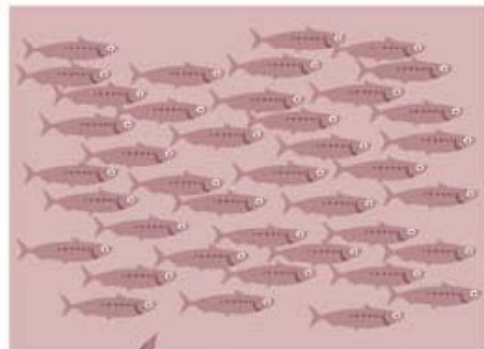


Dynamics in the fish feed supply chain challenges for the future

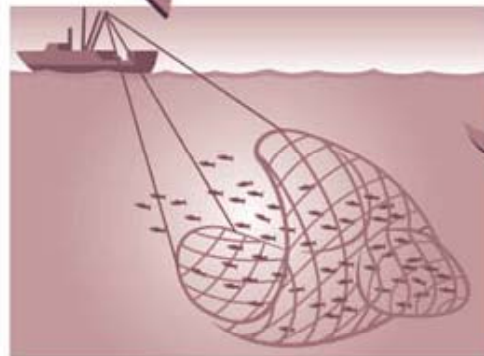
Trygve Berg Lea
International product manager BG salmon feed



Salmon farming uses fishmeal and fish oil

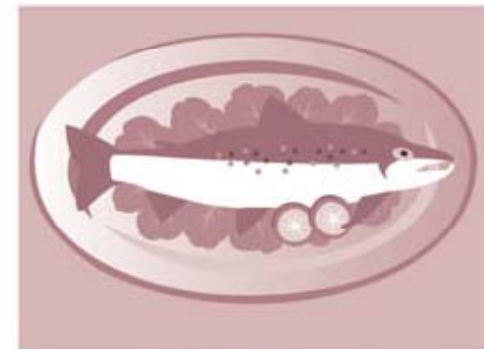


Small pelagic fish such as anchovies and sardines are caught by industrial fishing fleets.



The small fish are processed into fishmeal and fish oil.

Farming carnivorous fish such as salmon results in the net loss of fish protein since they are fed a diet rich in fishmeal and fish oil obtained from wild fisheries. In 2000, the production of 876,00 mt of farmed salmon required fish oil manufactured from 2.5 million mt of small pelagic fish. Put another way, approximately three pounds of small wild fish are taken from the oceans to produce only one pound of farmed salmon.



After about two years, the salmon are harvested and transported to market primarily from Norway, Chile and Canada.



Fish raised in densely packed net pens are fed manually or by machine. Food waste and excretion pollute the surrounding water (see figure 6).



