Aquaculture for food production
– successes, constraints and future research requirements in salmon farming

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EAAP Stavanger 2011
Food security: policy perspectives for industry and research

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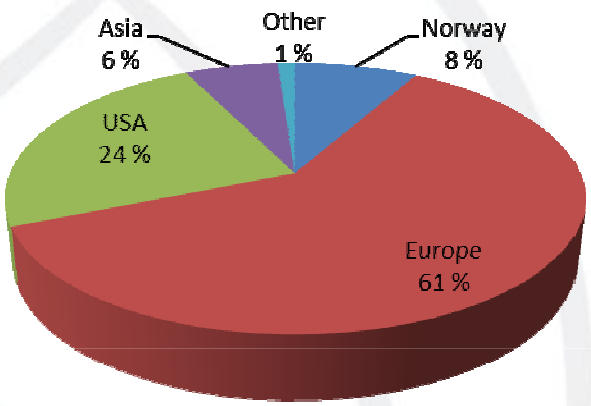
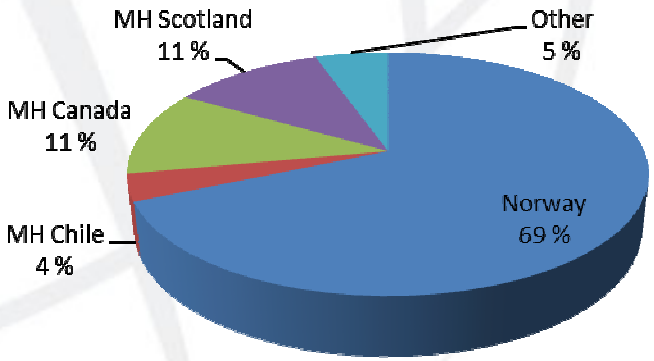
Marine Harvest at a glance

- Turnover NOK 15.2 billion
- Salmon volume 296' tonnes (HOG)
- 4 800 employees
- Presence in 21 countries
- Global market share of ~25%
  - Farmed Atlantic Salmon
- Leading producer in:
  - Norway
  - Canada (West Coast)
  - Scotland
  - Ireland
- Extensive value adding processing of convenient, healthy, natural and fresh salmon and other species
  - Europe (MH VAP)
  - USA
  - Japan

