

# Sustainability challenges in seafood business – The Norwegian case

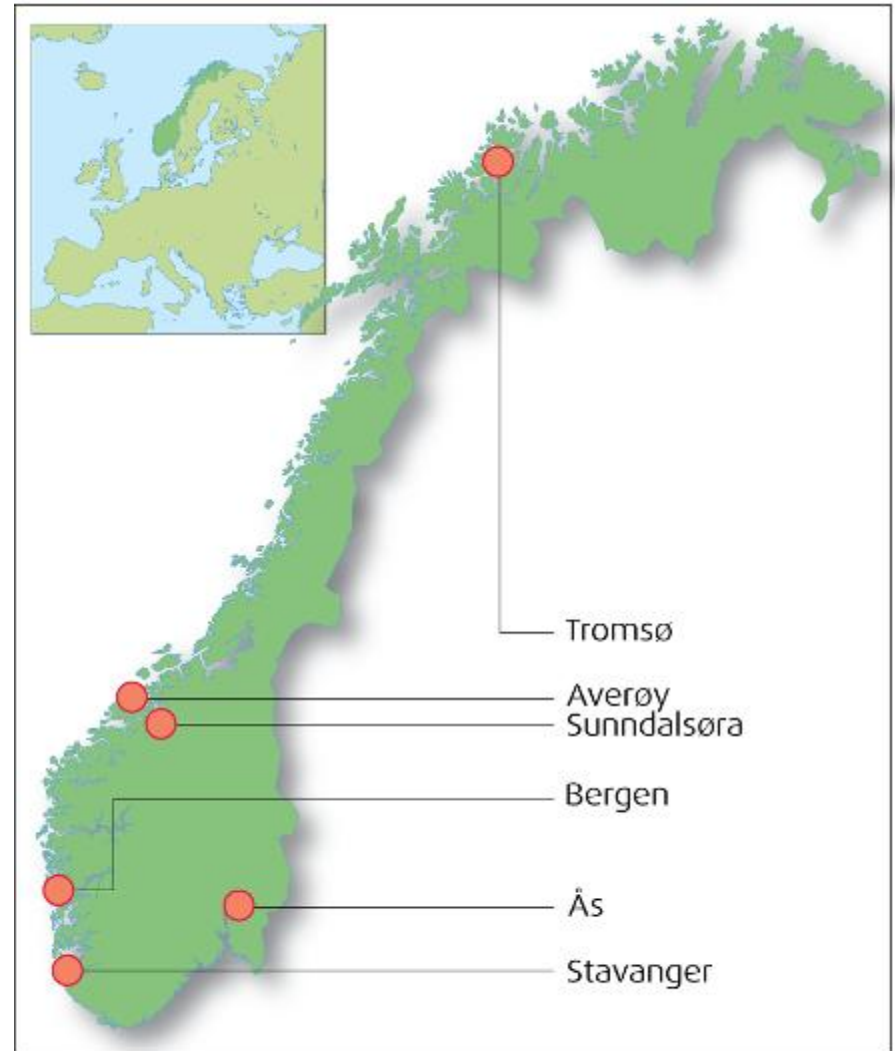
Bjørn Eirik Olsen and Bent Dreyer  
Nofima

The Protein Summit 2010  
Amsterdam, 25-26 November 2010

# Facts about Nofima

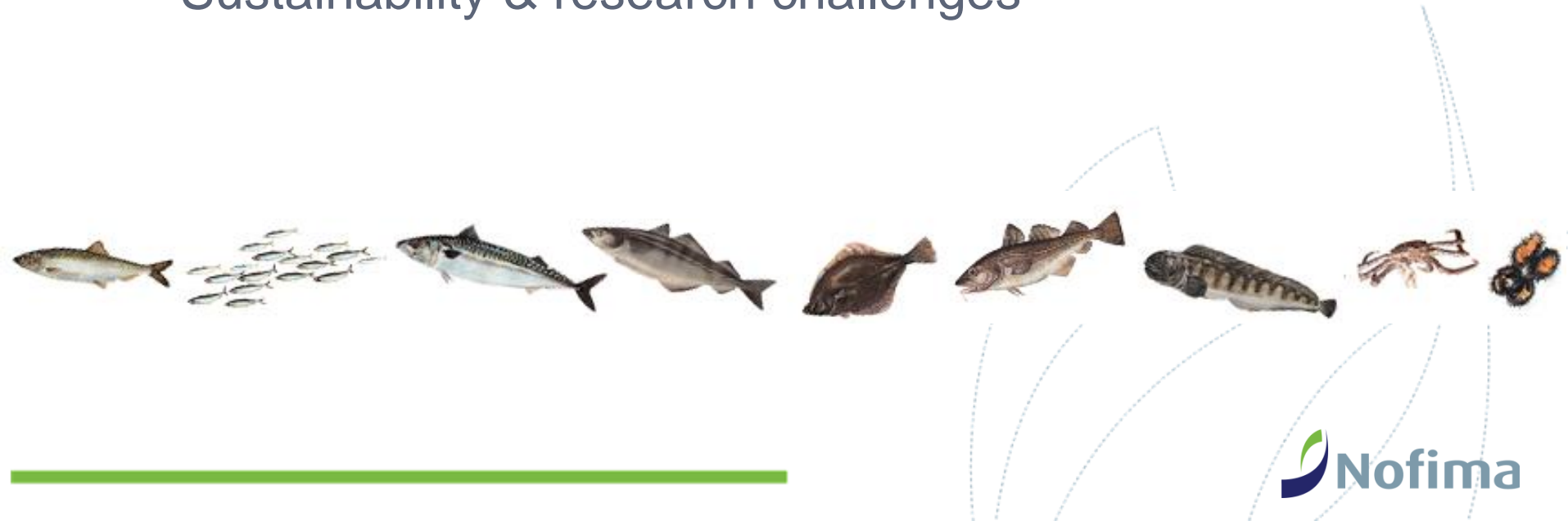
Norwegian Institute of Food, Fisheries and Aquaculture Research

- Established in 2008
- Former Akvaforsk, Fiskeriforskning, Matforsk and Norconserv
- Targets the food, aquaculture and fisheries industries
- Employees: approx. 500
- Turnover in 2010: approx. € 63 mill.
- Head office: Tromsø
- Owners:
  - State (Ministry of Fisheries and Coastal Affairs): 56.8%
  - The Agricultural Food Research Foundation: 33.2%
  - Akvainvest Møre og Romsdal: 10 %
- Four research divisions:
  - Marin (Aquaculture and fisheries)
  - Mat (Food production)
  - Ingredients (Feed components, etc.)
  - Marked (Social sciences)

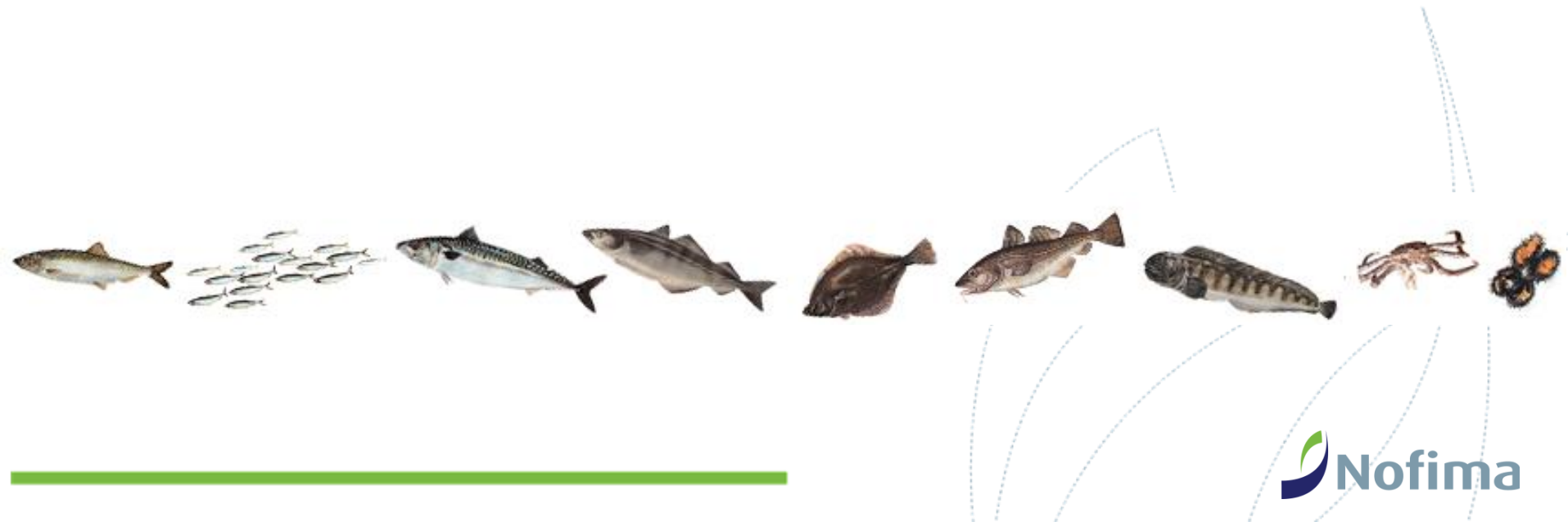


# Content

- Seafood in a global perspective
- Seafood production concepts
- The Norwegian case
- Sustainability & research challenges



# Seafood in a global perspective



# World fisheries and aquaculture production and utilization

	2002	2003	2004	2005	2006
	<i>(Million tonnes)</i>				
<b>TOTAL CAPTURE</b>	93.2	90.5	94.6	94.2	92.0
<b>TOTAL AQUACULTURE</b>	40.4	42.7	45.9	48.5	51.7
<b>TOTAL WORLD FISHERIES</b>	<b>133.6</b>	<b>133.2</b>	<b>140.5</b>	<b>142.7</b>	<b>143.6</b>
<b>UTILIZATION</b>					
Human consumption	100.7	103.4	104.5	107.1	110.4
Non-food uses	32.9	29.8	36.0	35.6	33.3
Population ( <i>billions</i> )	6.3	6.4	6.4	6.5	6.6
Per capita food fish supply ( <i>kg</i> )	16.0	16.3	16.2	16.4	16.7

