Baltic Sea Fish Feed – Recycling nutrients in the Baltic Sea

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Aquaculture seminar

Stockholm

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Background

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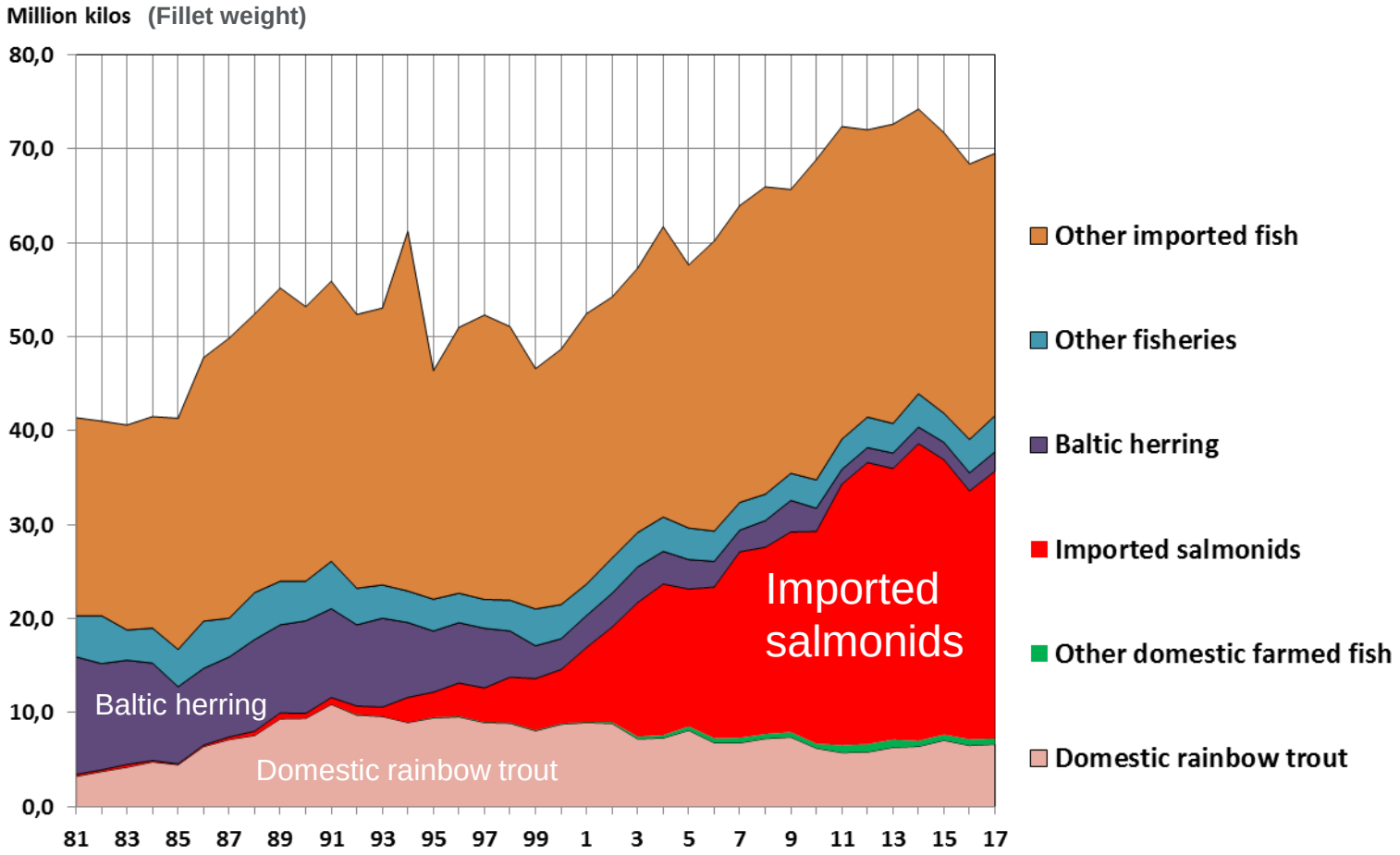
Declining domestic production



Only 19 % of food fish in the Finnish market is of domestic origin!

