





NEW PROTEIN SOURCES

- > Agenda is based on current research projects
 - > Insects
 - > Blue protein: blue mussels + starfish
- > Purpose is to provide overview
 - > Why produce it?
 - > Use as feedstuff
 - > Future





INSECTS





INSECTS

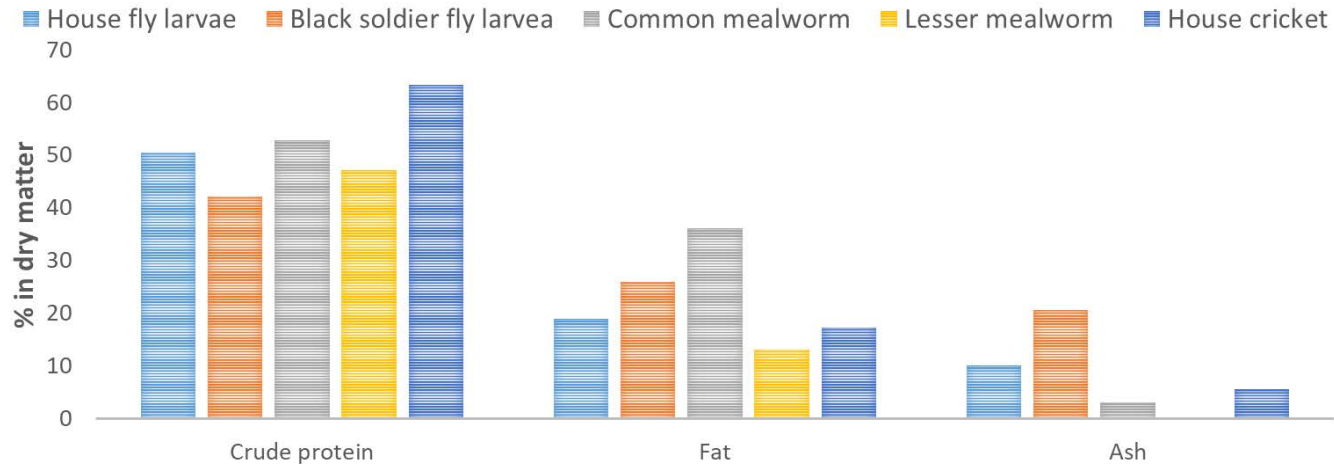
- › Industrial production is possible
 - › Black soldier fly
 - › Common and lesser mealworm
- › Why mealworms
 - › Already natural habitants
 - › Already produced in 100 ton-scale
 - › Turns low-value biomass into high-value biomass
 - › High nutrient efficiency – low climate/environment impact
 - › Simple to produce at hobby scale
 - › Great potential for upscaling and big business!
 - › Food vs. Feed: Large scale = feed = impact !





INSECTS

> Nutrient content shows potential as protein source





INSECTS

- › Current EU legislation:
 - › Intact insects OK for human food
 - › 7 species OK in aquaculture
 - › Meal to pigs and poultry not allowed – but alive is OK
- › Long way to EU-approval for pigs and poultry
- › Production should be automatised
- › Feed for beetles and larvae should be low-value and EU approved
- › Processing should handle potential zoonotic hazards





INSECTS

- › Current research:
- › inVALUABLE (Innovationsfund Denmark, DTI lead)
- › Exp 1: Growing pigs fed 5 species of insects to evaluate nutrient value for human and pigs
- › Exp 2: Piglets fed black soldier fly, common and lesser mealworm +
- › Exp 3: Chickens fed black soldier fly, common and lesser mealworm
- › to evaluate impact on growth and health