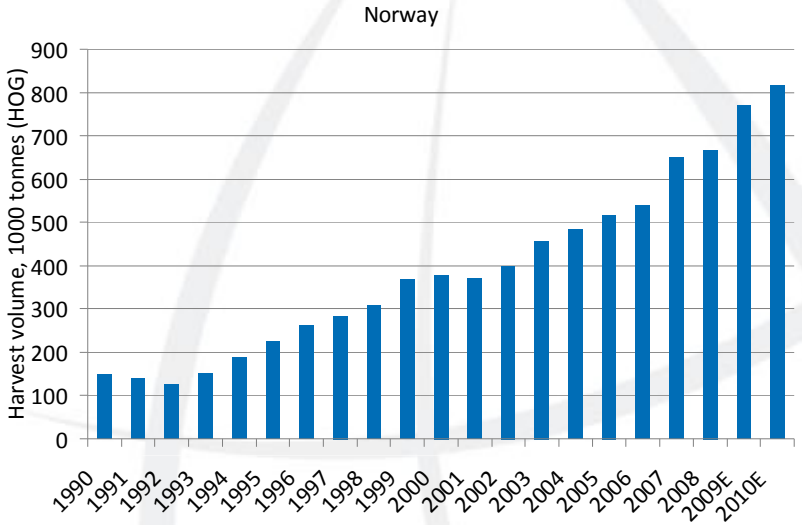
2010 Sales breakdown

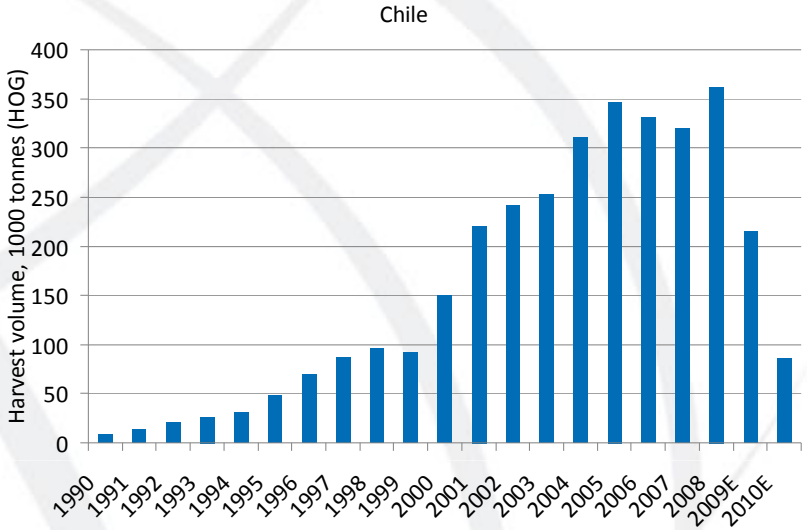


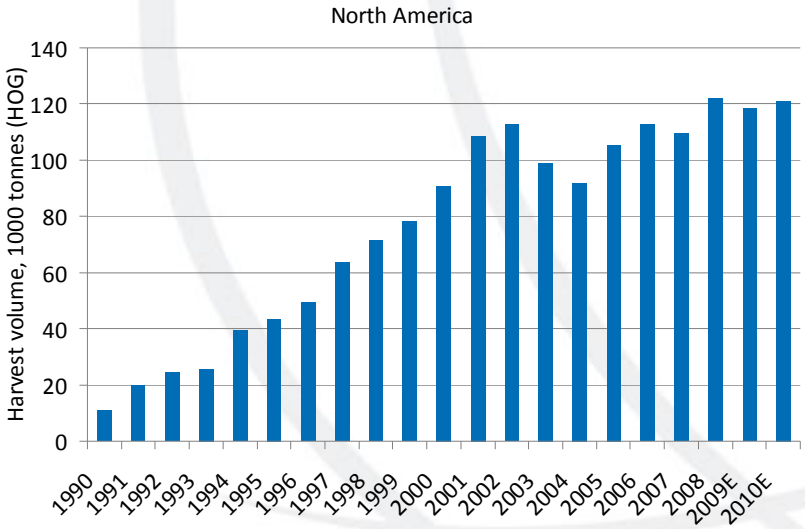
Harvest volume 2010 (HOG)