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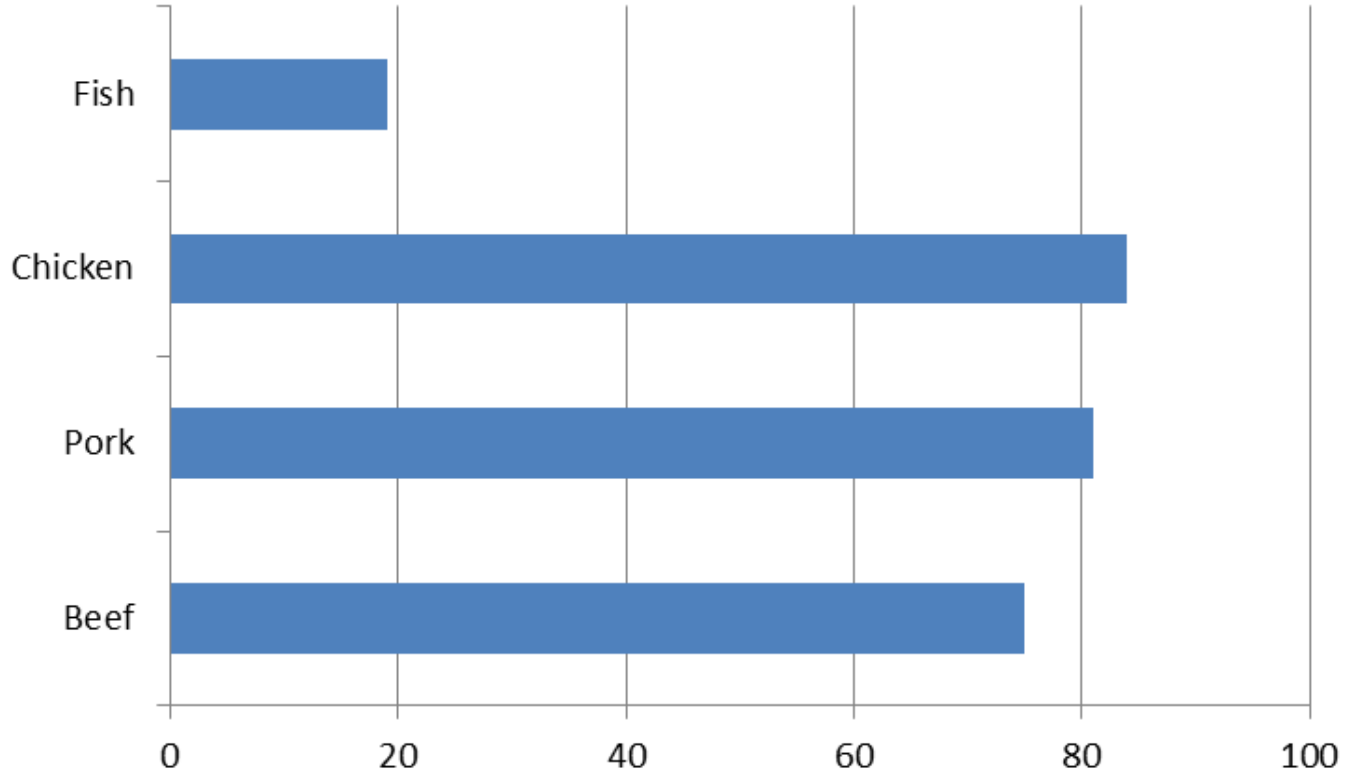
Meat self-sufficiency in Finland



