

Nya marina foderråvaror – från sjömatbiprodukter och odling av marina organismer

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ENSILAGE



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- Svenskt projekt finansierat av Formas och icke-akademiska partners



- WP1 – Marknadsanpassning @ RISE
- **WP2 – Optimering av råvaruval och processförhållanden @ CHALMERS**
- WP3 – Uppskalning av ensilseringen @ Rena Hav AB/Scandic Pelagic AB
- WP4 – Utveckling av uppvärmnings- och torkningstekniker @ RISE
- WP5 – Optimering av foderkvalitet @ SLU
- WP6 – Analys av värdet hos nya foder @ SLU





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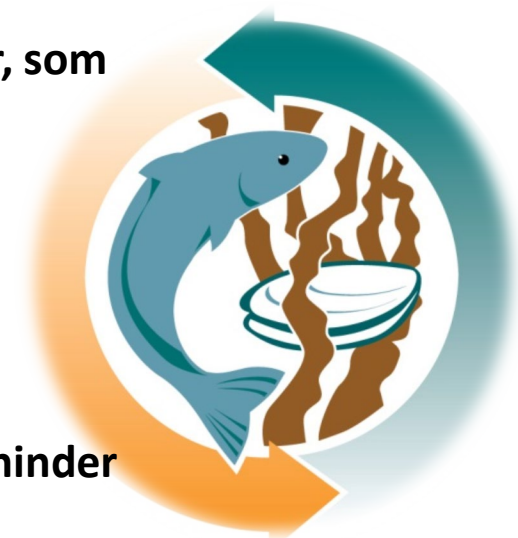
Research challenges within SWEMARC



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Vår vision är att utveckla nya hållbara marina vattenbruksmodeller, som präglas av:

- **minskat beroende av vildfångad fisk för foderproduktion**
- **Nya odlingsarter**
- **minskade miljöeffekter**
- **cirkulära näringsflöden**
- **positiv integrering med lokalsamhällen och kustnära aktiviteter**
- **effektiv produktion med minskade administrativa och rättsliga hinder**
- **ökad kunskap och acceptans för odlad fisk och skaldjur**





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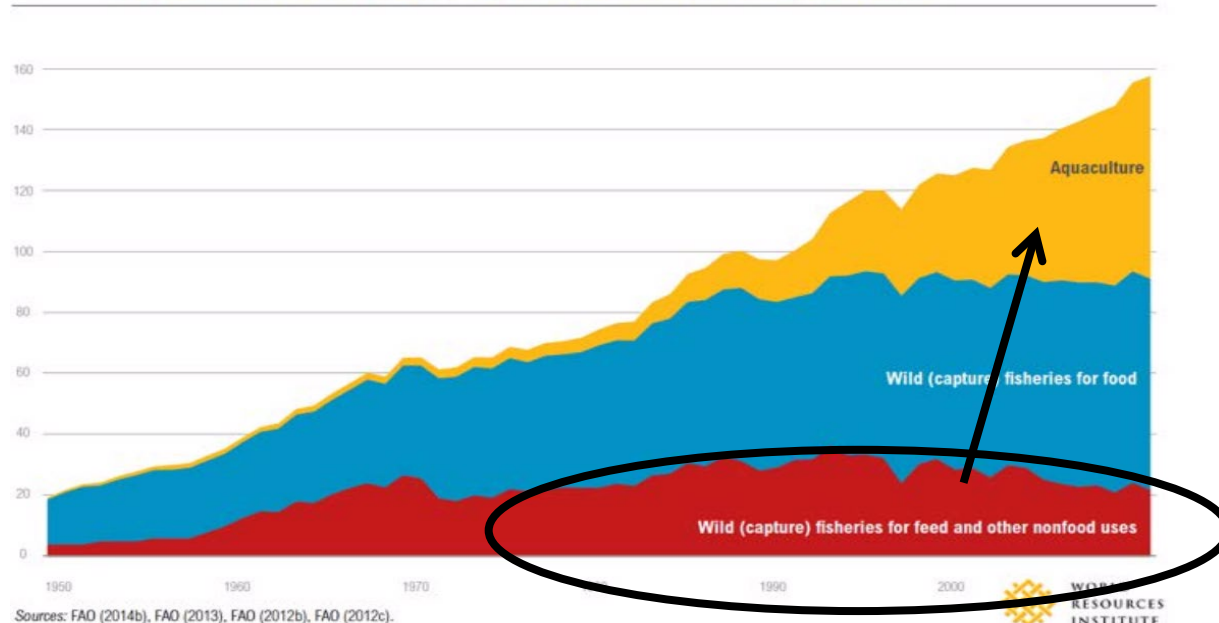
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Aquaculture filling the gap