BLUE PROTEIN: MUSSELS

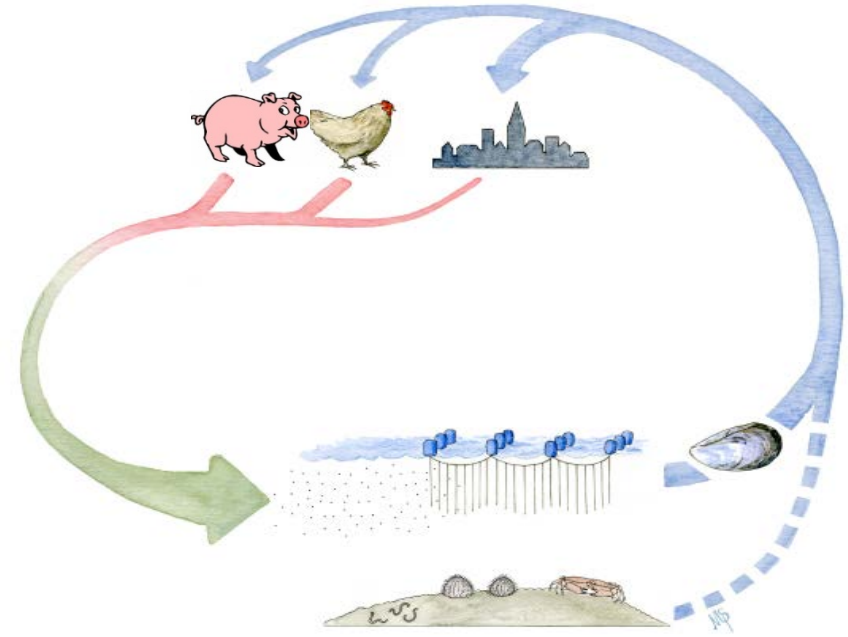




BLUE PROTEIN: MUSSELS

- › Blue mussels grown on lines/nets
- › Farmed in waters with high nutrient load=algae
- › Great production: 60 ton wet weight/hectar
- › Removes 600-900 kg N/hectar/year
- › Removes 30-40 kg P/hectar/year

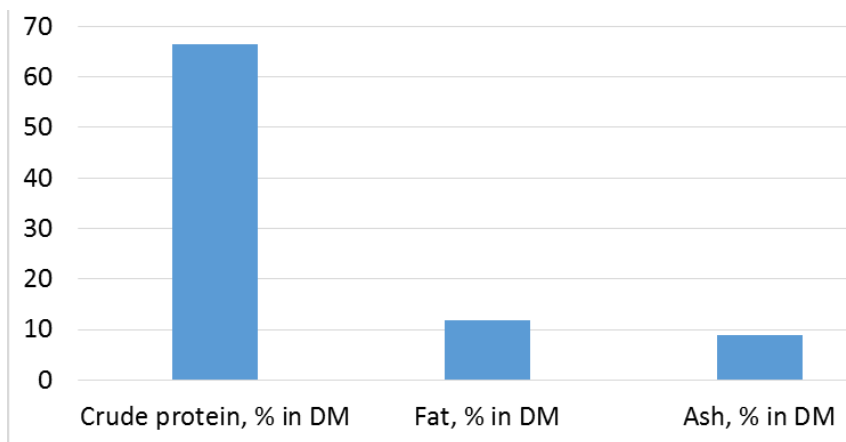
- › Future concept: Mitigation mussels
- › Farms (aquaculture, pigs, poultry) excrete N+P
- › Farmers or municipalities invest in mussel farms
- › Feed mussel to fish, pigs, poultry
- › ... Closing the N+P nutrient cycle





BLUE PROTEIN: MUSSELS

- > Very close to fishmeal:
- > 58-68% crude protein, 10-16% fat, 9-10% ash in dry matter
- > SID crude protein of 83-86%
- > The lipids may be interesting but can cause challenges. Season dependent





BLUE PROTEIN: MUSSELS

- › Current research:
- › MuMiPro (Innovationfund Denmark, DTU-AQUA lead)
- › Exp 1: Feeding egg layers mussel meal with/without shells
- › Exp 2: Feeding organic piglets mussel meal
- › Exp 3: Using mussel silage to stimulate feed intake of piglets