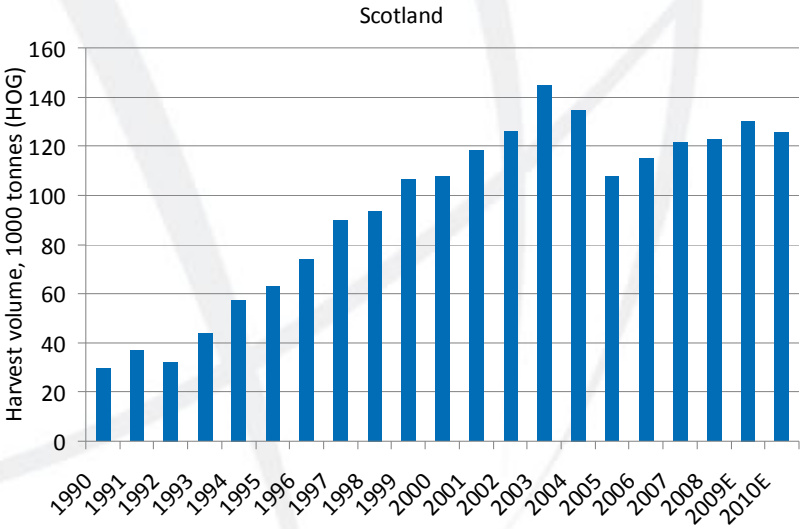


Atlantic Salmon – global volumes







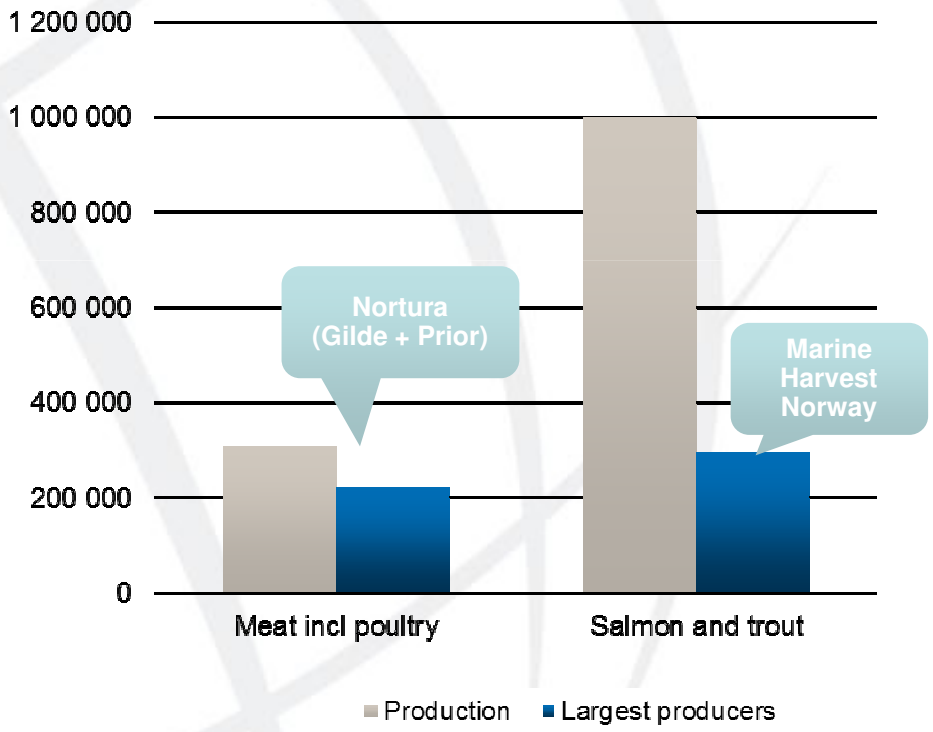


Source: Kontali Analyse/MHG mid range estimate for 2010

Salmon is the No.1 farmed animal in Norway

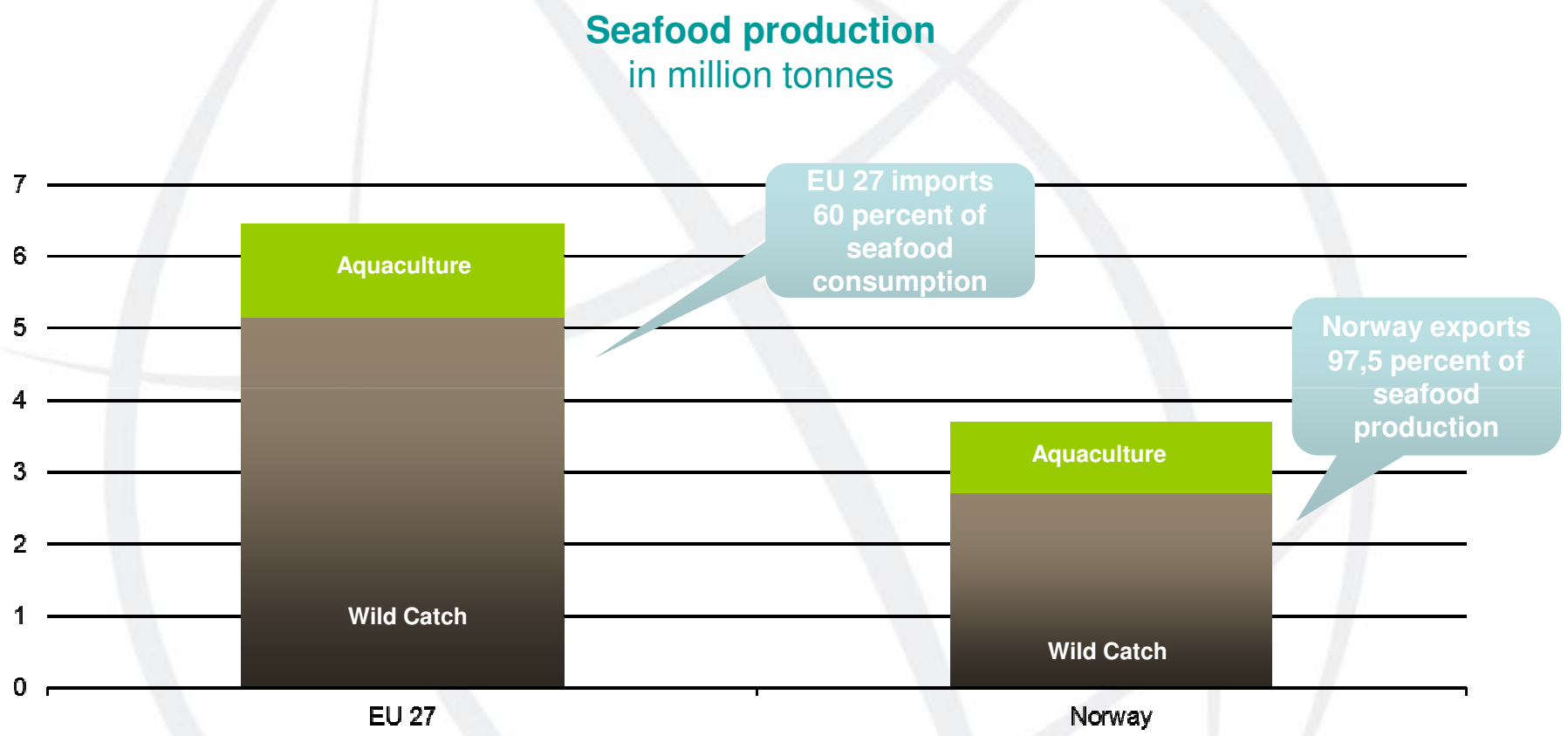
- Annual salmon production 1 mill tonnes
- More than 3 times that of meat production
- Represents 5 billion meals/year
- 31.4 billion NOK in export value (4 billion €)
- Creates close to 20 000 jobs (including supplier industry). Most of them in rural areas on the coast
- Trend towards increased local processing (value adding)

Total production of meat and farmed fish in Norway (slaughter weight tonnes)* 2010



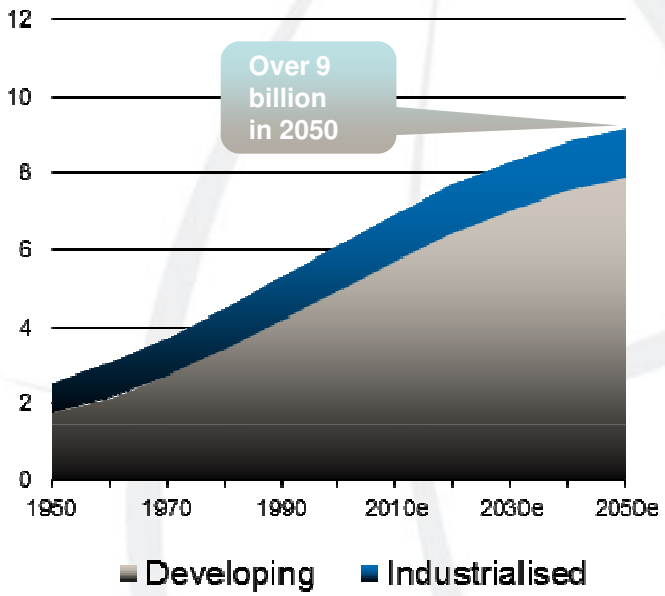
* Gross slaughter weight for industry. Source: FHL, SLF, Nortura, NSEC, Marine Harvest.