Share of domestic meat and fish in the Finnish market

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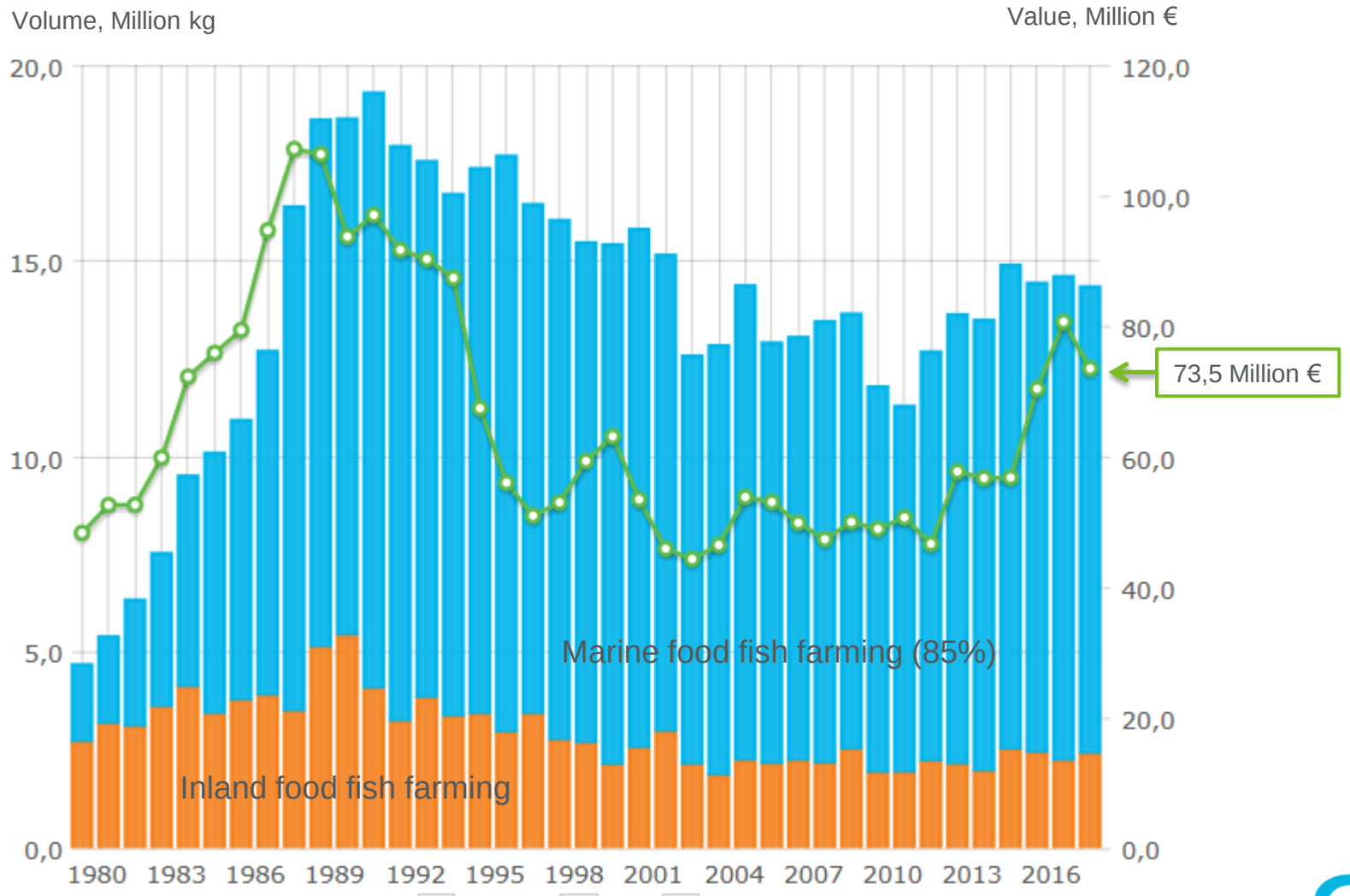
Fish farming in Finland



Environmental restrictions >
Efforts to decrease nutrient loadings

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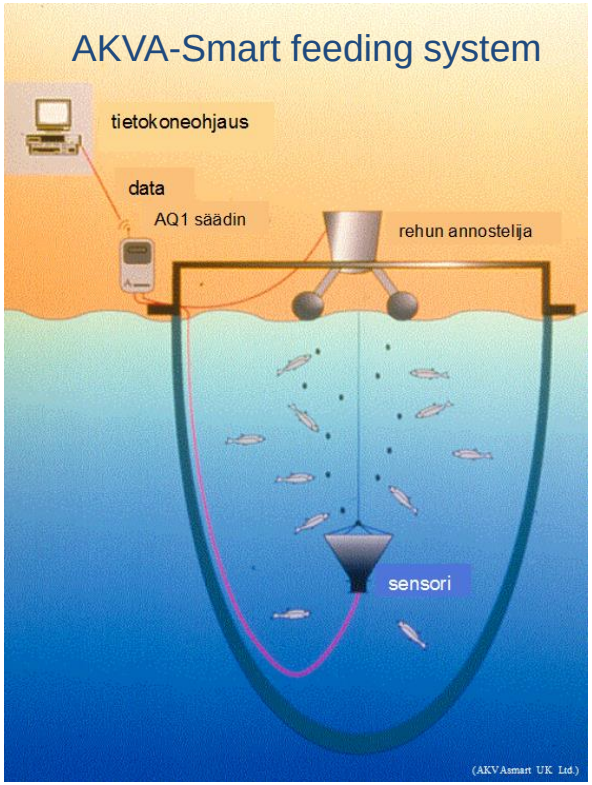
How to improve sustainability?

