



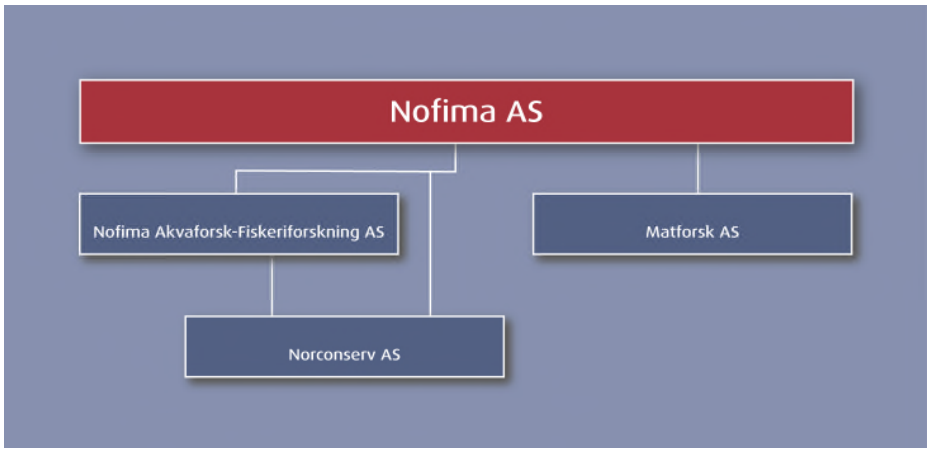
Latest developments and way forward regarding feed for cod

Torbjørn Åsgård, Grete Bæverfjord, Synnøve Helland, Ståle Refstie, Gerd Berge, Yoav Barr, Bente Ruyter, Jon Arnason

04.10.2008 test 1




Who are we?



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graph TD; Nofima_AS[Nofima AS] --- Nofima_Akvaforsk_Fiskeriforskning_AS[Nofima Akvaforsk-Fiskeriforskning AS]; Nofima_AS --- Matforsk_AS[Matforsk AS]; Nofima_Akvaforsk_Fiskeriforskning_AS --- Norconserv_AS[Norconserv AS];
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04.10.2008 test 2



History



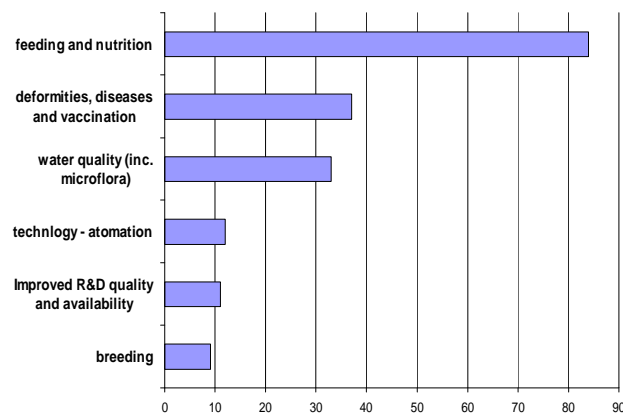
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3



Cod Hatcheries' recommendations 1



Innovasjon Norge study to identify the most urgent needs for improvements that the industry needs to improve the biological and economical results.

Sats på torsk, Tromsø, 16-17 februar 2006

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4



Initial feeding

Live feed

natural zooplankton

rotatoria

artemia

enrichment and
boosting

Protein content

FAA and AA profile

Lipid classes, PL

FA profile

Oxidation

Weaning diets

Nutritional balance

FAA and AA profile

Nutrient leakage

Ingredients (Hydrolysates)

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5



Gastro intestinal tract in Atlantic cod



Large storing capacity in stomach and long intestine

Cod 100 - 300 g

Dietary protein (49-63%) and lipid (11-28%)

49 % protein and 20 % is adequate for optimal growth and nutrient utilization, but carcass growth rate was higher at 58 % protein.

- HSI may be positively correlated to dietary lipid level and negatively correlated to dietary ash level.

Grisdale-Helland, B, Shearer, K.D., Gatlin III, D.M. & Helland, S.J. 2008. Aquaculture 283:156-162.