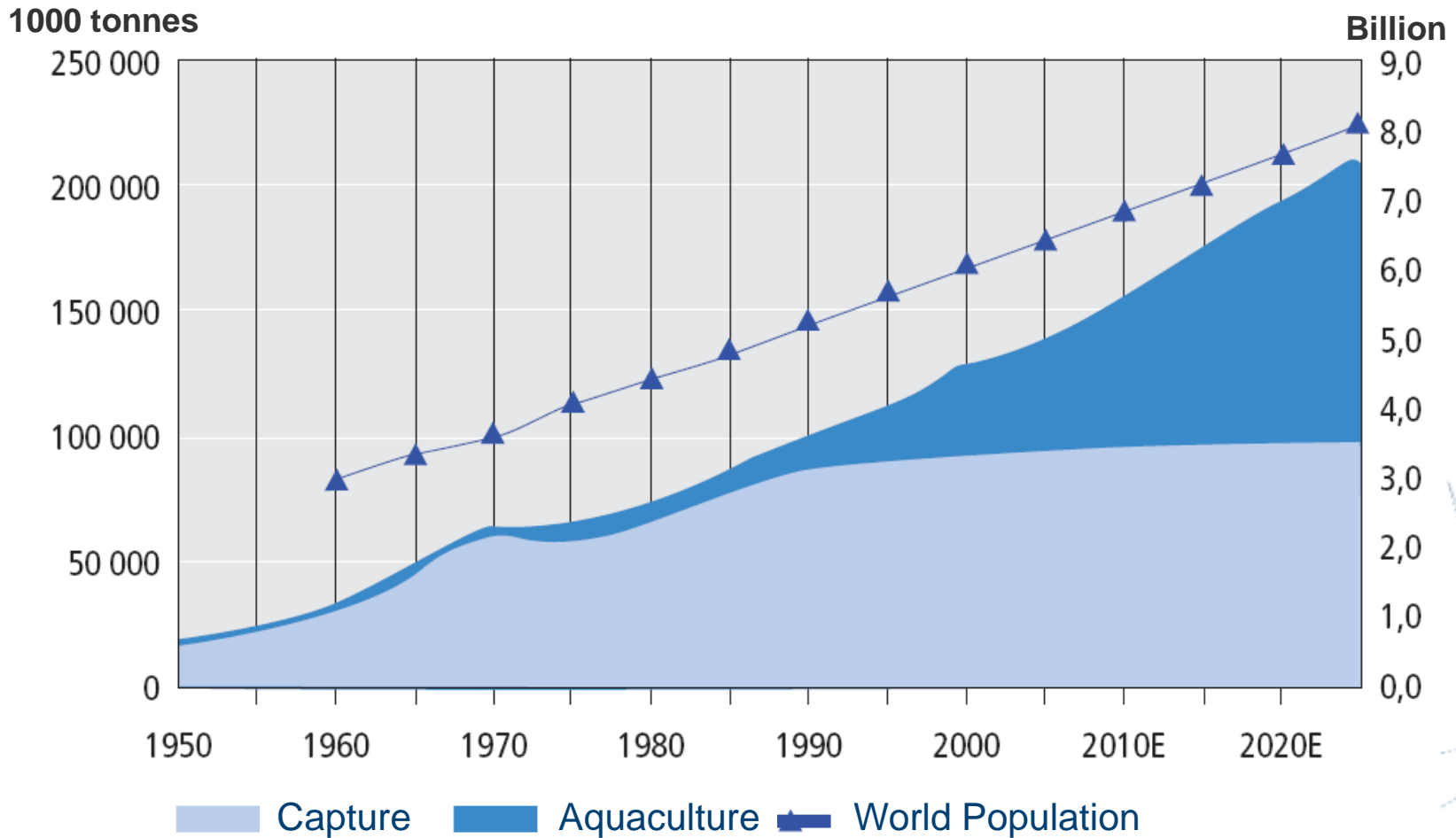
Note: Excluding aquatic plants.

Source; FAO, 2009

# FAO Committee on fisheries (April 2010):

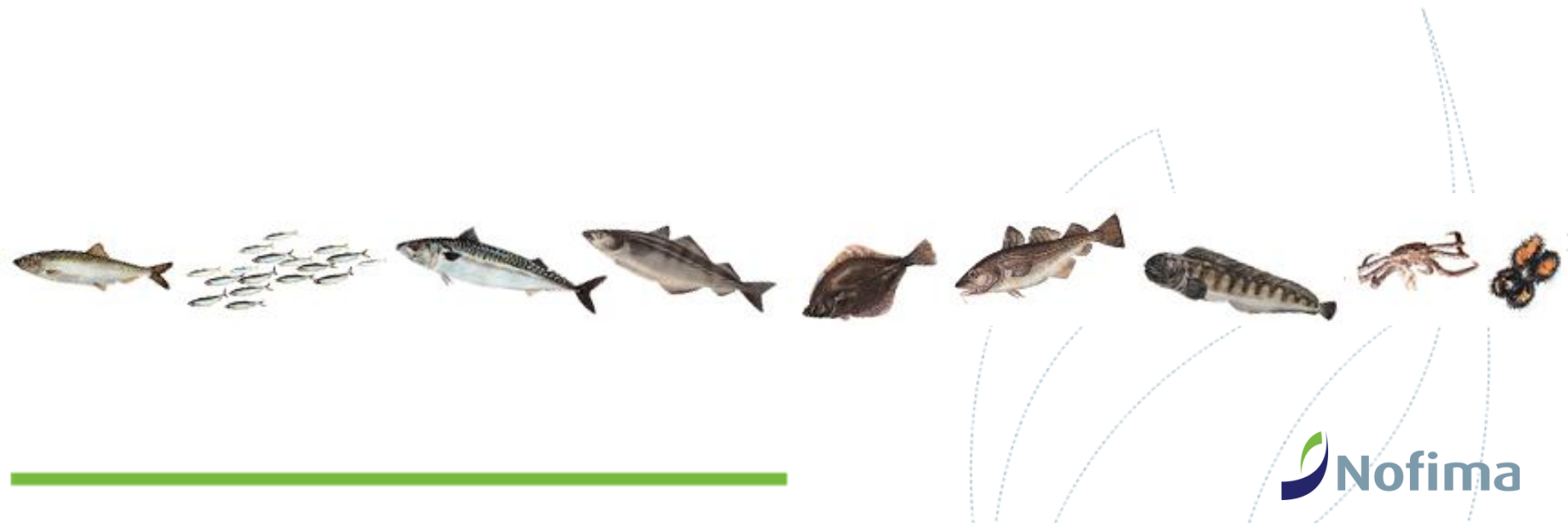
- Further growth in production of Fish and Shellfish by 3 million tonnes in 2007 and in 2008
- Aquaculture: 37 % (47 % of Human Consumption)
- 80 % of total production takes place in Developing Countries
  - |China: 48 million tonnes (33 mill tonnes aqua, 15 mill tonnes wild capture)
- World Per Capita Consumption:
  - 11,5 kg in the 1970s
  - 12,5 kg in the 1980s
  - 14,4 kg in the 1990s
  - 17,1 kg in 2008
    - Estimated to 16-18 % of total Protein intake
    - However, higher in developing countries than in developed countries