1) Fact-based collaborative decision analysis 1992:
   > Result: Develop environmental-friendly feeds

2) Investments in research facilities to enable:
   - laboratory scale experiments
   - field scale experiments at sea



Marine Aquaculture Research facilities (1993)

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Research strategy

Environmental-friendly feeds were developed in co-operation with feed industry and fish farmers

Benefits of this research concept for fish farmer:

- better fish growth and less feed lost
- fish farmers do not need to make expensive investments
- research results are easy to adapt

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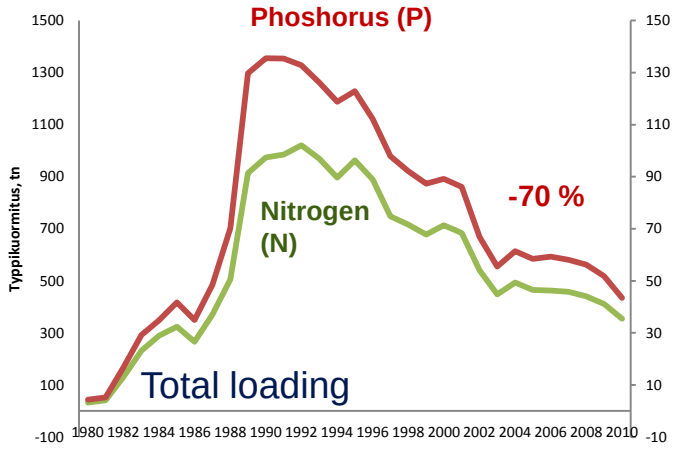
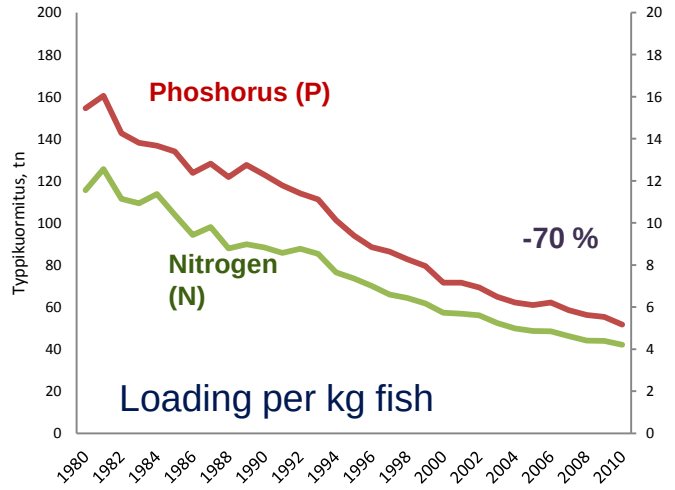
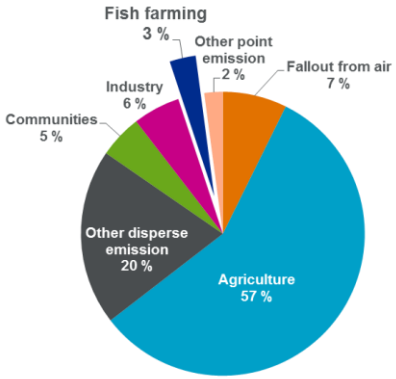
Nutrient loading reduction

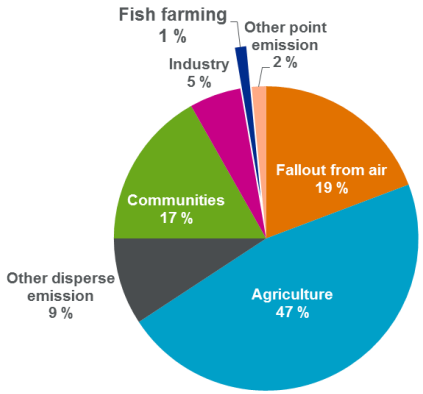






Phosporus

94 tn / 3 144 tn
Fish farming / Total emission



Nitrogen

776 tn / 64 938 tn
Fish farming / Total emission

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Aquaculture spatial plan

Collaborative process: Fish farmers, fisheries and environmental experts and administration, included public hearings