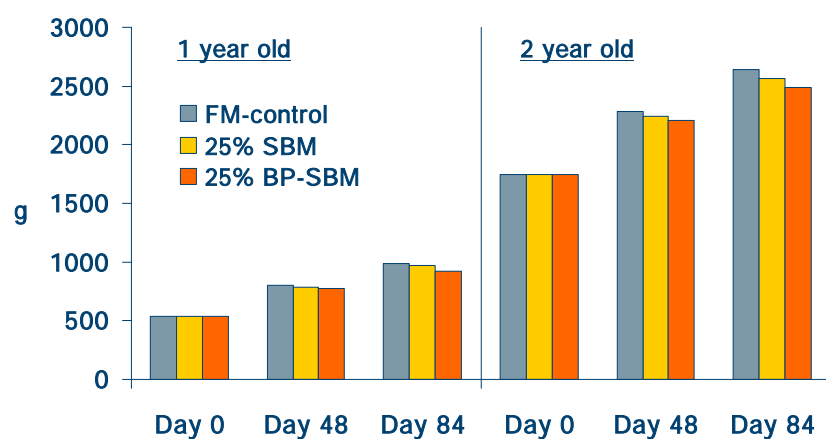


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7

Growth in cod fed SBM and BP-SBM



Refstie, S., Førde-Skjærvik, O., Rosenlund, G., Rørvik, K-A. 2006. Aquaculture 255:279-291.

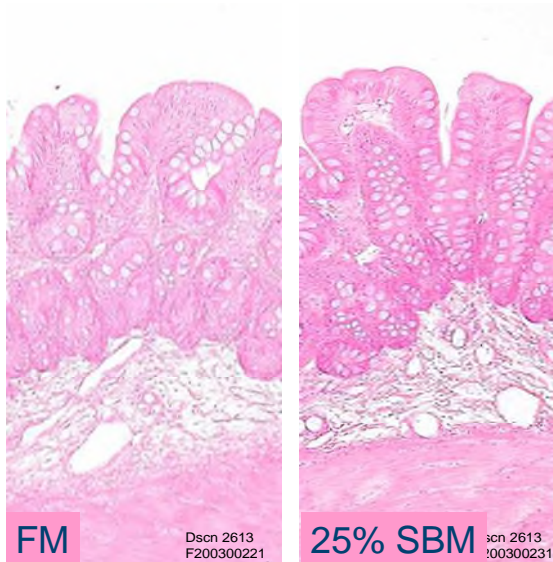


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8

Intestinal mucosa from Cod



No inflammatory reactions
in cod intestinal mucosa
due to SBM

Cod hind gut
Photo: Thor Landsverk, NVH



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9

Fish bone and Crab by products => 10 % growth increase
Protein 50 %, Lipid 18 %

Fish bone meal	150, 300, 450 g/kg
Crab meal	54, 115, 176 g/kg
Ash	84, 117, 148, 180 g/kg

Toppe, J., Aksnes, A., Hope, B., Albrektsen, S. 2006.
Aquaculture 253: 636-645.




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10



ff **ine** **ish** 

FINE FISH task 5-2
Critical components of dietary minerals
in juvenile Atlantic salmon

- First feeding experiment A. salmon
- Start weight 0,2g, final weight 25-30g
- Feeding period 20 weeks
- 4 diets x 3 replicates = 12 tanks
- Continuous feeding, continuous light, flow through water supply

Diet 1	Diet 2	Diet 3	Diet 4
Control	Low P	Low Zn	Low Mg

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Nofima

Growth rate in cod (F3, MarineBreed) in comparison with salmon and rainbow trout at 11 °C