# Global production of fish and shellfish, 1950-2025



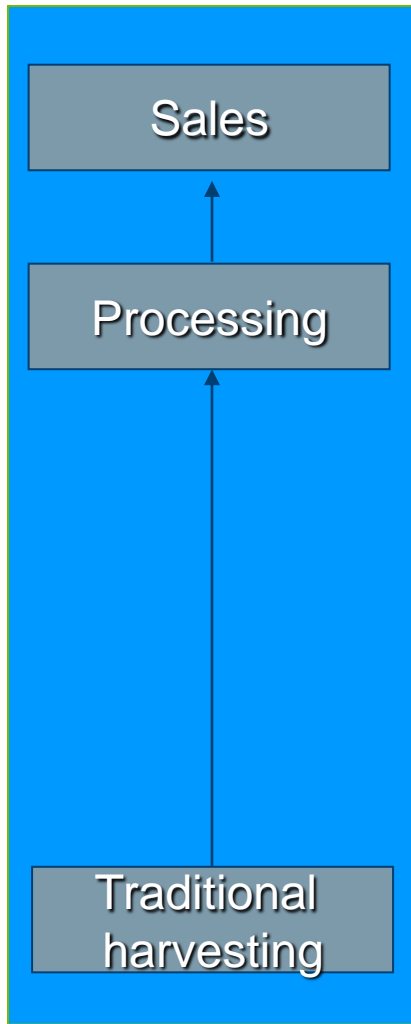
Source: Globefish

# Seafood production concepts

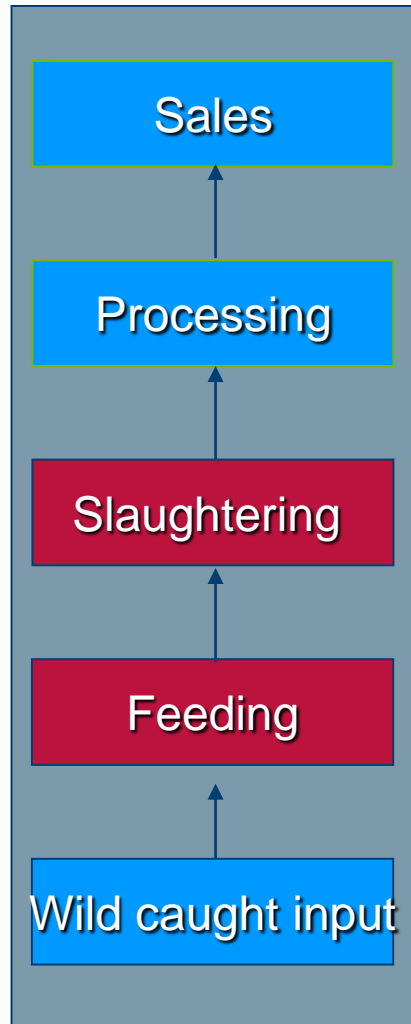




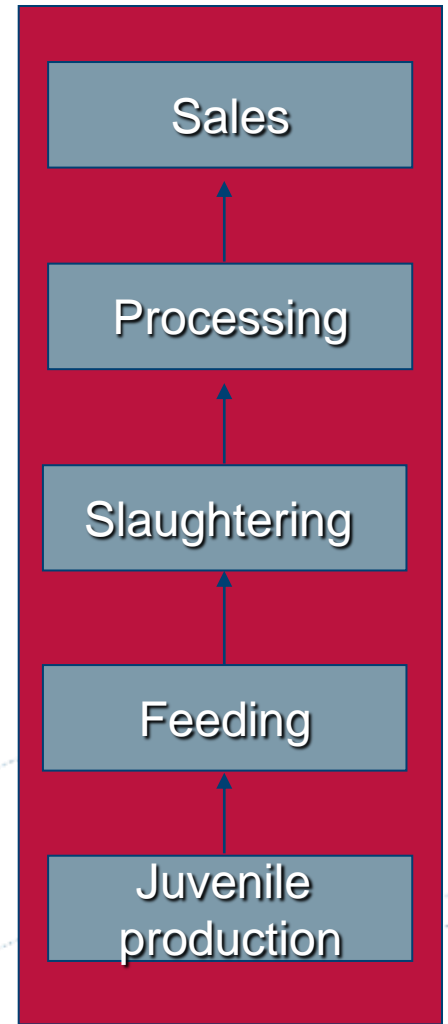
# Three main concepts



Capture



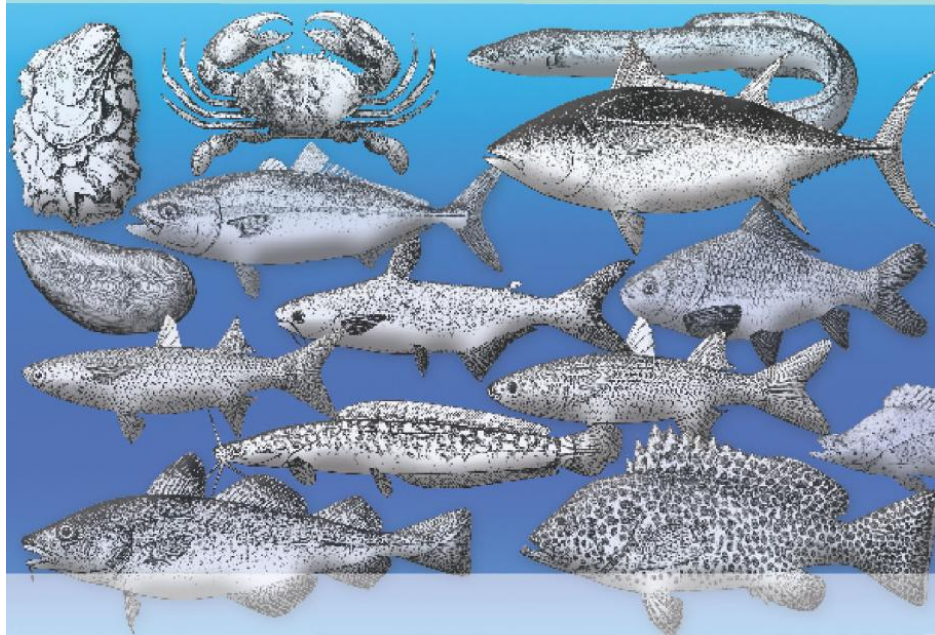
Capture based aquaculture



Aquaculture

## Capture-based aquaculture

Global overview



# Capture-based aquaculture (CBA)

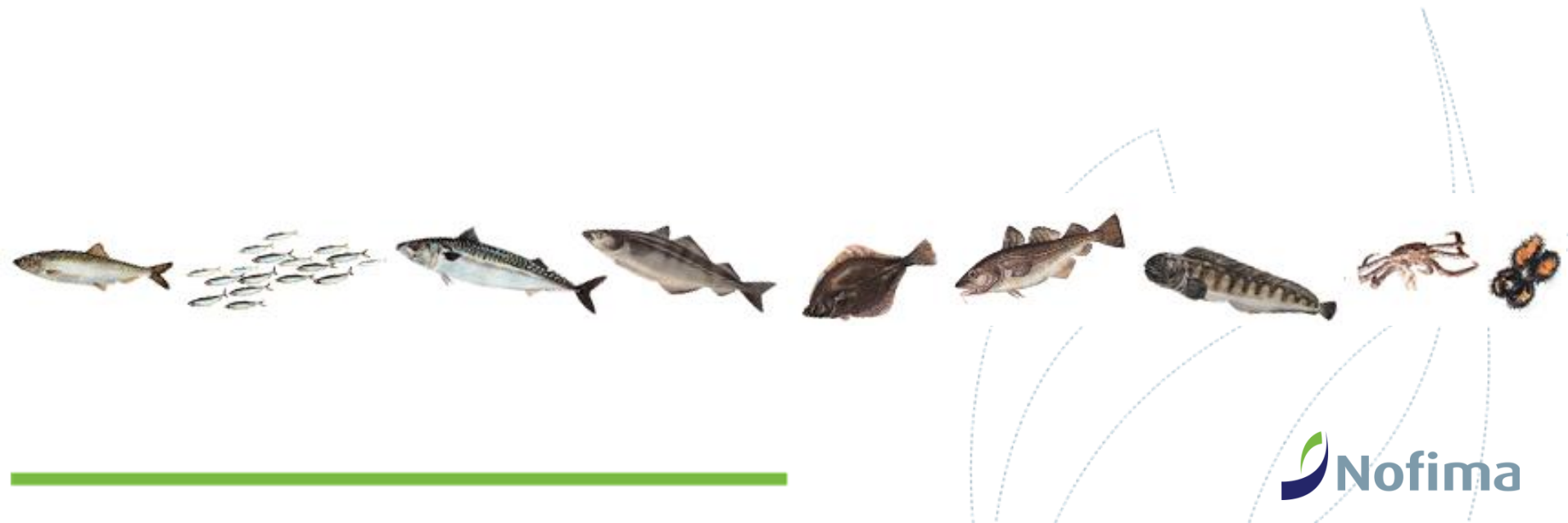
FAO and UN:

*“Use of wild fish and fisheries resources for Aquaculture production has been identified as a priority for target action”*

- Global activity in fresh and salt water
- More than 20 % of all aquaculture production
- A National Center of Excellence established at Nofima in Tromsø in 2010



# The Norwegian case

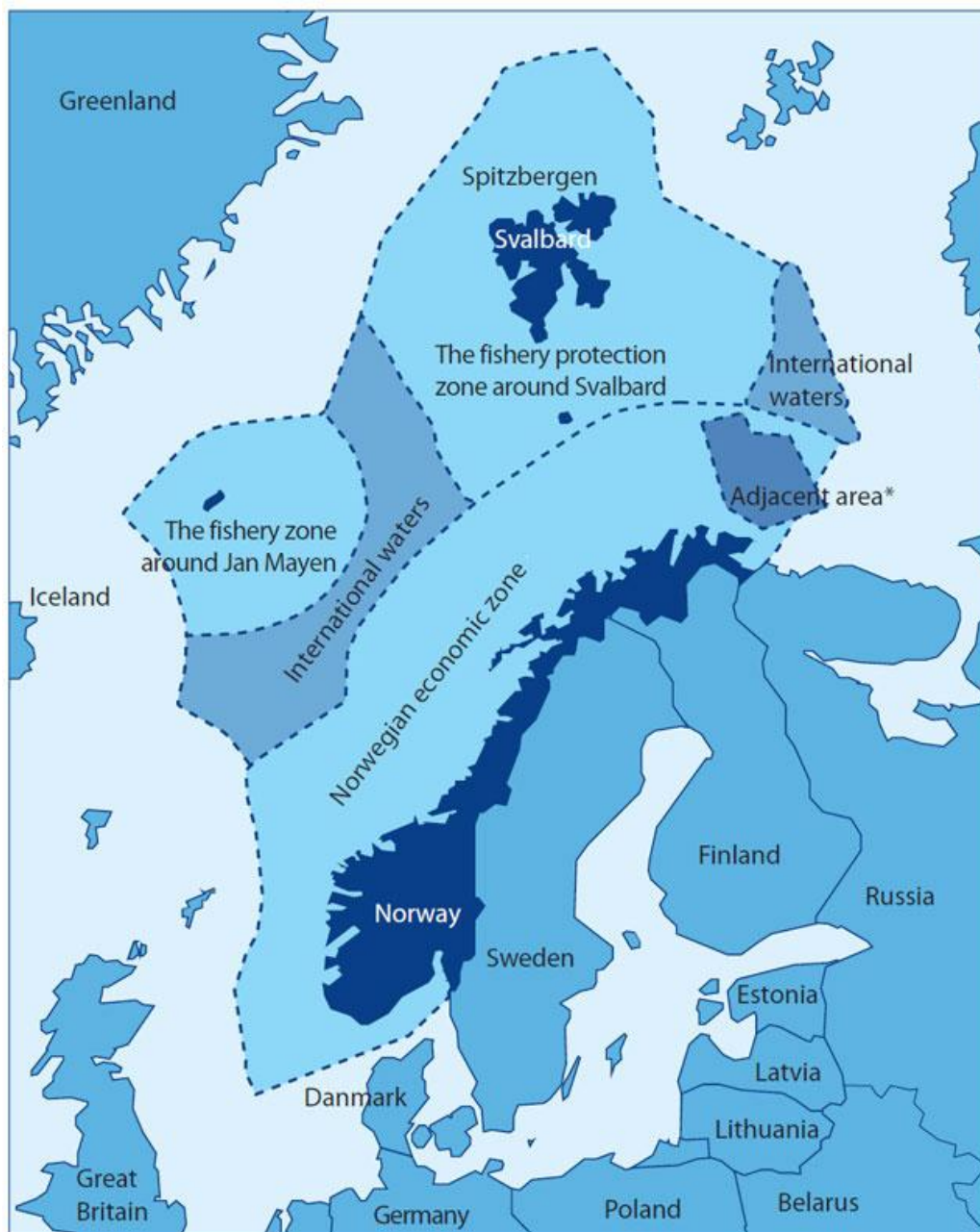


## Norway

6 times more sea  
than land:

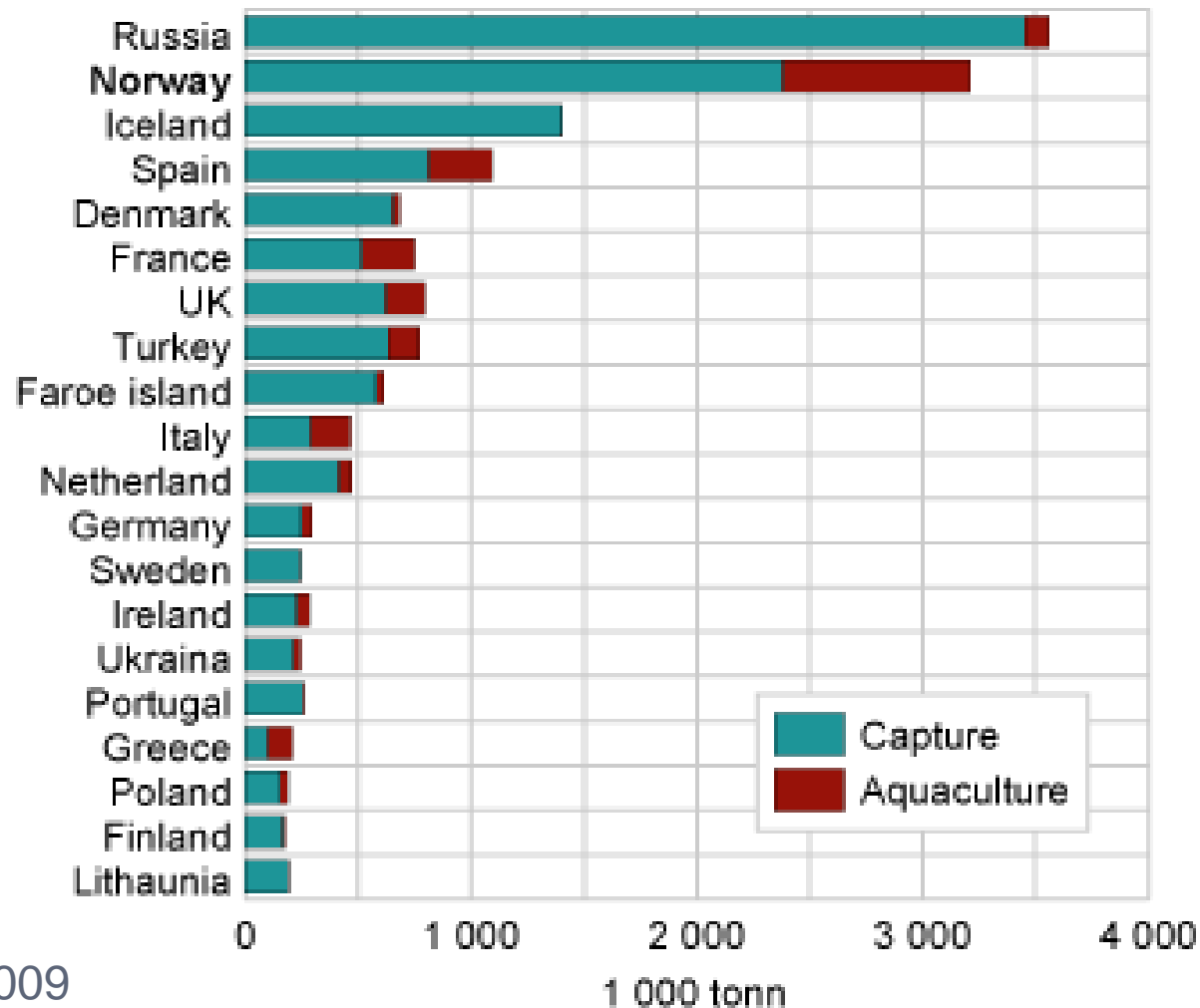
- Land: 385 000 km<sup>2</sup>
- Sea: 2 119 000 km<sup>2</sup>

- Highly productive areas
- Increasing production
- Resources moving North due to climatic change



\* Agreement has now been reached between Norway and Russia on the bilateral maritime delimitation in the Barents Sea

# Seafood production in Europe, 2007



Source; FAO, 2009

# Top ten exporters of fish and fishery products

	1996	2006
	<i>(US\$ millions)</i>	
<b>EXPORTERS</b>		
China	2 857	8 968
Norway	3 416	5 503
Thailand	4 118	5 236
United States of America	3 148	4 143
Denmark	2 699	3 987
Canada	2 291	3 660
Chile	1 698	3 557
Viet Nam	504	3 358
Spain	1 447	2 849
Netherlands	1 470	2 812

Source; FAO, 2009

# Norwegian pros ....

- 83,000 km coast line – 6 times more sea than land
  - Wild capture: 2,5 million tonnes
    - 312 000 tonnes of herring landed in January 2010 – 1 billion herring dishes
  - Aquaculture: 958 000 tonnes
  - Since 2006, aquaculture larger (in value) than captured
- Well educated labour force
- Good infrastructures
- Successful management of wild resources and costal zone
- Generic Marketing: Norwegian Seafood Exports Council
- Generic Research: The Fishery and Aquaculture Industry Research Fund
- 97 % of the seafood has to be exported
  - 2,6 million tonnes in 2009 (up 268 000 tonnes from 2008)
  - Export value 5,6 billion €
  - More than 10 billion seafood dishes in 155 countries

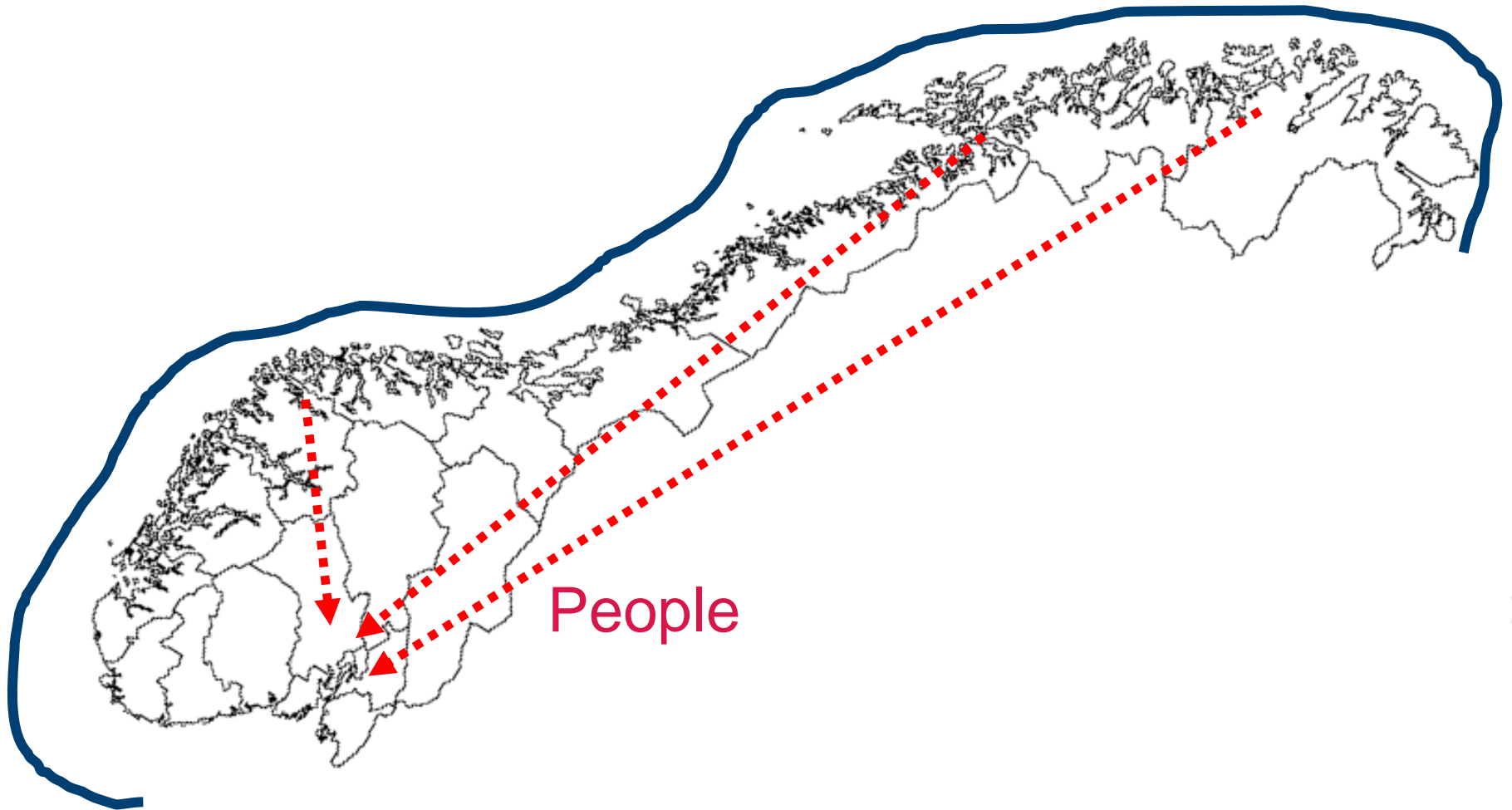
# .... and cons

- High labour costs (UK 65%, Poland 12%)
- NOK: Vulnerable currency
- Long and often difficult transportation
- Wild capture challenges:
  - High levels of uncertainty
  - Difficult capacity considerations
  - Strict fishery management regime
- Aquaculture challenges:
  - Diseases, salmon lice and escaping
  - Availability of productive sites
  - Supply of marine based feed