Europe needs more seafood



Source: Eurostat aquaculture and Wild catch, Norwegian Seafood Export Council

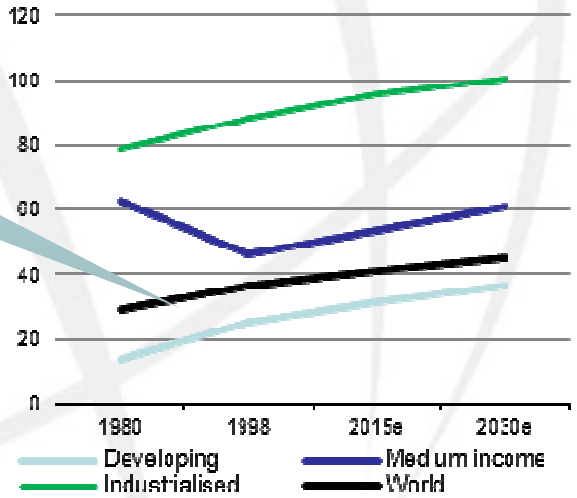
The world needs more food



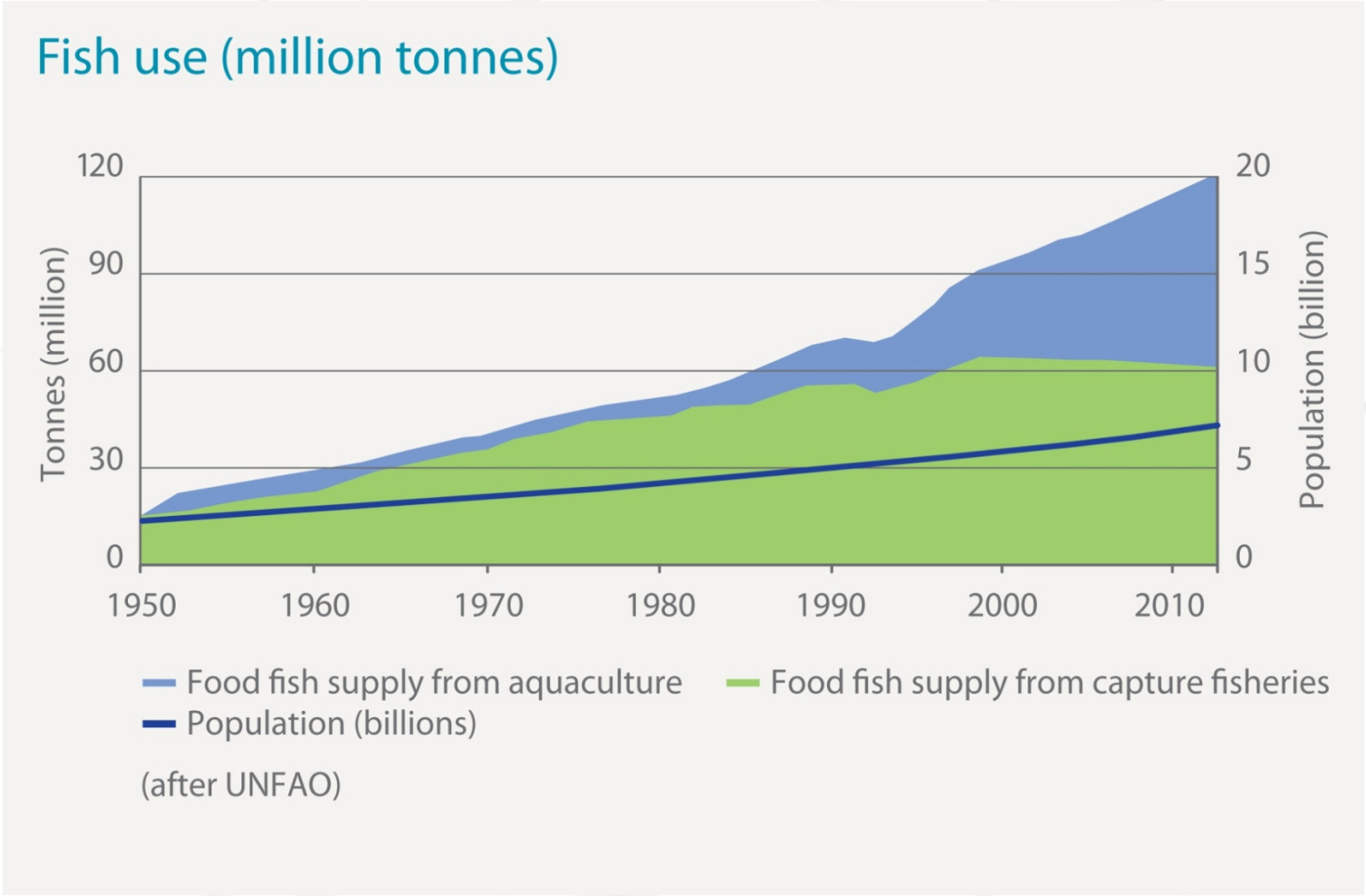
Growing poplation

On average we will eat 55% more meat in 2030 than in 1980

We eat more protein
(kg per capita per year)



Aquaculture - increased contribution to global food consumption



Opinions on aquaculture

"… the fish farming industry must be able to document that the production is truly sustainable. Both the fishery and the fish farming industry must have the perspective of eternity. Industry and nature must go hand in hand"