Key feed related environmental challenges

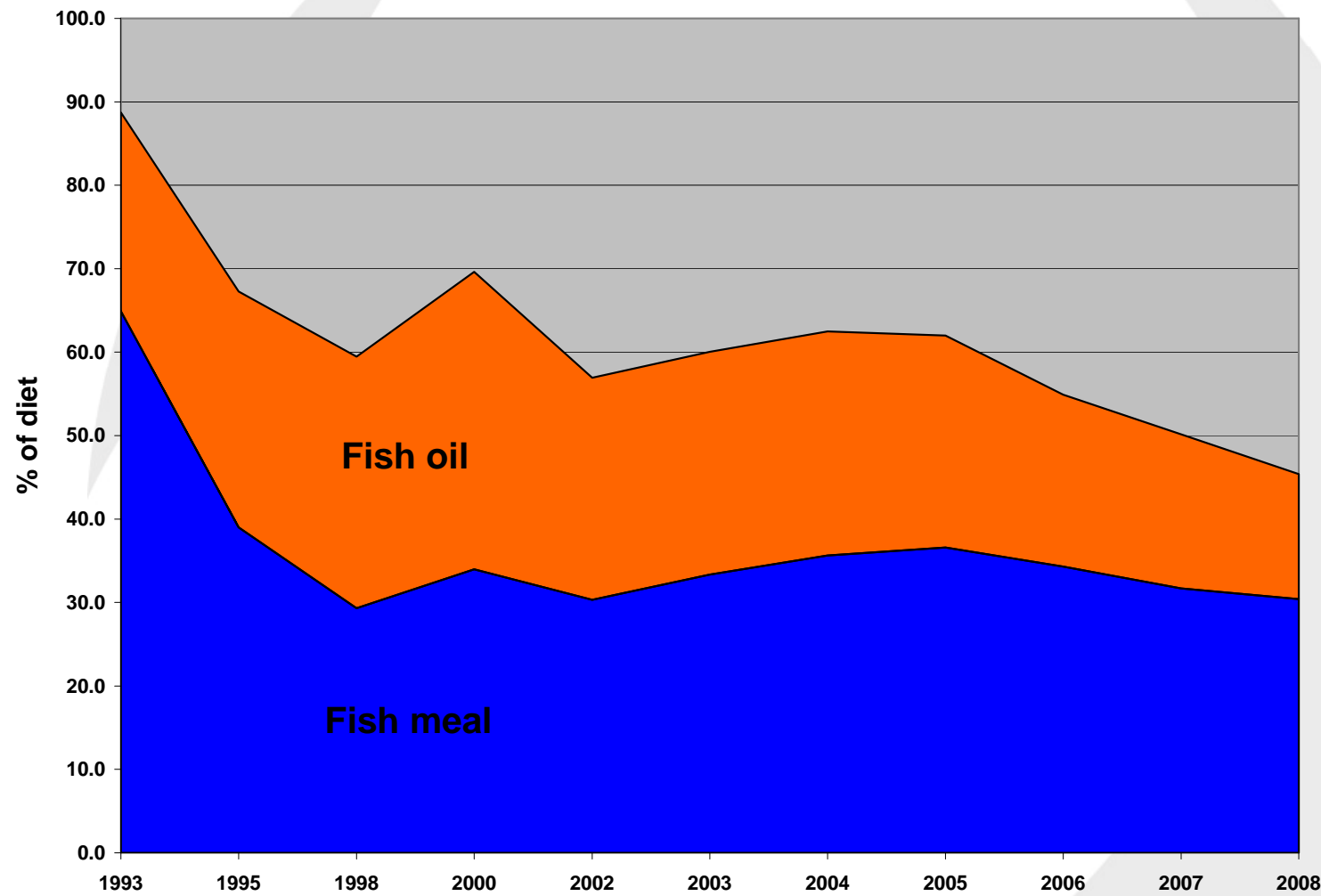
1) The level of fishmeal and fish oil in salmon and trout diets

- 1) Use based on nutritional knowledge (a certain use because of nutritional factors and knowledge a certain minimum is needed)
- 2) Used based on economic factors (fishmeal and fish oil are the most economic raw materials to use)