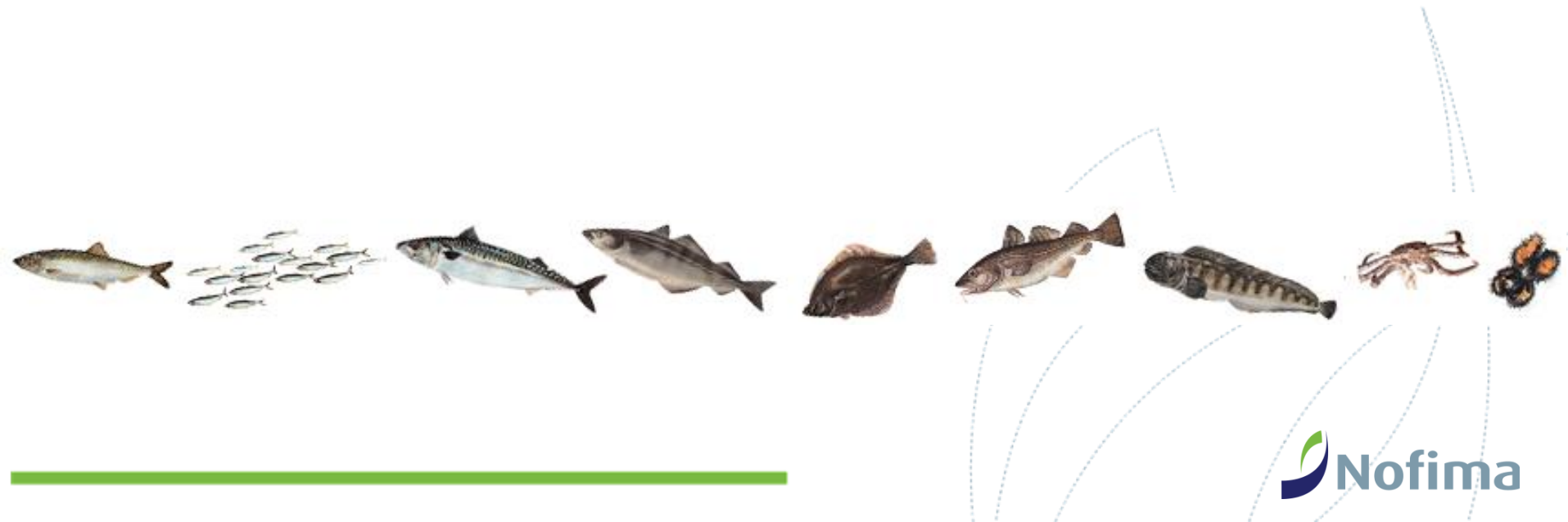


...and people are not always where they should be...