Aquaculture production is expanding to meet world fish demand (million tons)





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Arbetar mot en cirkulär produktion
av sjömat i Sverige



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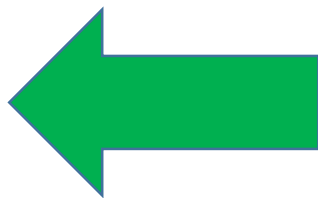
Musselfeed



Marina
foderingredienser



Sjömat**s**biprodukter &
organismer lägre i
näringkedjan



Slutprodukter med
hög kvalitet





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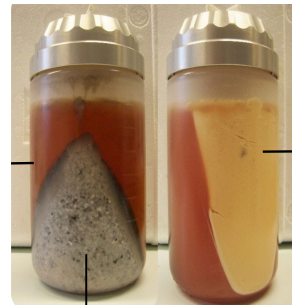
Processtekniker



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Sillbiprodukter



pH-skift-processning



Ensiling



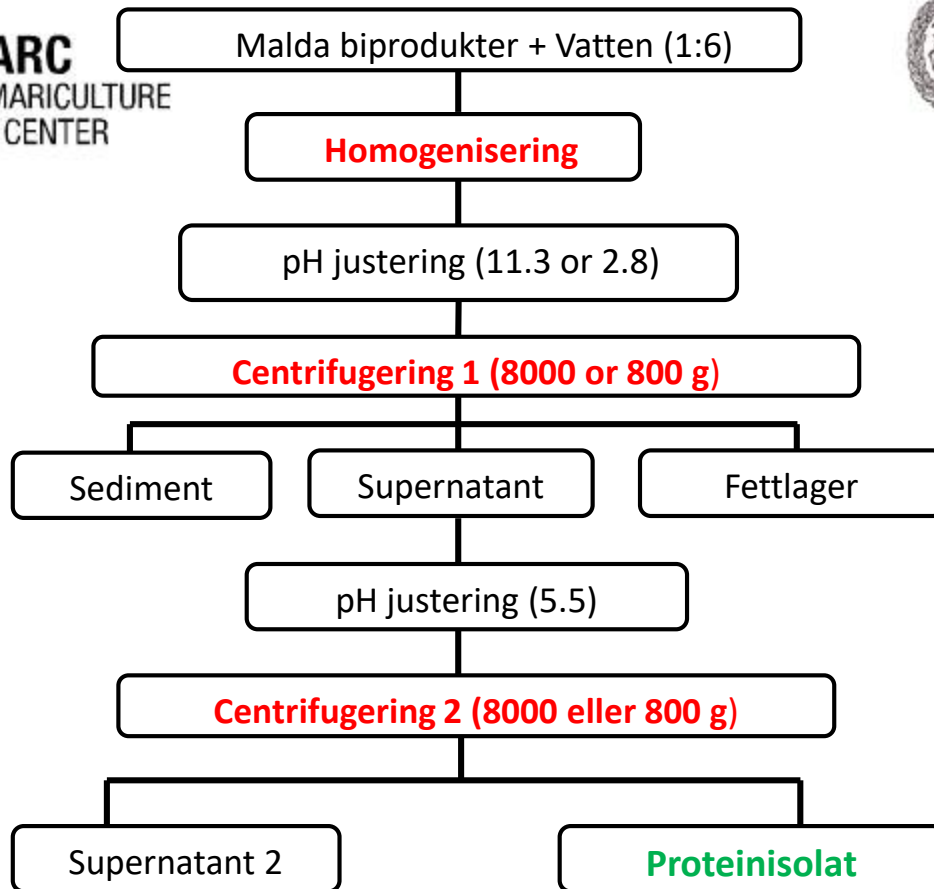
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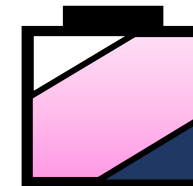


