Farming the Sea

by

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Global seafood production

[Graph showing trends in global seafood production from 1970 to 2003, with lines for Wild, Aquaculture, and Total production.]
Introduction

- In 1970 aquaculture contributed 5% of the total supply of seafood. In 2005 aquaculture’s share was 40% with a production of 62.9 million tonnes.

- Although aquaculture is old, a revolution occurred in the 1970s.

- New technologies and better feeding have led to an enormous increase in production.

- Increasing control with the production process, and semi-intensive and intensive farming allow productivity growth and market development.

- Aquaculture is increasingly becoming more like any other crop, and one is Farming the Sea.
Farming the Sea

- The farming practice varies from highly extensive and very close to hunting and gathering (fisheries) to highly intensive and industrialized.

- It is intensive industrialised farming that allows us to produce much more, and that makes aquaculture a significant source of food.
  - And not all is traded on the global market.
  - Still, the EU, Japan and the US will be the main markets in the foreseeable future.

- This development is still in the early beginning, and there is still a substantial scope for innovation.
  - Salmon and shrimp is so far leading this development.

- Compared to agriculture, there is still a long way to go.
Quantity shares

- Carps, barbels and other cyprinids
- Oysters
- Freshwater fishes
- Molluscs
- Scallops
- Mussels
- Shrimps, prawns
- Clams, cockles, arkshells
- Tilapia
- Salmon
Value shares

- Scallops
- Carps
- Salmon
- Shrimps, prawns
- Freshwater fishes
- Freshwater crustaceans
- Clams
- Oysters
- Coastal fishes
- Tilapia
Global production of farmed salmon and real Norwegian export price, 1981-2006
Global production of farmed salmon and real Norwegian export price, 1981-2006
Production of Sea bass and real unit price (2005=1)
Production of Sea bream and real unit price (2005=1)
Production of European turbot and real unit price (2005=1)
Production of tilapia and real unit price (2005=1)
Production of milk fis and real unit price (2005=1)
Production of pangasius and real unit price (2005=1)
Shrimp production and real US import price (2003=1)
New species

- Most new aquaculture species have, to varying degrees, had to develop their own markets, and has accordingly moved down along the demand schedule.
- To a varying degree one has also succeeded in developing new markets.
- This is profitable because of lower production cost due to technical innovations.

- Salmon leads in many areas (and we do have most data for salmon).
  - Sea bass and sea bream are interesting examples of how no market development limits growth.
Norwegian export price and unit cost 1985-2006 (2006=1)

*Estimate
Productivity growth

- The main reason for the increased production in aquaculture is the productivity growth that reduce production costs, and makes it profitable to sell the product at lower prices
  - Market growth and product development has further contributed to the industry growth

- The productivity growth is possible because the control of the production process

- It also allow supply chain innovations
Productivity

- Productivity can be decomposed into input factor effects and improved technical efficiency.
- For salmon about 60% of productivity growth is improved input factors, while about 40% is better farming practices (Tveterås).
- In addition, the scale of the operations has changed. A single plastic pen in the early 1980s were 5 meters in diameter and about 4 meters deep. A standard modern pen is about 40 meters in diameter and are also 50 meters deep.
Productivity growth

• The development of the input factors has been tremendous, with better feed, automatic feeding systems etc
  – And there is a substantial catching up potential for most species

• Twenty years ago feed made up 25% of salmon farmers cost, and smolt about 20%. Currently feed is 55% and smolt is still 20%
  – For efficient chicken farmers, feed is more then 80% of the production cost

• Efficient species are basically converters of cheap low quality inputs to more desirable outputs
Feed cost share

![Chart showing feed cost share from 1985 to 2003]
Norwegian farmgate price and French retail price for whole salmon

![Graph showing the Norwegian farmgate price and French retail price for whole salmon from 1993 to 2002. The graph compares the Euro/kg price over the years. The Supermarket line is shown in yellow and the Farmgate line is shown in blue.](image)
Price at different stages of the supply chain for cod to the UK

- **Ex.vessel, Norway**
- **Import**
- **Retail**
Supply chain innovations are important

- For fresh cod, the fishermen get 10-15% of the retail value
- For salmon, the farmer gets 40-50%

- This implies that the retail price of salmon relatively to cod is cut by more than a half because of more efficient distribution
- This is possible because of control and scale

- Will the communities benefit by economies of scope?