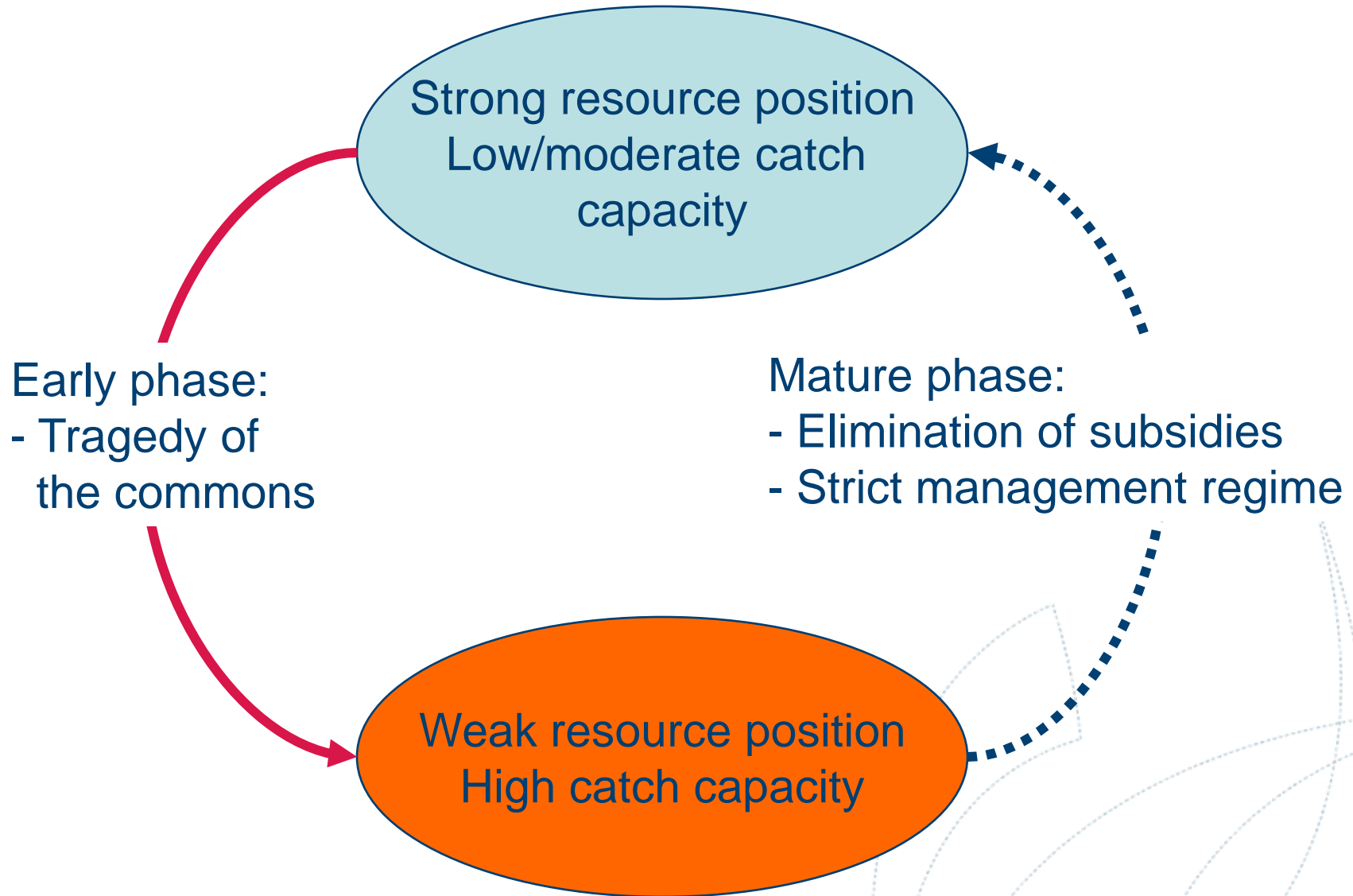
Fish and other resources



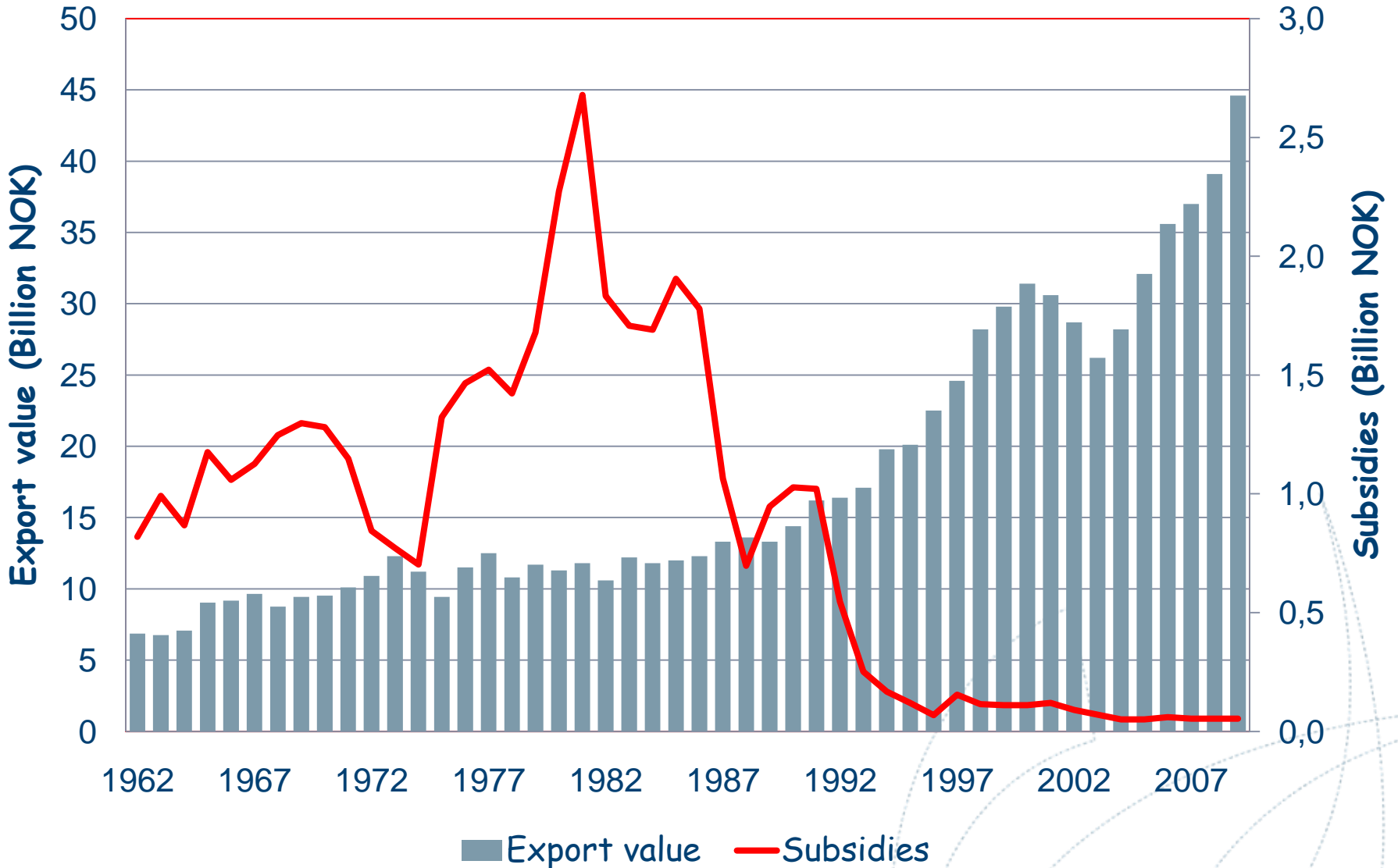
# Sustainability & research challenges



# Sustainability in capture based industry

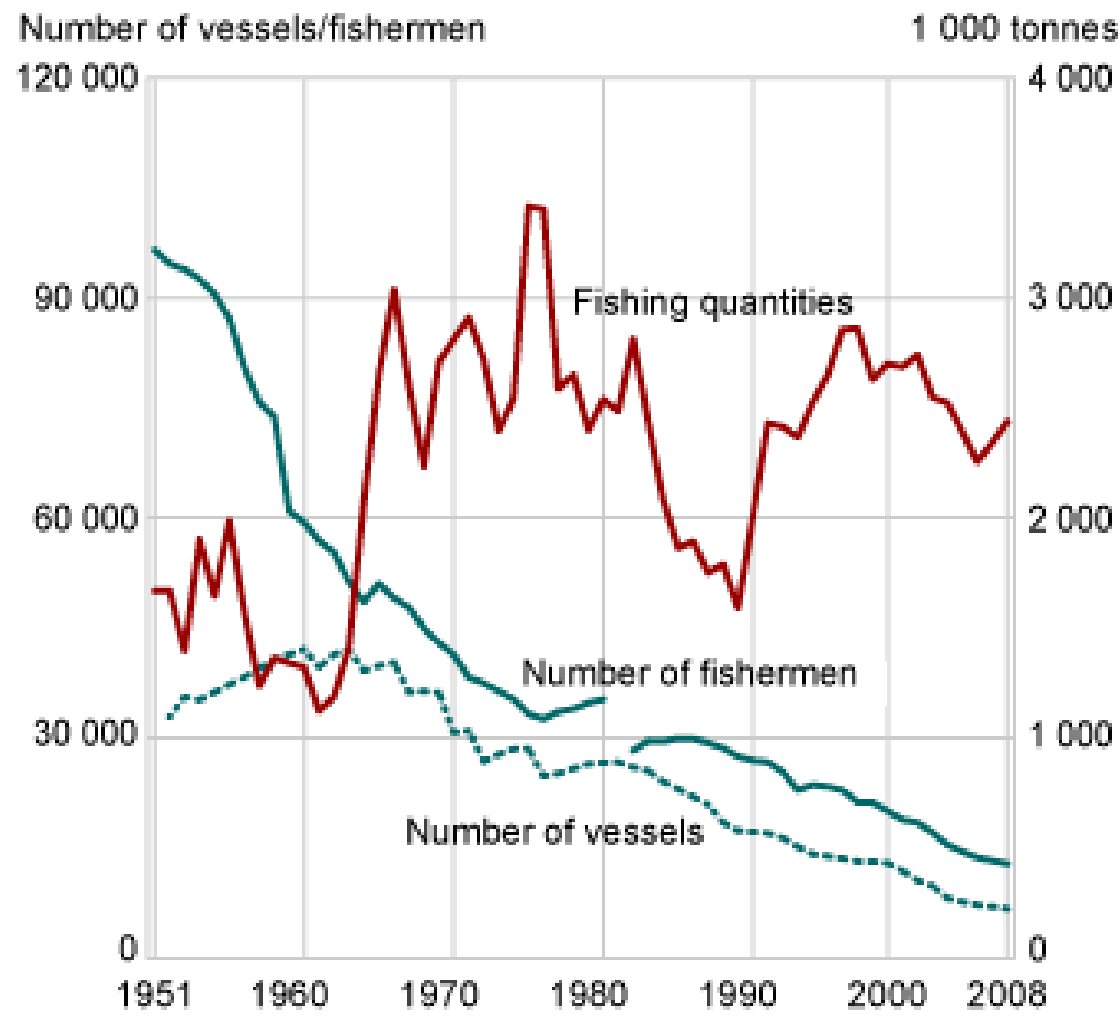


# Production and subsidies in fisheries

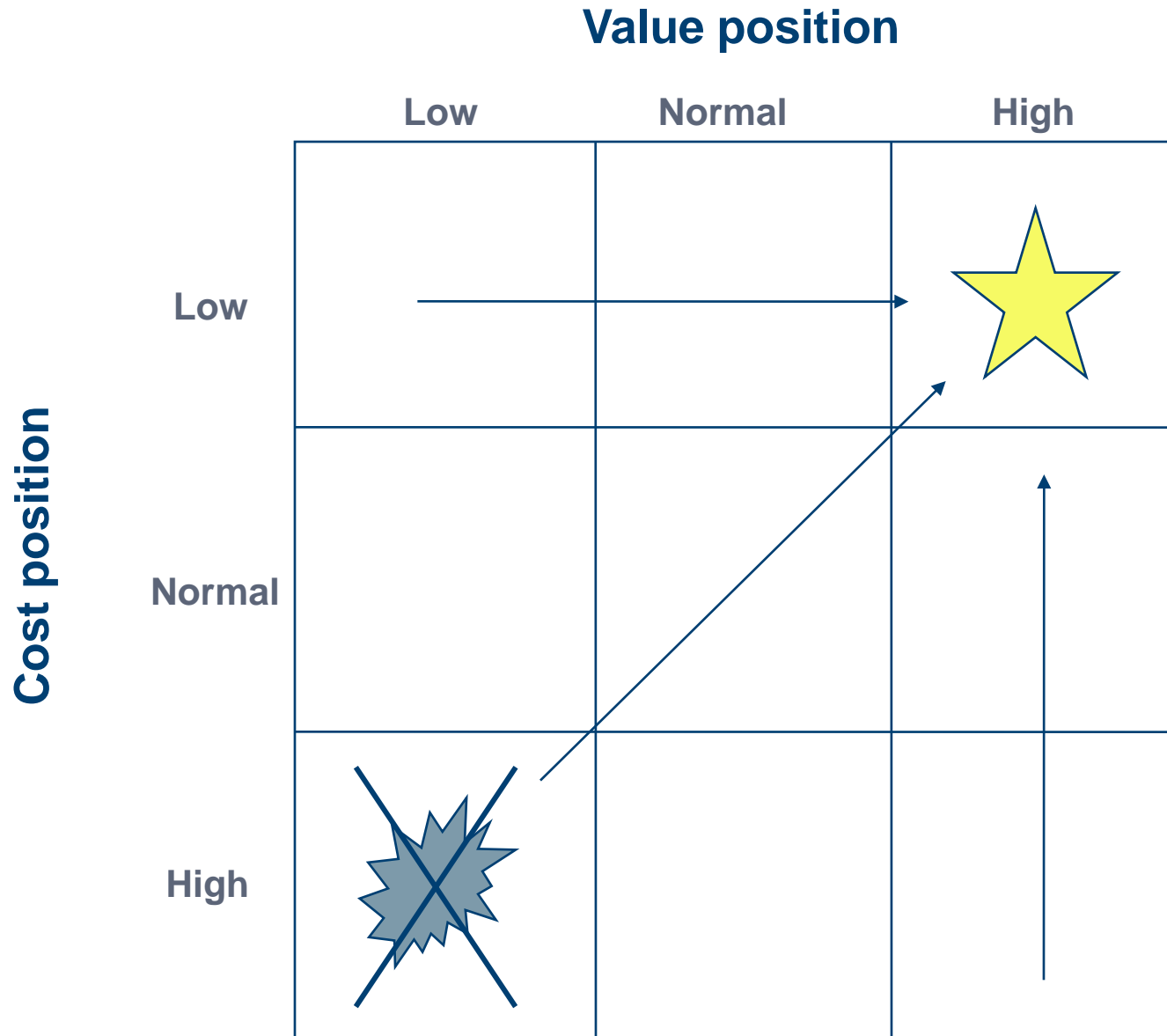


# From labour to capital

**Development in number of vessels, number of fishermen and fishing quantities. 1950-2008**



# Efficiency and value



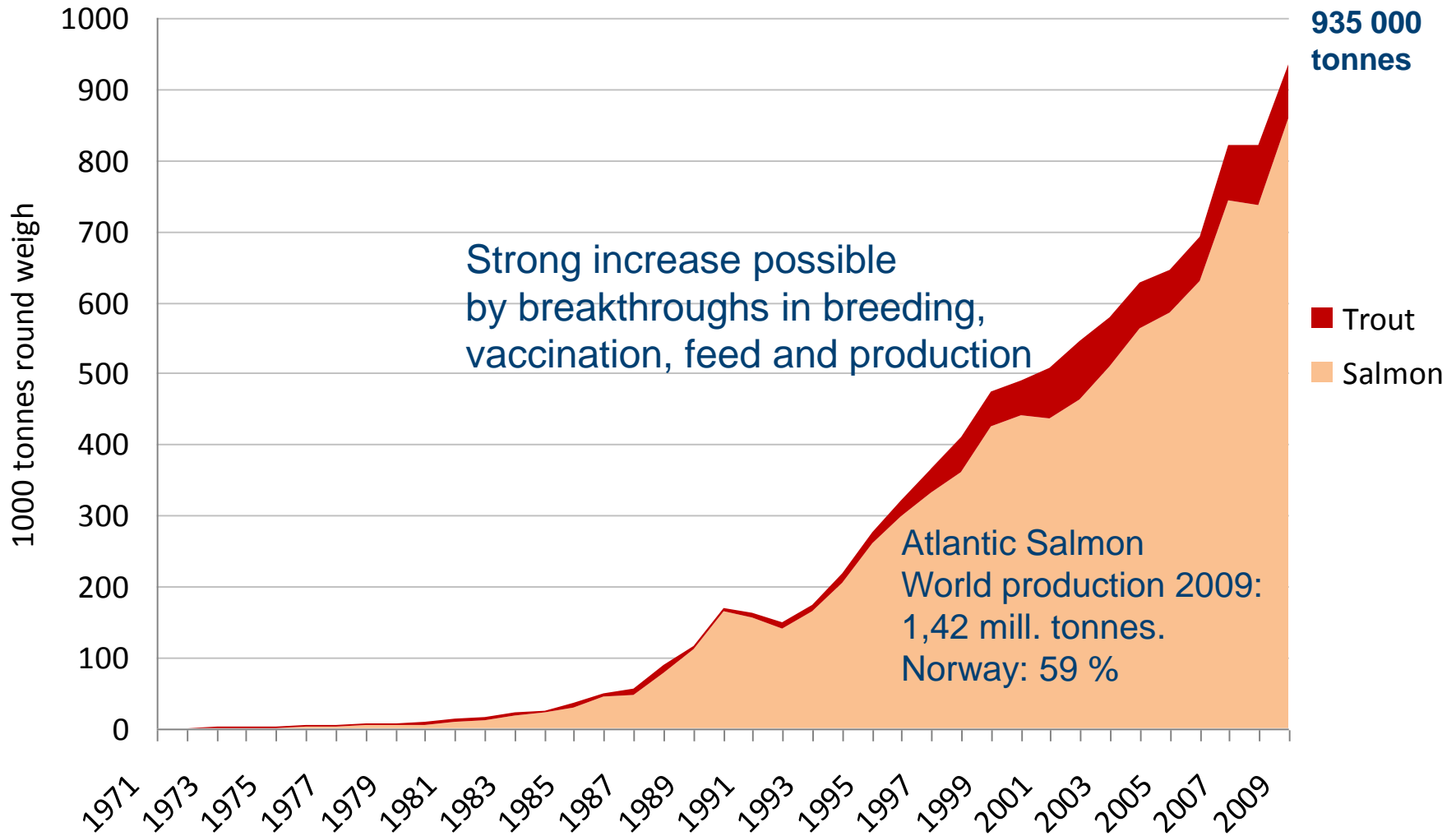
# Catch of main species (2006-2011)

	2006 Tonnes	2007 Tonnes	2008 Tonnes	2009 Tonnes	2010 Tonnes	2011 Tonnes	Historical peak for each species Tonnes
Cod	212 700	192 500	195 413	233 000	271 000	319 000	560 000
Haddock	63 500	73 250	74 500	93 050	116 000	148 000	162 500
Saith	175 000	175 500	225 350	225 350	204 000	173 000	300 000
Caplin	0	0	0	233 000	245 000	275 000	1 740 000
Herring	564 200	780 800	925 980	1 002 000	894 000	602 800	1 160 000
<b>Sum</b>	<b>1 015 400</b>	<b>1 222 050</b>	<b>1 421 243</b>	<b>1 786 400</b>	<b>1 730 000</b>	<b>1 517 800</b>	<b>3 922 500</b>

Research challenges related to:

- Achieving maximum sustainable yield
- Choosing between species