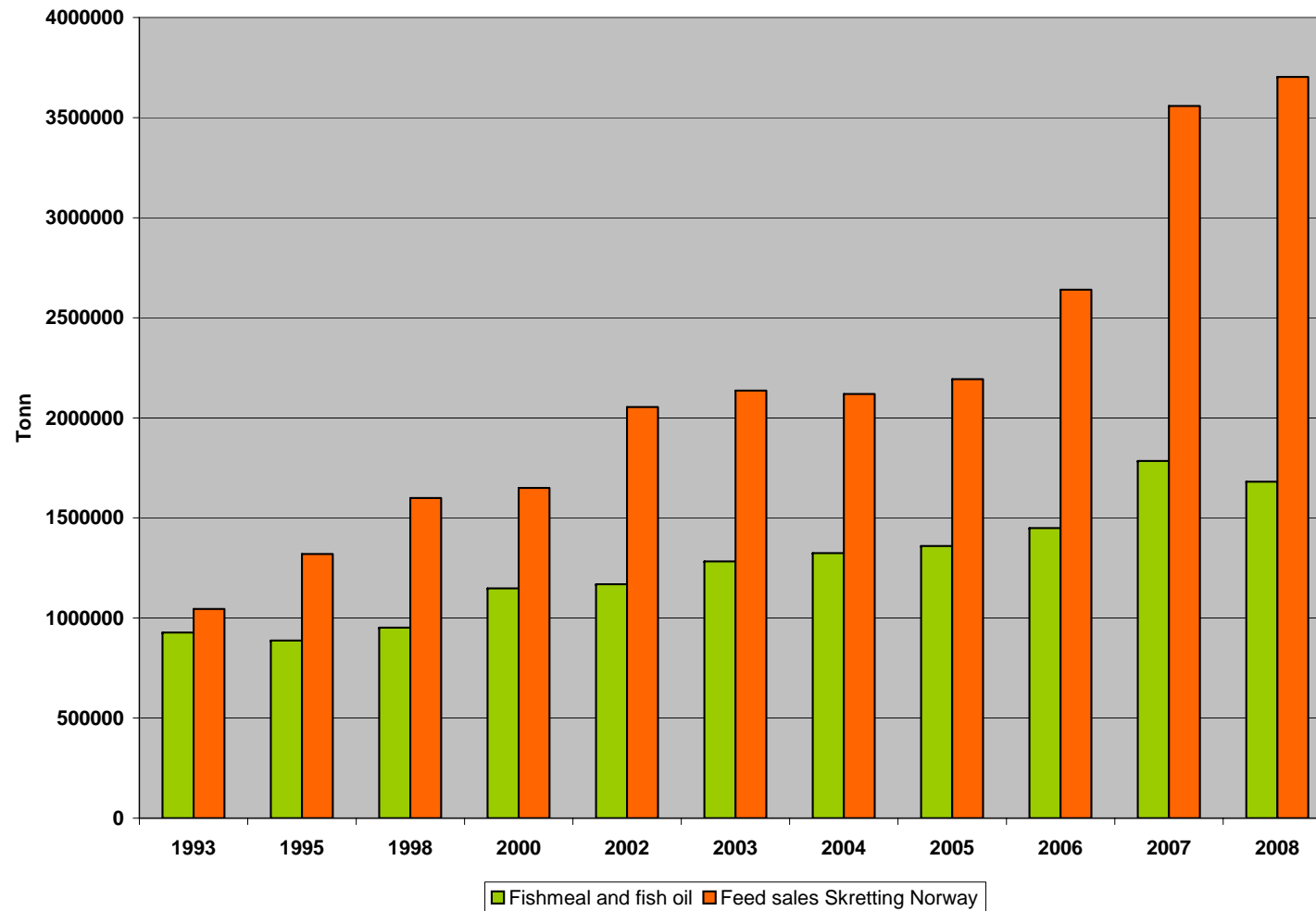
2) The origin of fishmeal and fish oil used in the diets

- 1) How are the fisheries used for fishmeal production managed and how are their status regarded?

Historical development salmon diets Norway



Historical development salmon diets Norway



The level of fishmeal and fish oil in salmon and trout diets

- The fishfeed industry has for decades invested in R&D to find alternatives to fishmeal and fish oil
 - Today it has been succesful in under commercial conditions to substitute up to 80% of the oil in the diet with alternative oils
 - Fishmeal inclusion can be lowered to the region of 15-20% of the total diet, and nutritional scope for further decrease
- In most cases today the level of fishmeal and fish oil in the diets are decided by economic evaluation (and are higher than nutrional knowlegde would allow for)

The level of fishmeal and fish oil in diets

- The principal of using fishmeal and fish oil in feed is not an environmental issue
 - Fish used to farm fish versus fish only used for human consumption directly, is an ethical question
- A growing salmon farming industry must be able to control its dependency of fishmeal and fish oil
 - To control its dependency means to have the nutritional knowledge to be able to use alternatives if supply becomes scarce

The origin of fishmeal and fish oil

- Recent developments has put focus on which fish stocks that are used for fishmeal and fish oil production
- Are these fish stocks well managed?