Minister of Fisheries and Coastal Affairs Lisbeth Berg-Hansen

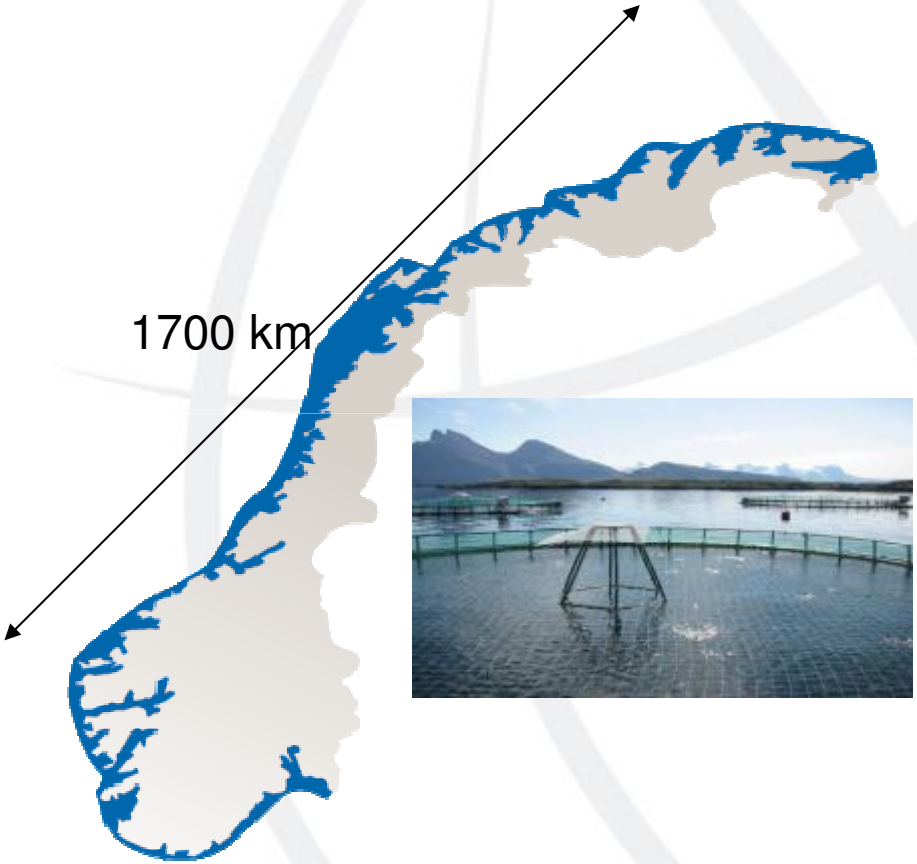
«If Aquaculture did not exist we would have to invent it. … the declining European fisheries stocks complicate the supply of fish. Aquaculture plays a significant role in offsetting this ever-increasing gap …»

European Commissioner for Maritime Affairs and Fisheries Maria Damanaki

"*Farmed fish is an excellent source of protein and, when produced well, helps protect the environment. I am totally convinced that aquaculture is the most sustainable way to feed the world."*

Director WWF Aquaculture Program Jose Viallon

Norway's success formula for salmon farming



- Long sheltered coastline with temperate water (Gulf Stream) and 90 000 km2 within the sea boundary
- Visionary, innovative, hard working and dedicated people
- Willingness to invest
- Political support
- Strong regulations
- Strong tradition for collaboration between research, regulators and industry
- Steady growth in market demand for salmon (5-10% annually)

40 years of technology development

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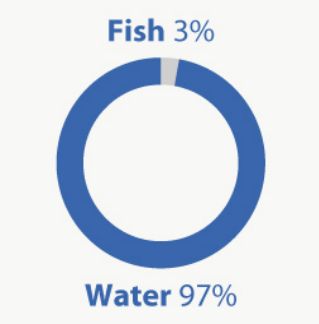
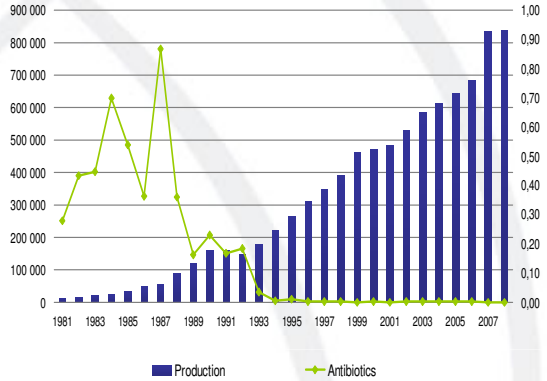
Healthy fish are happy fish