Tools: GIS-mapping and impact assesment

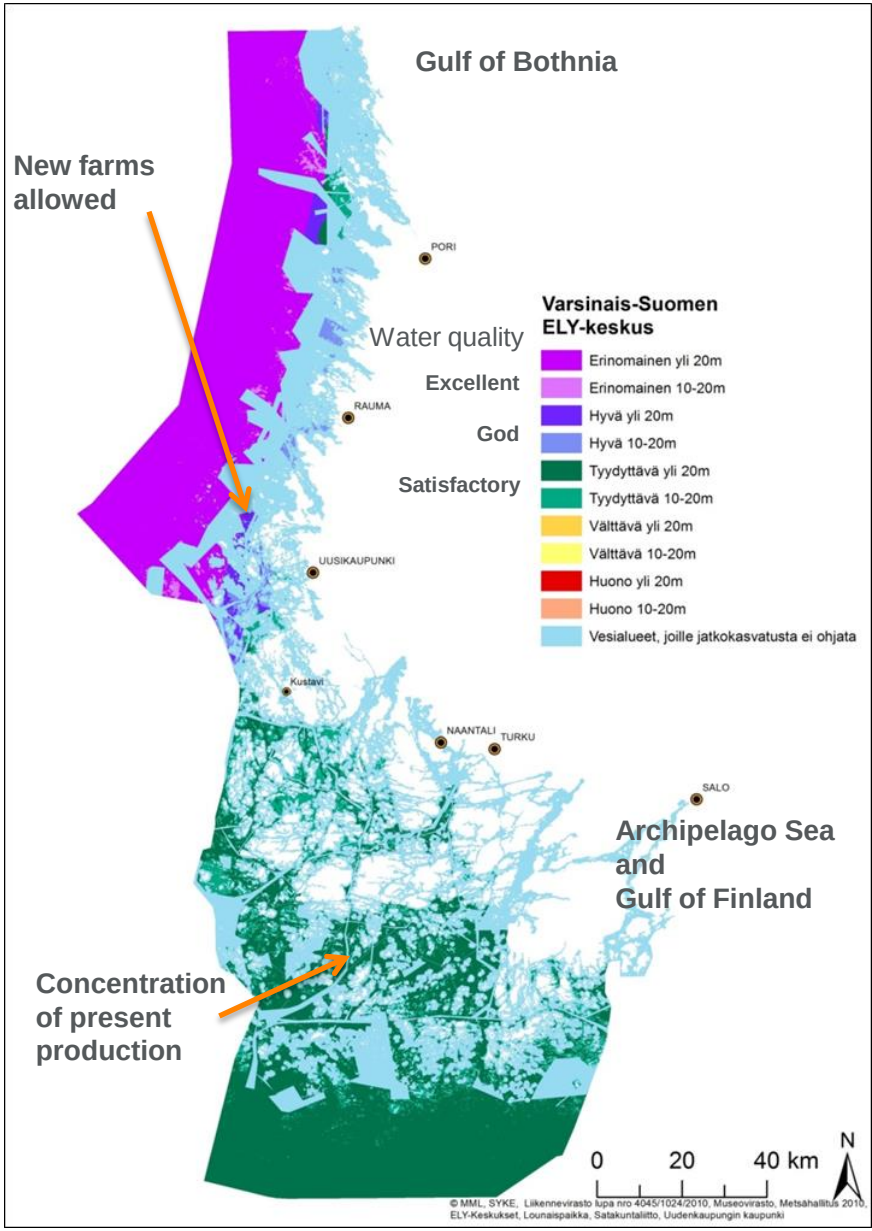
- incl. for instance modeling increase of algae production

Diverse factors and various interests were taken into account

- water depth and water quality
- fisheries, boat routes
- conservation areas
- summer cottages
- ship wrecks etc.