Fishmeal origin BG Salmonfeed

2008

Rank	Species	Latin	%	Main area of origin
1	Anchoveta	<i>Engraulis ringens</i>		Peru and Chile
2	Blue whiting	<i>Micromesistius poutassou</i>		North East Atlantic
3	Herring	<i>Clupea harengus harengus</i>		North East Atlantic
4	Fish trimmings			North East Atlantic
5	Jurell	<i>Trachurus sp</i>		Chile
	Sum	Main species	88	
6	Sardine	<i>Clupea bentincki</i>		Chile
7	Sandeel	<i>Ammodytes sp.</i>		North Sea
8	Mackrell	<i>Scomber scombrus</i>		North East Atlantic
9	Merluza	<i>Merluccius australis</i>		Chile
10	Sprat	<i>Sprattus sprattus sprattus</i>		North Sea
11	Capelin	<i>Mallotus villosus</i>		North East Atlantic
12	Other			
13	Boarfish	<i>Capros aper</i>		North Sea
14	Norway Pout	<i>Trisopterus esmarkii</i>		North East Atlantic
15	Horse mackrell	<i>Trachurus trachurus</i>		North East Atlantic
	Sum	Other species	12	
	Total		100	

54

South East Pacific

46

North East Atlantic

Nearly 90% from a few pelagic fisheries in the North East Atlantic and South East Pacific

Data exclude Canada



The challenge

- Fish feed producers can source fishmeal and fish oil world wide
- Within one country, one must assume that the fishmeal is produced according to national law and according to national fishery management
- How to evaluate the quality of fishery management in Iceland, Norway, Denmark, Peru, Chile, Morocco, India, Thailand, Indonesia - and where do we draw the line?

A comparison



Cotton
produced in
India



Used to
produce a
cotton shirt
in Norway



Fishmeal
produced in
India



Used to farm
a salmon in
Norway

Is it an industry task to define that the cotton and the fishmeal produced in India are acceptable according to Norwegian environmental standards??

Towards a new future

- The salmon farming industry must be transparent about the origin of fishmeal (fish stocks used for fishmeal production)
 - Demands information tracking and tracing
- End market demands (consumers, retailers, independent certification schemes) can influence future demands regarding the quality of fishery management of reduction (forage) fisheries
 - Demands that the fishmeal industry produce products that can be identified and sourced according to the acceptable standard



Herring



Blue whiting



Fish trimmings



FF Skagen Havnevej 12 Postboks 164 DK-5950 Skagen Denmark 08287 T. Skretting AS Box 319 N-4002 Stavanger Norge		 <i>Mottermann</i> <i>- Gudrun</i> <i>Muh</i> <i>Roo</i>		Telefon: +45 98441100 Telefax: +45 98450211 Momenr.: DK31987628 E-mail: ff@ffskagen.com WEB-site: www.ffskagen.com	
		Faktura 66038 Dato: 19-01-08 Side: 1			
Mummer	Beskrivelse	Antal	Enhed	Salgspris	Beløb
103	Fiskemel - NSM - Lest	1.200.857	KG	712,60/100 NOK	8.556.106,13
					8.556.106,13
Vi bekræfter hermed at ovenstående vare er af Dansk Oprindelse B/L: 1.200.857 kg Skretting Ord. Nummer 1103106 Salmonsalanalyse: Nordlab No. 0465					
Råvareanalyse: Nordea Sild 85% Atlantikolmule 15%					
FF Fabrikanalyse Protein: 70,8% Fedt: 10,4% Vand: 6,8% Salt: 2,7% Aske: 12,8%					
Tilset: 150 ppm antioxidant - Ethoxyquin					

The supplier provides information about the species used for production

FF Skagen
Havensvej 13
Postboks 164
DK-5950 Skagen
Denmark

Tel: +45 9941 1000
Telefax: +45 9942 211
E-mail: ff@ffskagen.com
www.ffskagen.com

06287
T. Søsting A/S
Box 210
DK-6100 Skovager
Hinge

Hoffmann
- Gudrun
M.H.
ROO

Faktura 00038
Dato: 19.01.08
Side: 1

Nummer: 103
Beskrivelse: Fiskerifugt
Fiskerifugt - NEM
Løst

Antal: 1.303.807 KID
Enhed: KID
Vægt: 712,00/100 NDK
Rabat: 8,555,196,13

Vejledning: Ved indlevering af fiskerifugt skal der indleveres en af følgende dokumenter:
BL: 1.269.857 kg
Søsting OMR Nummer 1103182
Søsting OMR Nummer 1103182