- Low stocking densities



- Optimal farm location

- Vaccination=reduced antibiotics



- Sea lice: from medication to biological control

Trend towards larger integrated management zones with big production units

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Modern cages are big

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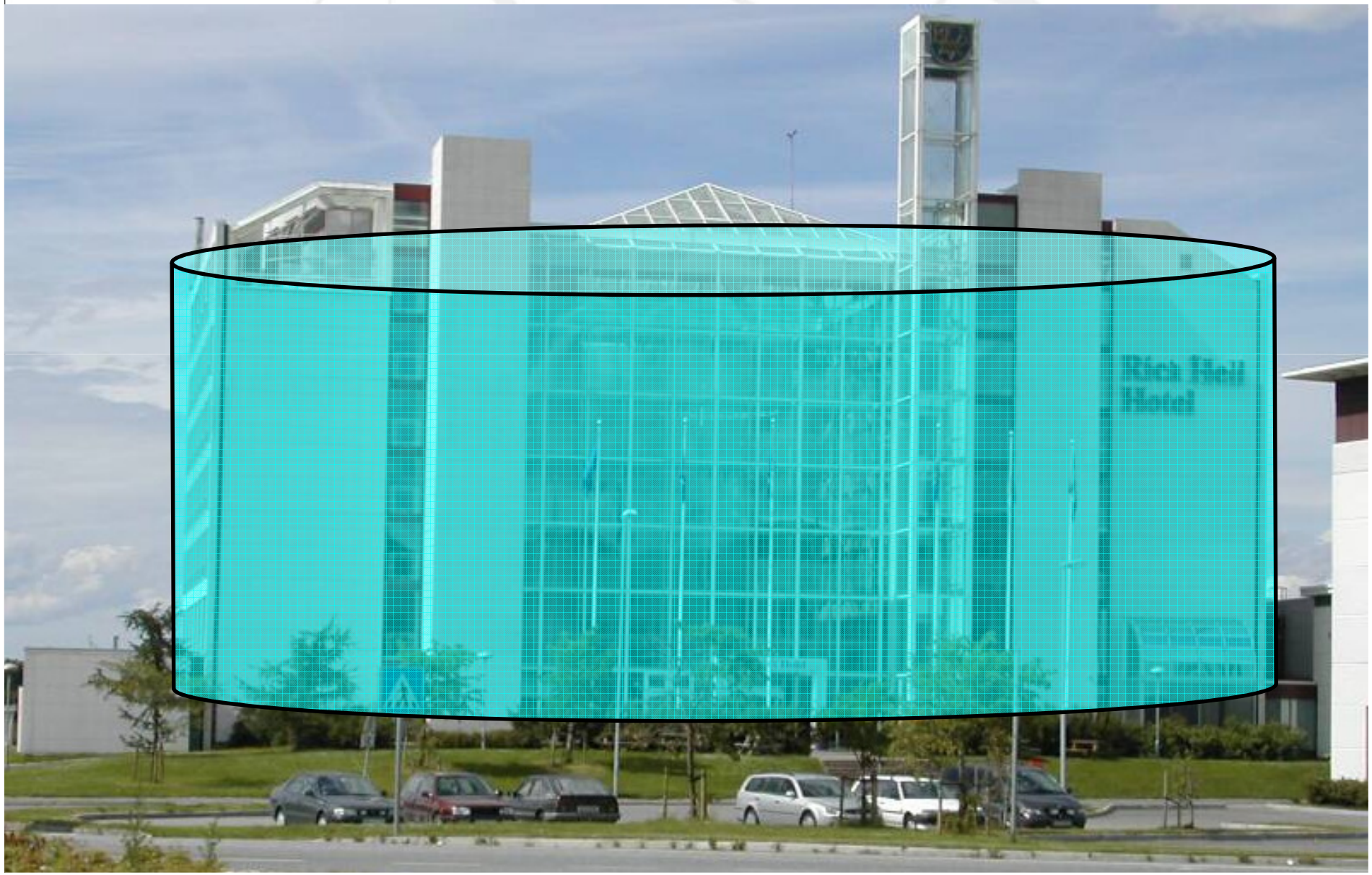
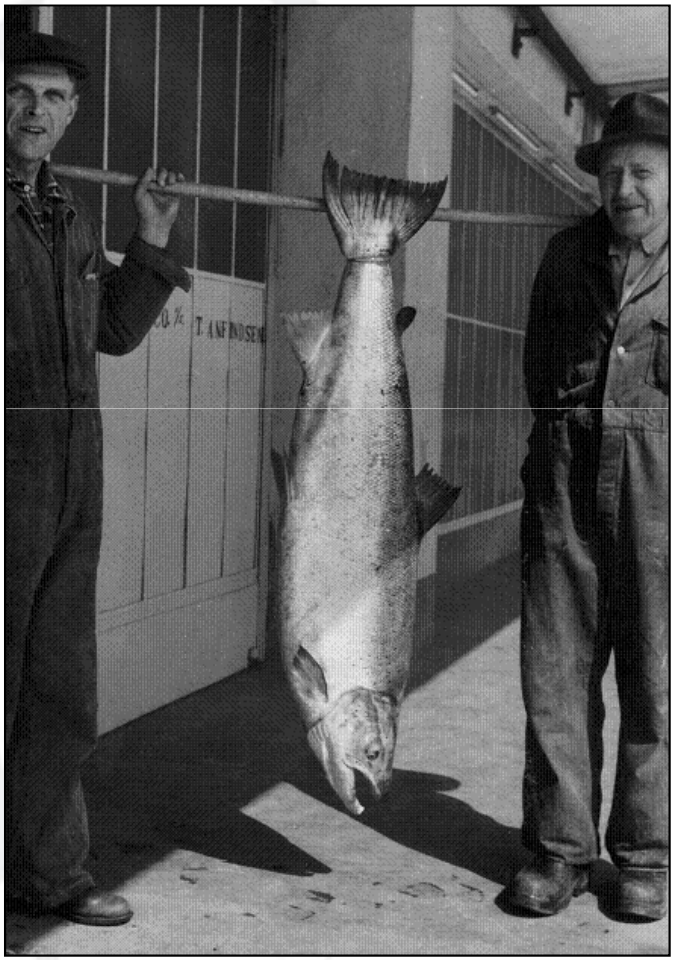