Goals: Reduce conflicts with other water users, smaller environmental harms, improve profitability of fish farming, enable production growth

Approval: Plan was approved by the Minister Of Agriculture and Forestry and the Minister of Environment in 2014 (process took 6 years)

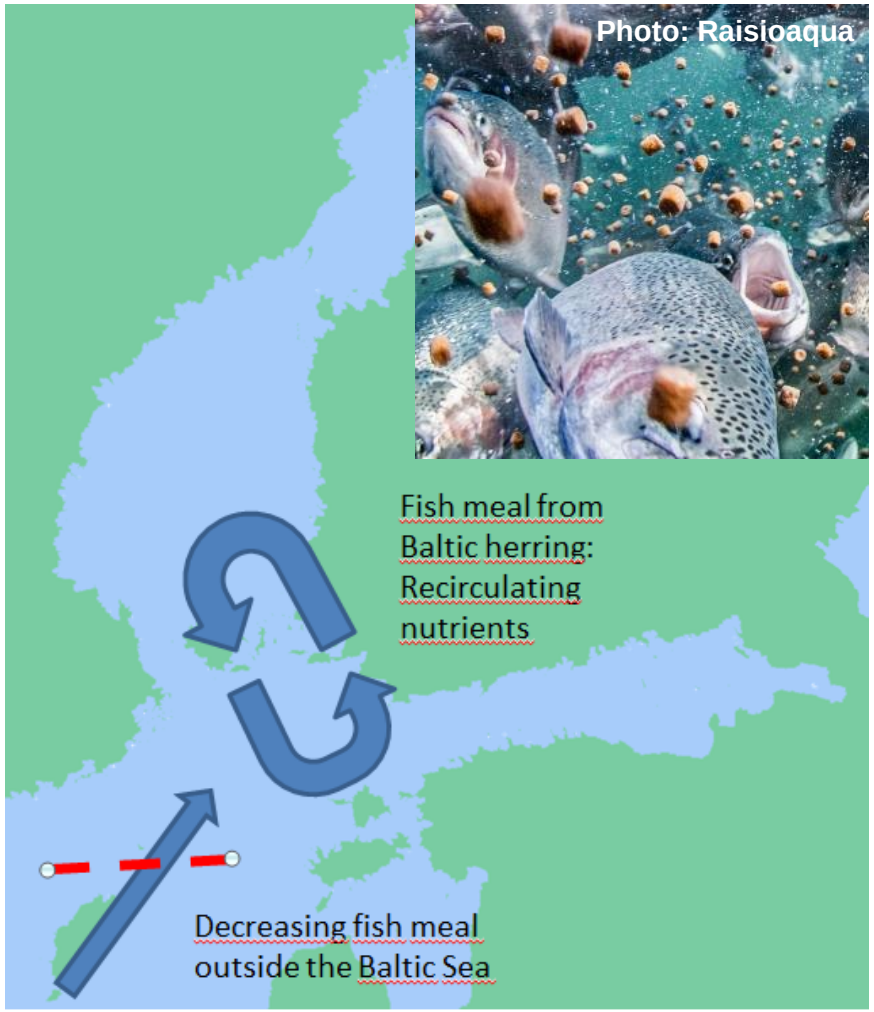


Baltic Sea Fish Feed

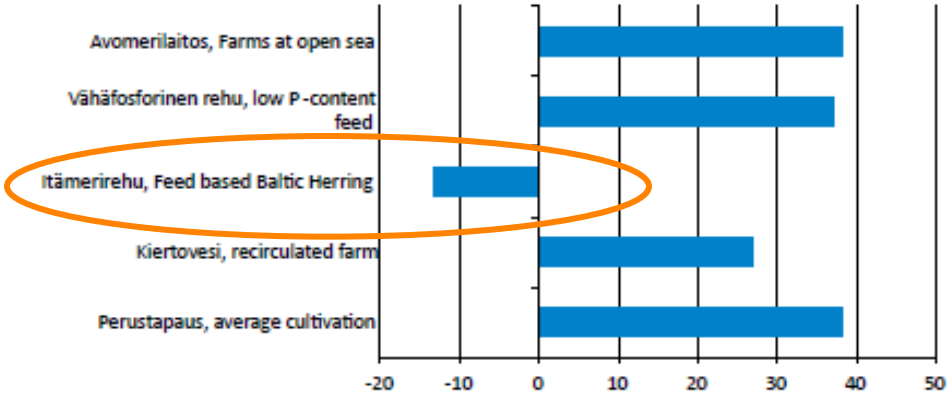
Replacing fish meal raw material coming outside the Baltic Sea with Baltic herring decreases substantially net loading of nutrients in the Baltic Sea