FF Fiskerifugt
Procent: 79,5%
Vægt: 10,4%
Rabat: 12,0%

Fish meal

	Originated in: Chile	Originated in: Denmark	Originated in: Faroe Islands	Originated in: Global	Originated in: Iceland
Anchovy	1 612 808			860 263	
Blue whiting		2 934 779	3 947 096	929 034	6 680 914
Capelin					2 357 359
Greater argentine					
Herring		3 710 492	583 126		9 644 893
Herring cuttings				86 626	
Horse mackerel	990 296				
Jack/Horse mackerel	1 997 394				
Jack mackerel	3 259 679				
Lesser argentine					
Lesser Argentine					
Mackerel	3 259 679				
Norway pout					
Other					
Saithe					
Sandeel					
Silvery pout					
Sprat		6 432 396			
Tranmings					
Winter Capelin					
Sum:	11 119 846	13 077 467	4 530 222	1 875 373	18 583 196

Report

LIMS
Laboratory information and
management system
(Species and country)

Movex
(Main frame system)

Data warehouse

SKRETETING



Report can be generated to track origin

Fish meal

	Originated in: Chile	Originated in: Denmark	Originated in: Faroe Islands	Originated in: Global	Originated in: Iceland
Anchovy	1 612 808			860 263	
Blue whiting		2 934 779	3 947 096	929 084	6 680 914
Capelin					2 357 389
Greater argentine					
Herring		3 710 492	583 126		9 544 893
Herring cuttings				86 026	
Horse mackerel	990 286				
Jack/Horsemackerel	1 997 394				
Jackmackerel	3 259 679				
Lesser argentine					
Lesser Argentine					
Mackerell	3 259 679				
Norway pout					
Other					
Saithe					
Sandeel					
Silvery pout					
Sprat		6 432 396			
Trimnings					
Winter Capelin					
Sum:	11 119 846	13 077 667	4 530 222	1 875 373	18 583 196