BLUE PROTEIN: STARFISH





BLUE PROTEIN: STARFISH

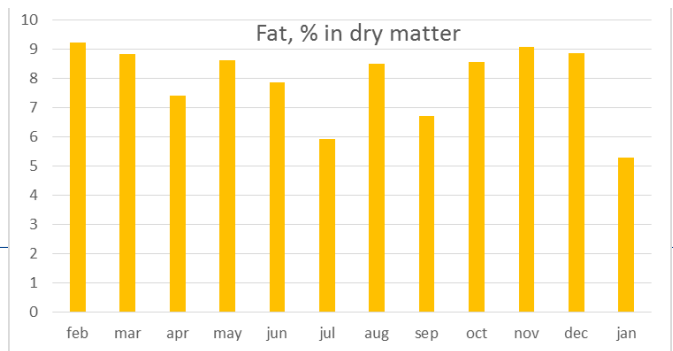
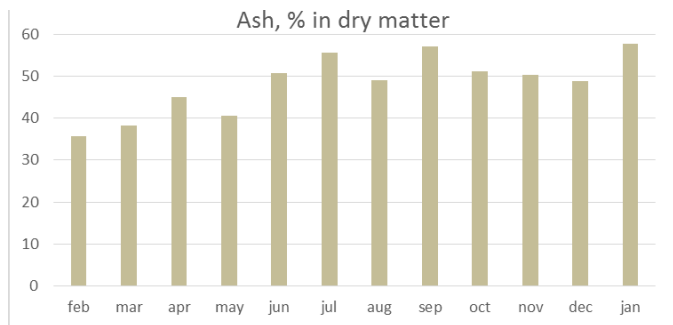
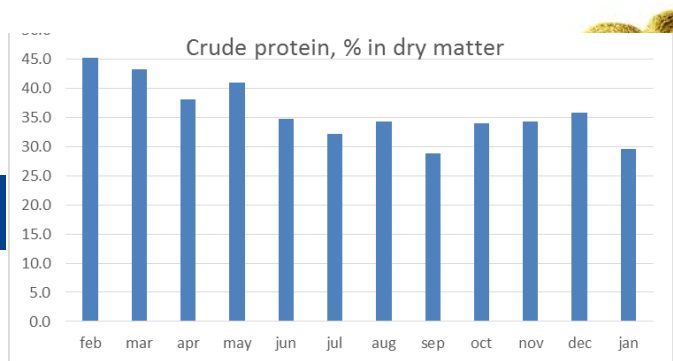
- › Starfish predate on mussels = a pest for the mussel industry
- › Easy and gentle to catch
- › Simple and fairly easy to make into starfish meal
- › STARPRO (GUDP funding, DTU-AQUA lead)
- › Problem -> research -> solution + product





BLUE PROTEIN: STARFI

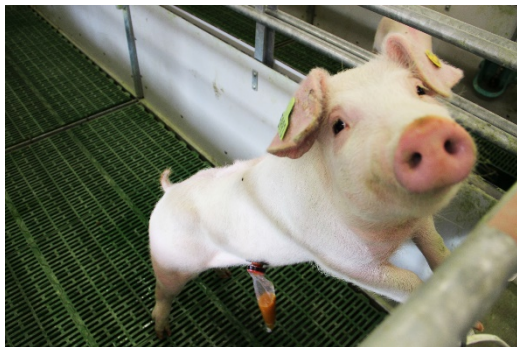
- > Chemical composition
- > 29-45% (70%!) crude protein
- > 35-57% ash
- > 10-18% calcium
- > 5-9% fat





BLUE PROTEIN: STARFISH

- > 3 pig experiments at AU Foulum
- > Exp 1: SID crude protein is 80%
- > Exp 2: pilot scale; 5% = fish meal
- > Exp 3: full scale; 5% = fish meal
- > Recommendation: analyze and dose up to max calcium





NEW PROTEIN SOURCES

- › Great opportunities for industry and society
- › Great challenges regarding practical issues
- › Current development is driven by society needs/research
- › Industry should start now to prepare for the future markets





THANK YOU FOR YOUR ATTENTION!

> Underlying projects:

- > Mealworm: inVALUABLE (Innovation Fund Denmark) www.invaluable.dk
 - > Blue mussel: MuMiPro (Innovation Fund Denmark) www.mumipro.dk
 - > Starfish: STARPRO (GUDP) www.skaldyrcenter.dk
 - > Seaweed: Tang.nu (Velux Foundation) www.tangnu.dk
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- > Jan Værum Nørgaard
 - > Aarhus University, Foulum, Denmark
 - > JanVNoergaard@anis.au.dk