Baltic herring includes about 0,4 % P and 2,2 % N per kg fish

Baltic Sea Fish Feed:
Halves the net loading of nitrogen
Removes phosphorus



Impact on phosphorus loading



Kuva 20. Erilaisilla kasvatusmenetelmillä kasvatetun kirjolohen rehevöittävät päästöt, kgPO4-ekvivalenttia/t fileetä. Avomerilaitoksen rehevöittävä päästö sama kuin perustapauksen. *The eutrophication impact of 1 ton skinless rainbow trout fillet produced in Finland in different production methods.*

Source: Live cycle analysis: MTT report 48. 2012.

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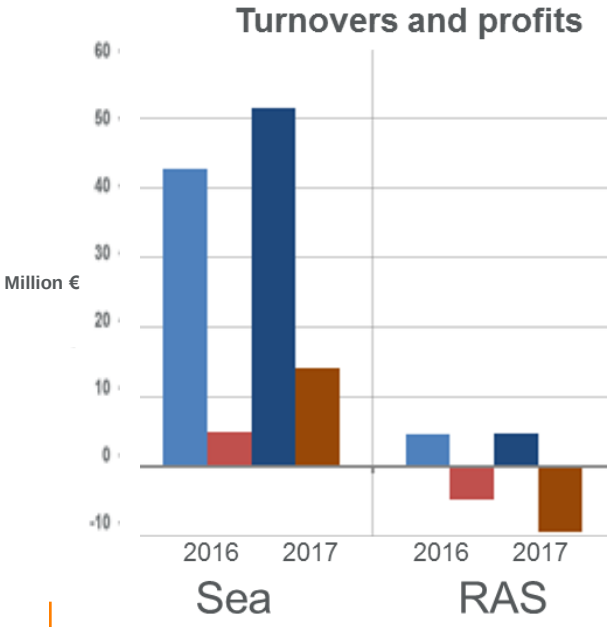
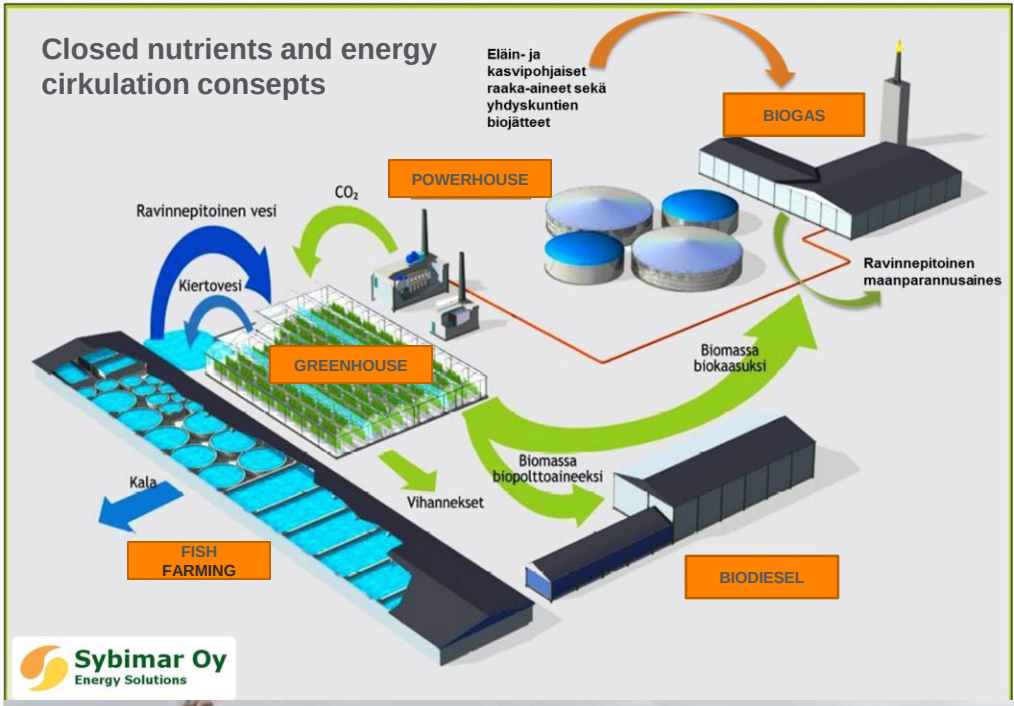
RAS in Finland