Herring



Fish trimmings

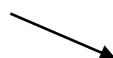


for example Sandeel



Product A

Fishmeal and fishoil originating from fish stocks responsible managed

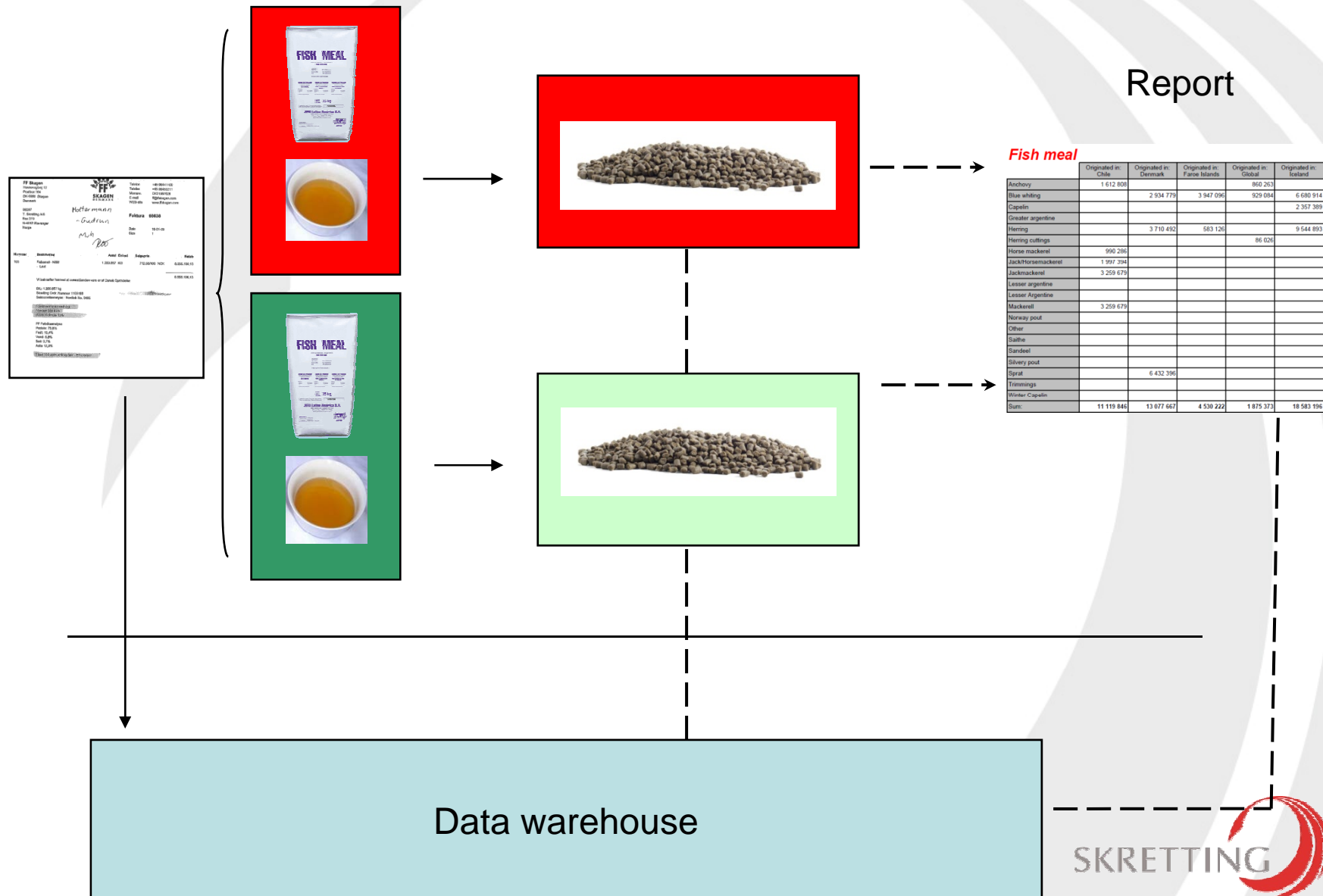


Product B

Fishmeal and fishoil originating from fish stocks not responsible managed (but legally caught and processed)

Note that only a small fraction of sandeel would make product A to be unacceptable

Information and physical tracking and tracing



Two classes of fishmeal

- If fishmeal (and fish oil) is going to be split into two classes based upon environmental standards, it will have the following implications
 - One has to be able to identify the product and keep it separated during production and in the logistic chain from the fishmeal producer to the fishfeed producer, and in the farming process
 - The fishmeal and fishfeed producer must have information systems and tracking and tracing systems in place to document the environmental quality of the fishmeal
- My estimate is that the whole salmon feed industry and fishmeal industry will need large investments (25 – 75 million Euro??) to implement such a system

How to do this

- Where to set the bar
 - Complies with FAO Code of Conduct for Responsible Fishing ?
 - Complies with MSC, average score in Fishsource, Certified by friends of the SEA????
- Can the fishery be certified (North Sea Herring for example)?
- Can the producer be certified (but then what about the fishery)
- Can a country get certified??

A confusing picture

Scientific advice

ICES - N.E. Atlantic
IMARPE - Peru
IFOP - Chile
IMR - Icelandic waters
NOAA - W. Atlantic



Guidance and control on how / when and how much to fish

FAO - UN Code of Conduct for Responsible Fishing
Quota setting - NEAFC & coastal states e.g. EU, Norway, Iceland



CONSUMER

Private opinion and advice

IFFO - Code of Responsible Practice
Feed Aquaculture standards
e.g. Soil Association (organic)
Farming standards –
Global Aquaculture Alliance,
Aquaculture Stewardship Council,
Scottish Code of Practice

Farmer and retailer schemes

Individual farming companies and
most retailers have codes of practice



Summing up

- From an environmental point of view, the principle of setting standards regarding the quality of fishery management of reduction fisheries is just and should be embraced by the salmon farming industry
- In order to fullfill such a principle, the fishmeal and fishfeed industry must invest in, and develop, their logistic systems and information systems

Summing up

- It will be difficult for the value chain to implement more than one standard
- The standard should be defined according to an independent stakeholder, like for example
 - FAO Code of Conduct for Responsible Fishing
- Such a standard must be linked to an ecolabel so that the salmon produced from such fishmeal can be identified by the end consumer