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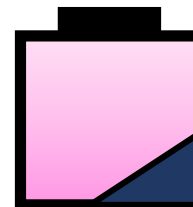
pH-skift-processing



Homogenat



Efter 1a centrifugeringen



Efter 2a centrifugeringen





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Bi-produktkombinationer



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1)

2)

3)

Protein solubility (%)

100
90
80
70
60
50
40
30
20
10
0

2 3 4 5 6 7 8 9 10 11 12 13

pH

Undeland, et al., 2003



Hinchcliffe et al., 2019





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Results



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- 1) Alkaliskt pH
- 2) 8000 g
- 3) Biproduktkombinationer; ryggben + huvud
och ryggben + huvud + inälvor





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Uppskalningsförsök



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Musselmjöl



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Musselfeed

Ca. 60% av odlade musslor bedöms vara ätliga
som livsmedel

Ca. 40% kastas ofta bort eller används som
gödselmedel

Sverige har vi arbetat med företagets
musselfoder för att optimera deras
torkprocess





Ensilaging



Sillbiprodukter



Ensileringsprocess



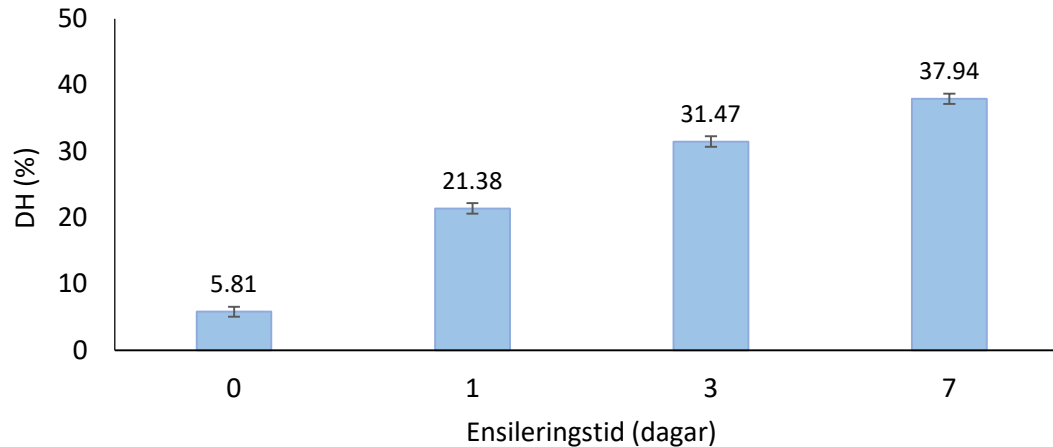
Sill-silage

- Varför ensilering?
 - Enkel process; preserveerar biprodukterna och producerar samtidigt en näringsrik produkt
 - Fördelar jämfört med fiskmjölsproduktion utifrån låga investeringskostnader, lågt energibehov, inget avloppsvatten och lukt



- Graden av proteinhydrolysis ökar med tiden → vi kan ställa in processen utifrån vilken hydrolysisgrad vi önskar!

Grad av proteinhydrolysis (DH, %)





- Lyckat ensileringsförsök i 350 L-skala



Notera att snart finns en 2 kubiks-ensileringstank från Landia på plats för storskaliga ensileringsförsök! Tillgänglig för alla!