Challenges to further growth

- Marine raw materials in feed
  - Growth from a finite resource of forage fish
  - Preserving wild stocks
- Fish Health and Wild-Farmed interaction
  - Disease management
  - Genetic interaction between wild and farmed fish
  - Sea lice management
- Transparency and dialogue



Escapes and protecting wild salmon stocks

- All stock losses – whether escapes or eaten by predatory seals or birds – are an unnecessary cost
- We have a zero target for escapes
- We are developing methods and equipment to minimise or eliminate escapes
- Wild salmon and farmed salmon are genetically similar. It is in our interest to maintain healthy diverse stocks of wild salmon for the future
- We are researching non-transgenic methods of farming sterile fish
- Obligatory tagging of all farmed salmon will be introduced in order to trace back to farm (DNA or physical tag)

So what do salmon eat?

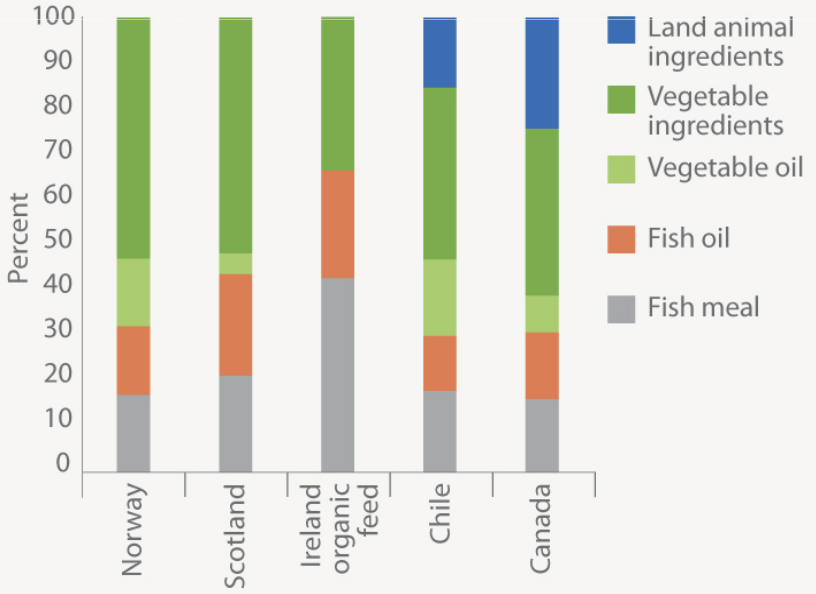
Decreasing marine ingredients, but…

- Increased use of by-products from fish processing (trimmings)
- Cereals and plants such as soy

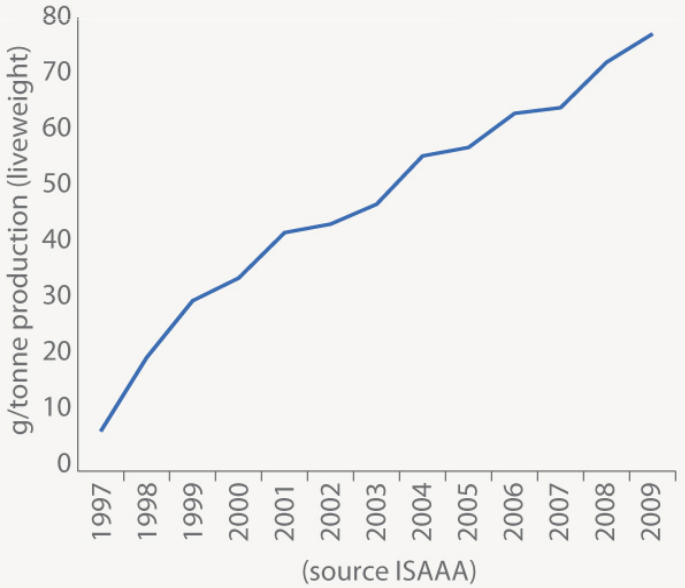
In certain territories only

- Land animal proteins
- Genetically modified soy

Raw materials in typical salmon feeds



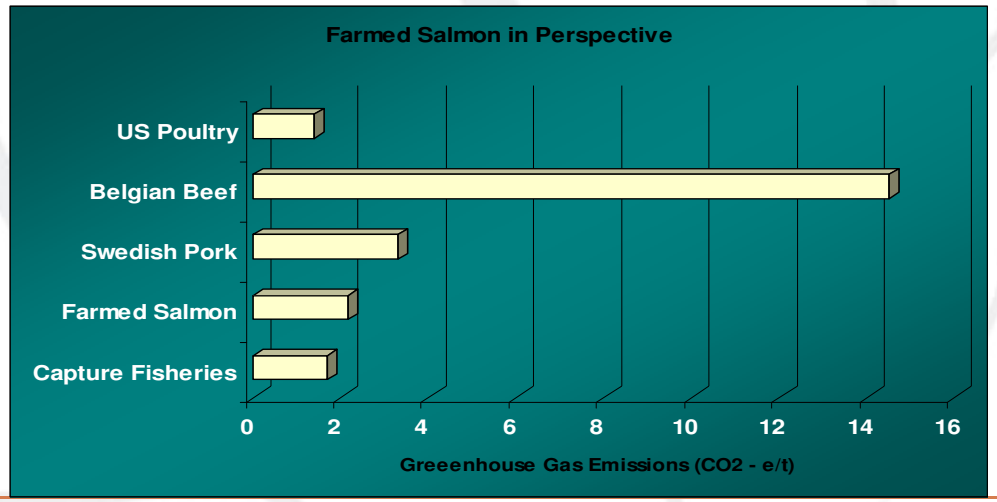
Percentage of global soy crop that is genetically modified