- Harvesting; when and how

# Norwegian production of farmed salmon and trout





# Challenges in aquaculture



- Shortage of productive sites
- Environmental problems
- Shortage of marine based feed
- Conflicts of interest
- What happened to other species like; arctic char, halibut, cod, catfish and mussels?

# Fish meal and fish oil

## Often produced from:

1. Fish species that can not be used directly for human consumption:
  - Bones, small fillets, not so tasty
2. By-products from fish processing
3. Fish species that has no market / low price

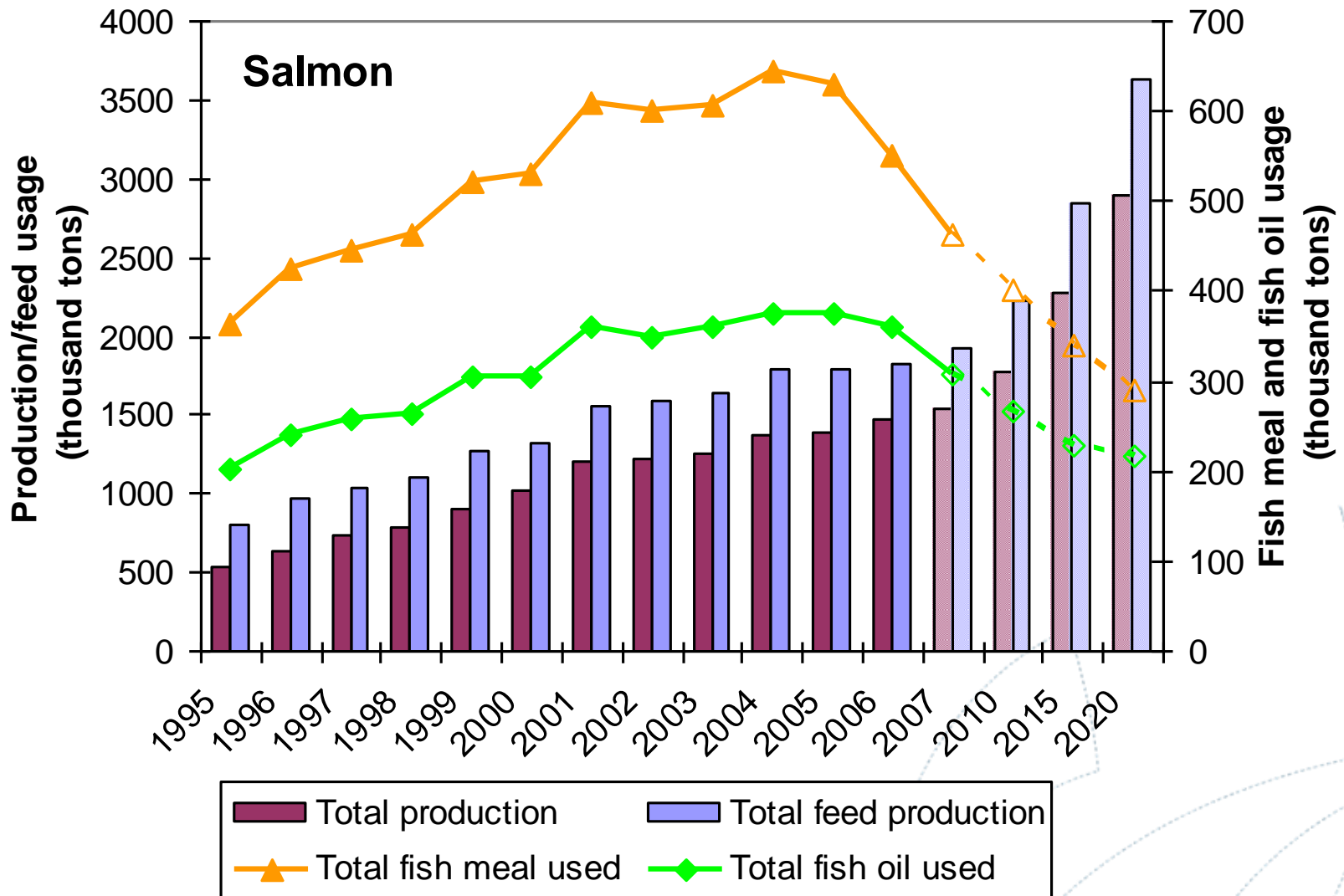
## How to utilize this fish in a best possible way:

- As feed for salmon?
- As feed for pork or chicken?
- As surimi?

Who is willing to will pay the market price?



# Reduced use of fish meal and fish oil



Source: Tacon & Metion, 2008

# Alternative ingredients

- Plant ingredients

- Proteins:

- Soy meal
    - Soy concentrate
    - Raps meal or canola
    - Barley
    - Wheat
    - Corn
    - Peas
    - Beans
    - Etc.

- Oils:

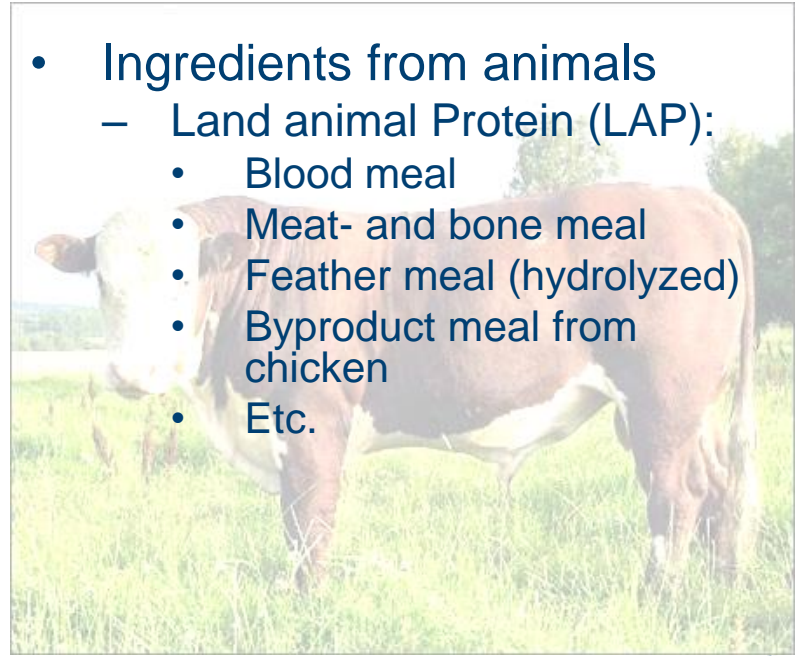
- Soy oil
    - Linseed oil
    - Rapeseed oil
    - Sunflower oil
    - Etc.