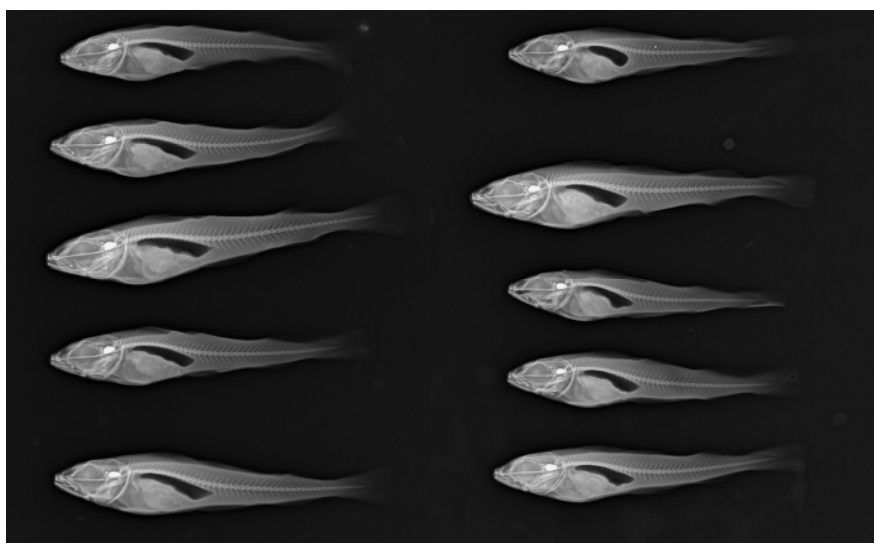
Weight class	Cod	Salmon	Rainbow trout
1-11 g			
% /day	23,5		
SGR	5,0	3,2	5,0
TGC	2,4	1,6	2,4

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13



Families/lines 2008 (10 fish sample)



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14



Feed

Igreedints:

Fish meal (60%), Wheat gluten (17-19%), Wheat (9-15%), Fish oil (7.5%), Vit. + min (0-5%)

Proximate composition:

Protein 56%, Lipid 15%, Ash 7-10%

Nofima, Matis, Laxa

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15



Restriction of lipid deposition in the liver and liver colour

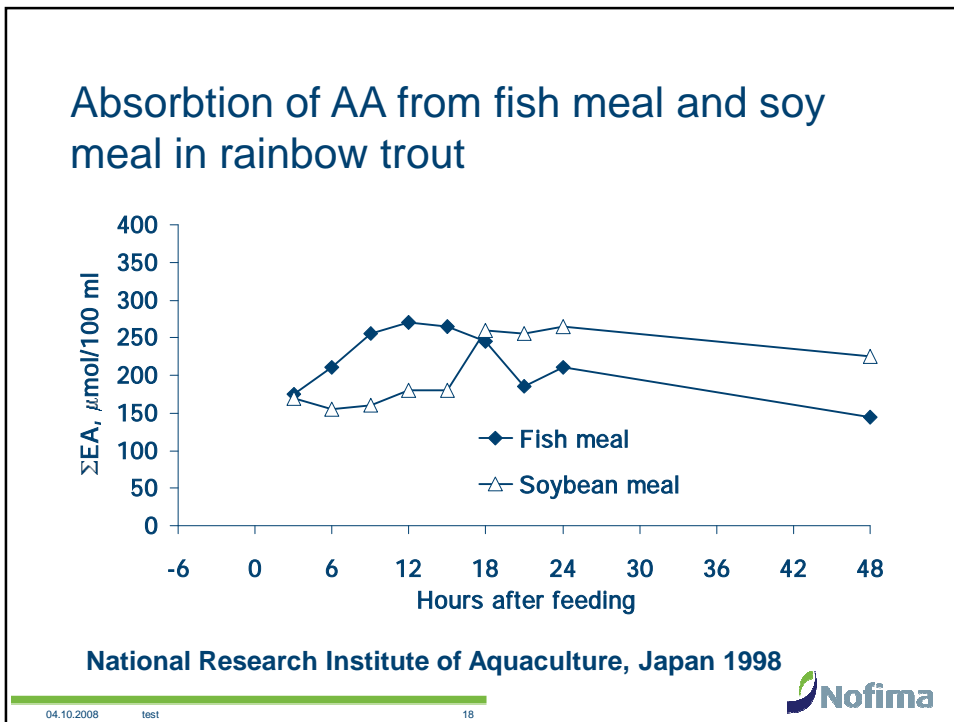
- Different lipids sources
- Different lipid qualities
- Fish trials and cell culture

FA requirement (ARA; EPA,DHA)

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16





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18

Feeding

- Cod has high storing capacity in the stomach and should be able to handle infrequent feeding

But

- Low cost diets high in fiber and ash and supplied with crystalline AA may require more frequent feeding
- Be precautious – feed often
- Selective breeding increases growth capacity
- Knowledge required

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19



Thank you for your attention!

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20