Salmon is a very efficient feed converter and has a favourable carbon footprint

Feed conversion ratios
(kg feed/kg growth)

Green house gas emissions
(”Farm gate” data)



(Pelletier et. al, 2009)

The future of fish farming

Fish health challenges

- Toolbox of new approaches– biological, mechanical, improved disease resistance through breeding, better understanding of natural processes

Feed improvements

- Increasing feed efficiency by reducing wastage
- Reduce dependency on wild marine ingredients
- Alternative sources to fish oil for omega 3 supply

More aquaculture research needed!

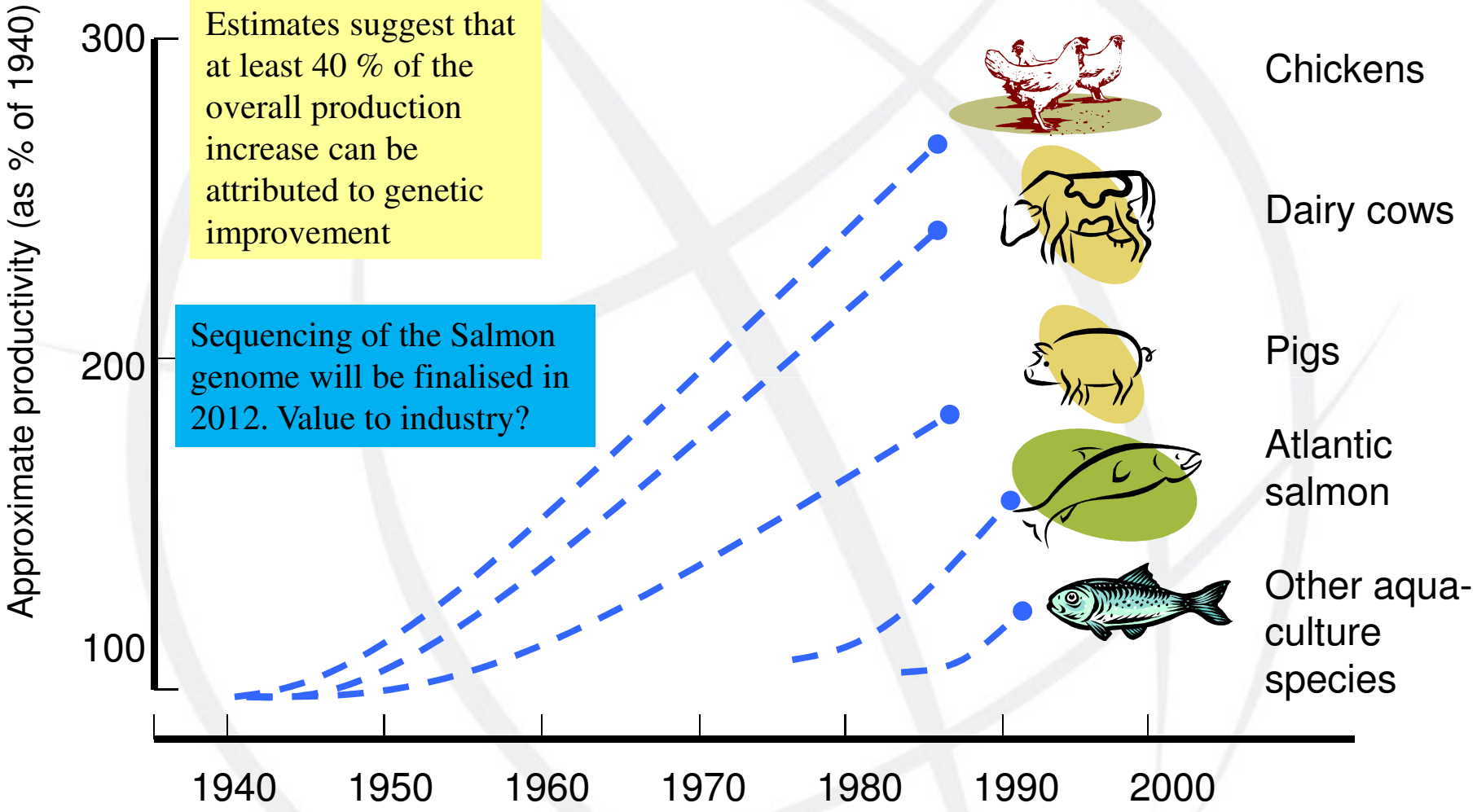
- The European Aquaculture Technology and Innovation Platform (EATIP) is developing strategic research agendas

➢http://www.eatip.eu/

Breeding and genetics
- Late start – Huge potential!

Estimates suggest that at least 40 % of the overall production increase can be attributed to genetic improvement

Sequencing of the Salmon genome will be finalised in 2012. Value to industry?



Modified by Aqua Gen from Eknath *et al.*, 1991

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Thank you!

For more information on sustainable salmon farming:

www.marineharvest.com

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