- Ingredients from animals

- Land animal Protein (LAP):

- Blood meal
    - Meat- and bone meal
    - Feather meal (hydrolyzed)
    - Byproduct meal from chicken
    - Etc.

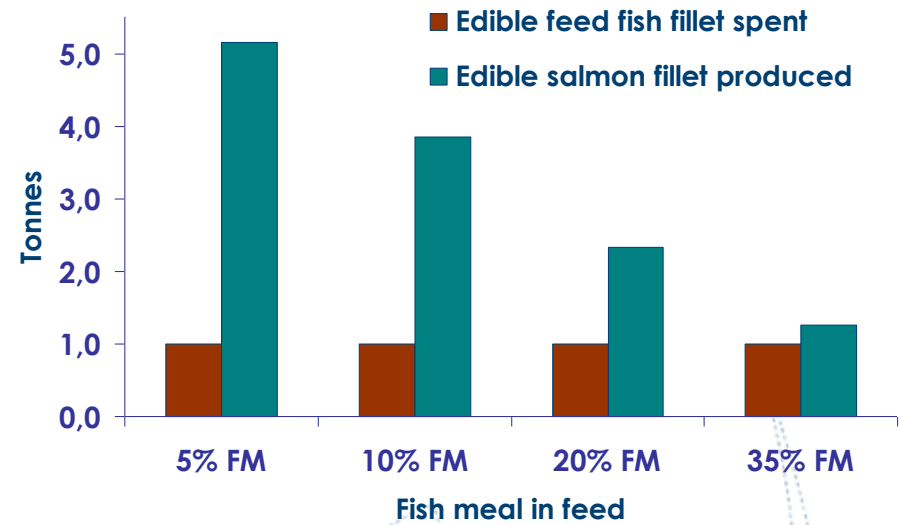
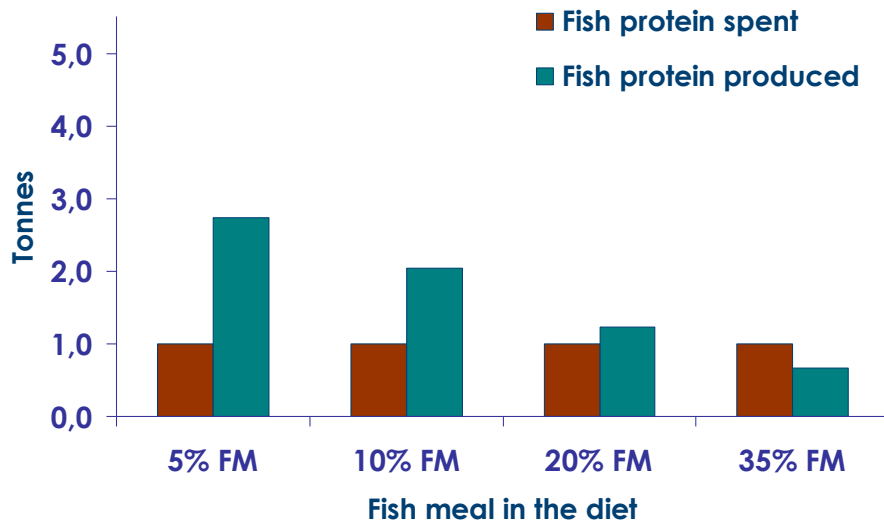


- Marine ingredients:

- Byproducts
  - Krill
  - Amphipodes
  - Etc.



# Salmon can be a net producer of protein!



Source: T. Åsgård, Nofima

# Greenhouse gaz emissions and energy use



Species	Carbon footprint (kg CO <sub>2</sub> e/kg edible part at slaughter/landing)	Energy use (MJe/kg edible part at slaughter/landing)
Beef, Swedish	30	79
Pork, Swedish	5.9	41
Chicken, Swedish	2.7	29
Salmon	2.9	40
Cod	2.9	27
Haddock	3.3	34
Mackerel	0.54	7.1
Herring	0.52	6.8

Source: Sintef, 2009



# SALMON AQUACULTURE DIALOGUE (SAD)

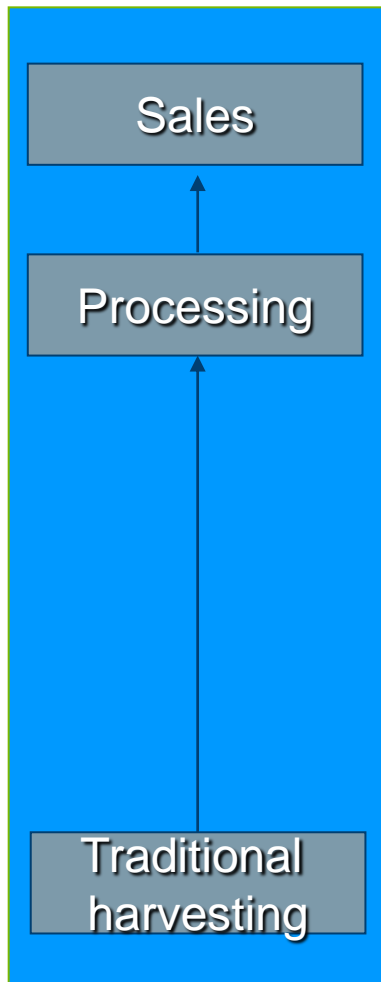
Draft standards for responsible salmon aquaculture (August 2010)

## PURPOSE AND SCOPE:

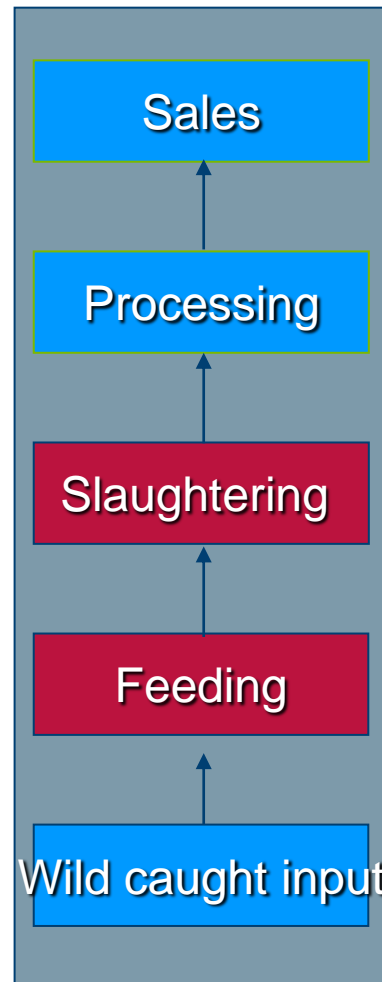
- The SAD is a science-based forum initiated by World Wildlife Fund (WWF) in 2004. The goal of the Dialogue is to credibly **develop measurable, performance-based standards that minimize or eliminate the key negative environmental and social impacts** of salmon farming, while permitting the industry to remain economically viable.
- More than 500 stakeholders, including producers, environmental and social non-governmental organizations (NGOs), seafood buyers, scientists, and government representatives have participated in the Dialogue.
- A nine-person Steering Committee (SC) is responsible for managing the SAD process and making all final decisions related to the salmon standards document. This group of volunteers includes representatives from salmon producer associations and companies, feed manufacturers, and environmental and social NGOs.

<http://www.worldwildlife.org/salmondialogue>

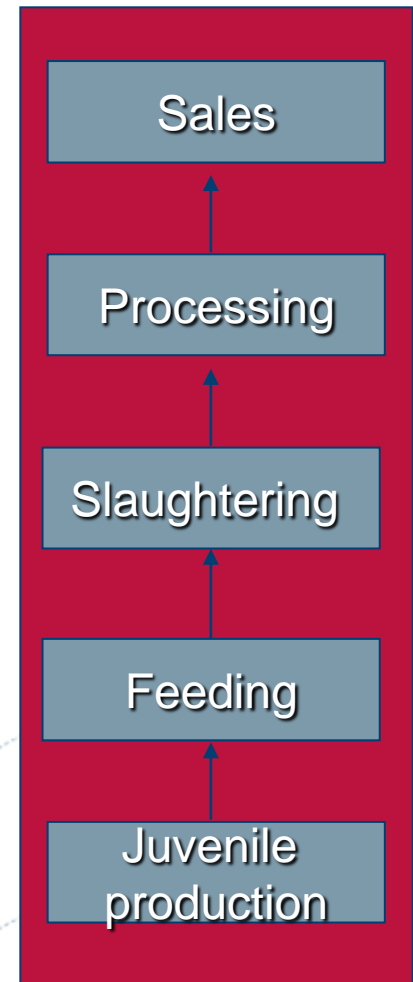
# What species in which concept – when?



Capture



Capture based aquaculture



Aquaculture



# Arguments for more aquaculture and CBA

- Limited and often decreasing wild fish resources
- Input uncertainty in capture
  - Volumes
  - Quality
- Consumer preferences for fresh seafood and for healthy fats and proteins
- Efficient feed utilization
- Relatively low carbon footprints



# Conclusion

- Norwegian seafood production is based on:
  - Presence of wild and valuable fish stocks
  - A long and sheltered coast line, well suited for aquaculture
  - Competence on sustainable management and harvesting
- The industry has succeeded in increasing their production of healthy seafood (fat and proteins)
- Seafood proteins are produced:
  - Without subsidies
  - With low carbon emission
- Present challenges in Norwegian aquaculture are related to feed, escape and salmon louse



Thank you for your attention!