- Consumers and downstream processors are only concerned about the retail price, not where the cost savings occur
The market has become global
Innovations in logistics and marketing

- The control in the production process has allowed a number of innovations in the supply chain
  - E.g. large scale air freight of seafood, just-in-time delivery, and substantial product innovation

- One started in the traditional fresh fish counter, with unprocessed products....
• ..and continued with fresh packed product, branded products..
..and one see an increased number of ready meals and convenience food based on salmon
Product development in Chile

- Chile has partly overcome long distances to the main markets with innovative product development, and has been leading on the development during the last decade.

- Exploit local competitive advantages in processing, which increase value and reduce transportation cost.

- “pinbone out” fillets opened up markets in the USA where fish normally were not consumed.
Chilean salmon exports to the US

- Fresh fillets
- Frozen fillets
- Whole fresh
- Fresh Coho

[Graph showing the export trends from 1989 to 2005]
Cycles in profitability

- Because there are a substantial lag from when the decision to produce is made until the product is ready for the market, there will be cycles in profitability

- Cycles can also be created by uneven market growth
Norwegian export price, unit cost and unit margin 1985-2006 (2006=1)

*Estimate
Norwegian unit margin
Uneven market growth in the EU

![Chart showing market growth and prices in the EU from 1992 to 2006. The x-axis represents years from 1992 to 2006, and the y-axis represents percentage changes from -30% to 30%. The chart includes columns for market growth and a line for prices.]
Local environmental issues

• Impacts on juveniles. Most aquaculture starts by feeding wildcaught juveniles. Can be avoided in intensive systems
• Internalisation or regulations give a Empirical Kuznets type of relationship
  – Degradation of habitat
  – Mining of locations
  – Use of antibiotics and other pollution

• Aquaculture is a young industry, and problems must be discovered before they can be solved
  – Environmental issues for salmon is substantially less serious than they used to be

• Good management (and regulations) gives sustainable practices, but this need not be the case
Use of antibiotics in the Norwegian salmon farming industry

![Graph showing the use of antibiotics and salmon production over time.](image-url)
Aquaculture production will continue to increase

• Because it is profitable
• Control of production process leads to technological development and productivity increase
  – Cost reductions
  – Breeding
• This makes aquacultural products increasingly competitive
• Species that does not have production processes with these characteristics, will not succeed as large volume species
  – In the intermediate term, there will be relatively many species exploring new technology
• As with agriculture, control with the production process and productivity improvement is necessary if one are to feed more people. Wild fisheries do not have this potential
Retail prices on selected food products and retail price index in UK

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Price index (Jan. 1991 = 100)
US producer prices on selected farm commodities

- Pork
- Beef
- Chicken
- Cod
- Salmon
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Aquaculture production will continue to increase

- Aquaculture is likely to be like any other crop or livestock in the future, because one has the same type of control with the production process
  - There will be a large range of practices but the large volume producers will be the most intensive

- Aquaculture will also face similar environmental challenges

- Most farmed species will primarily be fed with vegetable inputs

- Local environmental issues are a management problem and can be solved
Aquaculture production will continue to increase

- Cost consideration will leave only a few high volume species, of which there are produced millions of tonnes
  - Tilapia, and maybe some other finfish species?
  - Shrimps
  - Mussels and scallops
  - ?
- In animal production there are four; livestock, pigs, poultry and sheep
- These species will be sold in a similar fashion
- There will be a large number of species produced in moderate quantities
  - Like quail, deer etc.
Farming the sea

• Aquaculture is in many ways still in its infancy
  – There are still only a few species with closed production cycles and selective breeding
  – There are even fewer species that primarily is sold as fresh packed beside the chicken fillet
  – There are no farmers that specialize in producing feed for the food crops

• One can still only observe the first crude attempts to farm the sea
• We will therefore see a tremendous development during the next decades