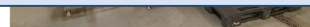
Herring by-products



Mincing



Ensilaging



Sterilization



Silage





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Innehåll av näringssämnen



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Foderingrediens				
Makronäringsämnen%	Sillmjöl	Musselmjöl	Fiskmjöl	Silage
Protein	76.09	60.84	72.50	56.40
Fett	14.32	10.93	5.30	21.40
Aska	3.44	15.93	17.50	9.75
Energi (MJ/kg)	23.72	20.60	20.70	
Vatten	3.77	4.78	6.70	11.70
Essentiella aminosyror%				
Arginin	4.80	4.07	3.73	3.78
Histidin	2.04	1.10	1.53	1.29
Isoleucin	3.60	2.29	3.64	2.31
Leucin	6.49	3.62	4.69	4.18
Lysin	7.29	4.43	7.30	4.38
Methionin	2.72	1.39	2.03	1.45
Fenylalanin	3.24	2.09	2.68	2.20
Treonin	3.67	2.62	2.49	2.50
Valin	4.37	2.50	3.26	2.95





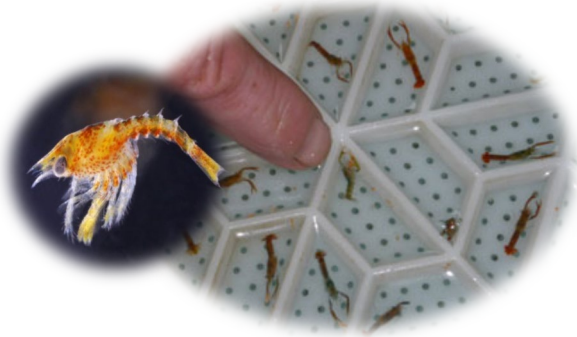
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Utfodringsförsök



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Muselmjöl
pH-shift isolat
Räkbiprodukter



Proteininnehåll
Muselmjöl



Marine jäst (Warwas
et al.)
pH-shift isolat
Ensilage





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Effect of mussel meal based diets on growth of Atlantic wolffish (*Anarhichas lupus*)

James Hinchcliffe¹, Jonathan Roques¹, Niklas Warwas¹, Ida Heden¹, Markus Langeland^{1,2}, Henrik Sundh¹, Björn Thrandur Björnsson¹, Elisabeth Jönsson¹, Kristina Sundell¹,



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²Department of animal nutrition and management at Swedish University of agricultural sciences Uppsala, Sweden

AquaAgri
NomaCulture

Wolffish

– promising species for Swedish aquaculture but with unknown nutritional requirements

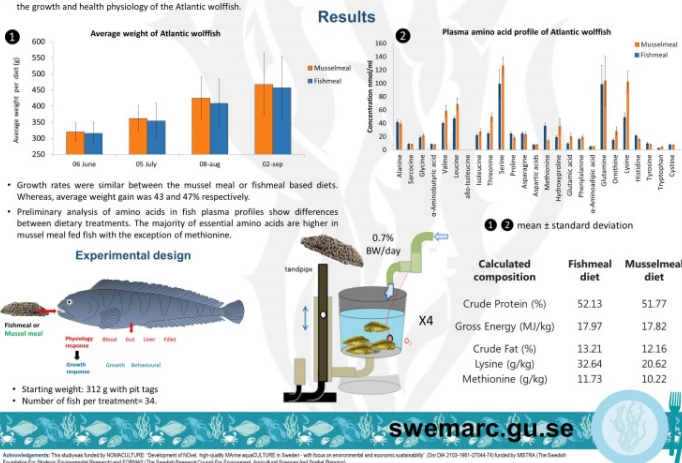
- The Atlantic and spotted wolffish, *Anarhichas lupus* and *A. minor*, have been proposed as promising species for cold-water, marine aquaculture. However, their nutritional requirements have yet to be established.
- Little attention to date has been focused on meal from lower trophic organisms such as mussels as a potential replacement for fishmeal in aquafeeds.
- Blue mussel byproducts have a high protein content and amino acid content that is similar to fish meal. Inclusion in diets can add nutritional value and reduce the need for wild fish.
- The objective of the present study was to evaluate the effect of mussel meal on the growth and health physiology of the Atlantic wolffish.

Prospects and Conclusion

- Musselmeal is a promising protein source and at least 50% inclusion can be included in the diets of Atlantic wolffish without adverse growth effects.
- Mussel meal has a strong potential to provide adequate essential amino acids as an alternative protein source.
- Further analytical work includes feed conversion ratio, feed consumption, nutrition and stress physiology parameters that will help us to understand any health effects.

Twitter:

SWEMARC_UGOT
JamesHinchclif6



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**HELGE AX:SON
JOHNSONS STIFTELSE**

FORMAS



MISTRA