- 9 RASin use
- Capacity some 4,7 M. kg
- Production some 1,2 M. kg
- Large investments
- Production is now highly loss-making
- Innovationsprogram and RAS research and learning facility in Natural Resources Institute





Aquaculture strategy 2020

Goal: Sustainable production growth in mainland (Åland excluded): 8 000 tn > 20 000 tn in 2020

Techniques:

Offshore fish farming in the identified areas
Baltic Sea feed in use
Developing RAS fish farming

Tools: Private and public (EMFF) funding investments
Research and innovation programs to support development of offshore and RAS farms
Improve legislation to enable these plans

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Baltic Sea Fish Feed (BSFF)

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Stepwise development

A lot of research to determine environmental, social and economic impacts:

Ruohonen, K. ja Vielma, J. **1994.** Kalojen pehmeäraerehut – suunnittelu ja käyttö. RKTL. 88 s. (in Finnish)

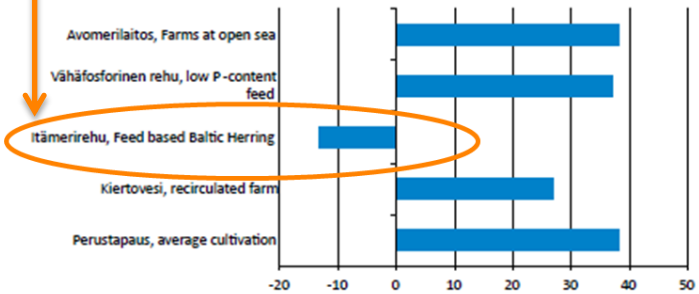
Mäkinen, Timo (toim.). **2008.** Voidaanko kalastuksella vähentää kalankasvatuksen ravinnekuormaa? Kalankasvatuksen nettokuormitusjärjestelmän esiselvitys. Riista- ja kalatalous. Selvityksiä 2/2008:27-30. (In Finnish)

Silvenius, F., Mäkinen, T., Grönroos, j., Kurppa, S., Tahvonen, R., Kankainen, M., Vielma, J., Silvennoinen, K., Setälä, J., Kausteli, S. ja Hartikainen, H. **2012.** Kirjolohen kasvatuksen ympäristövaikutukset. MTT Raportti 48. 46 s. (In Finnish)

Mäkinen, T., Forsman, l., Grönroos, J., Kankainen, M., Salmi, P., Setälä, J., Silvo, K. ja Vielma, J. **2013.** Baltic Sea Case Study Report. Co-exist case study report. FGFRI. 68 s.

Setälä, J., Virtanen, J., Nielsen, R., Hoff, A., Waldo, S. Hammarlund, C. **2019**. Determining the economic value of nitrogen and phosphorus removal from the Baltic Sea derived as a positive externality from fisheries and aquaculture activities. IFRO Report 287.

Impact on phosphorus loading



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Source: Live cycle analysis: MTT report 48. 2012.

Value added would be about **47 Million euros**, if 10 Million kilos production growth targeted in the Finnish Aquaculture Strategy is realised in a phosphorus neutral BSFF-value chain

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Stepwise development

Many administrative plans and programs:

Finnish Ministry of Agriculture and Forestry. **2007.** National Aquaculture program 2015.
Finnish Ministry of the Environment 2013. Guidelines for environmental protection in fish farming. (in Finnish). Department of Natural Environment Environmental Administration Guidelines 1/2013.
Finnish Government. 2014. Finnish multiannual strategic plan for Aquaculture. Competitive, viable and growing industry. 16 p.
Finnish Ministry of Environment **2016.** Actionplan of the Finnish Marine Strategy 2016-2021 (In Finnish). Laamanen, M. (toim.). Ympäristöministeriön raportteja 5/2016. 198 s.

… the goal is that fish farming in the Baltic Sea uses fish feed made of Baltic Sea Fish…

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Stepwise development

Strategic private and public investment (EMFF) on fish meal factory:

Produces fish meal and fish oil from Baltic herring and sprat
and
enables local nutrient recycling fish feed also in practise

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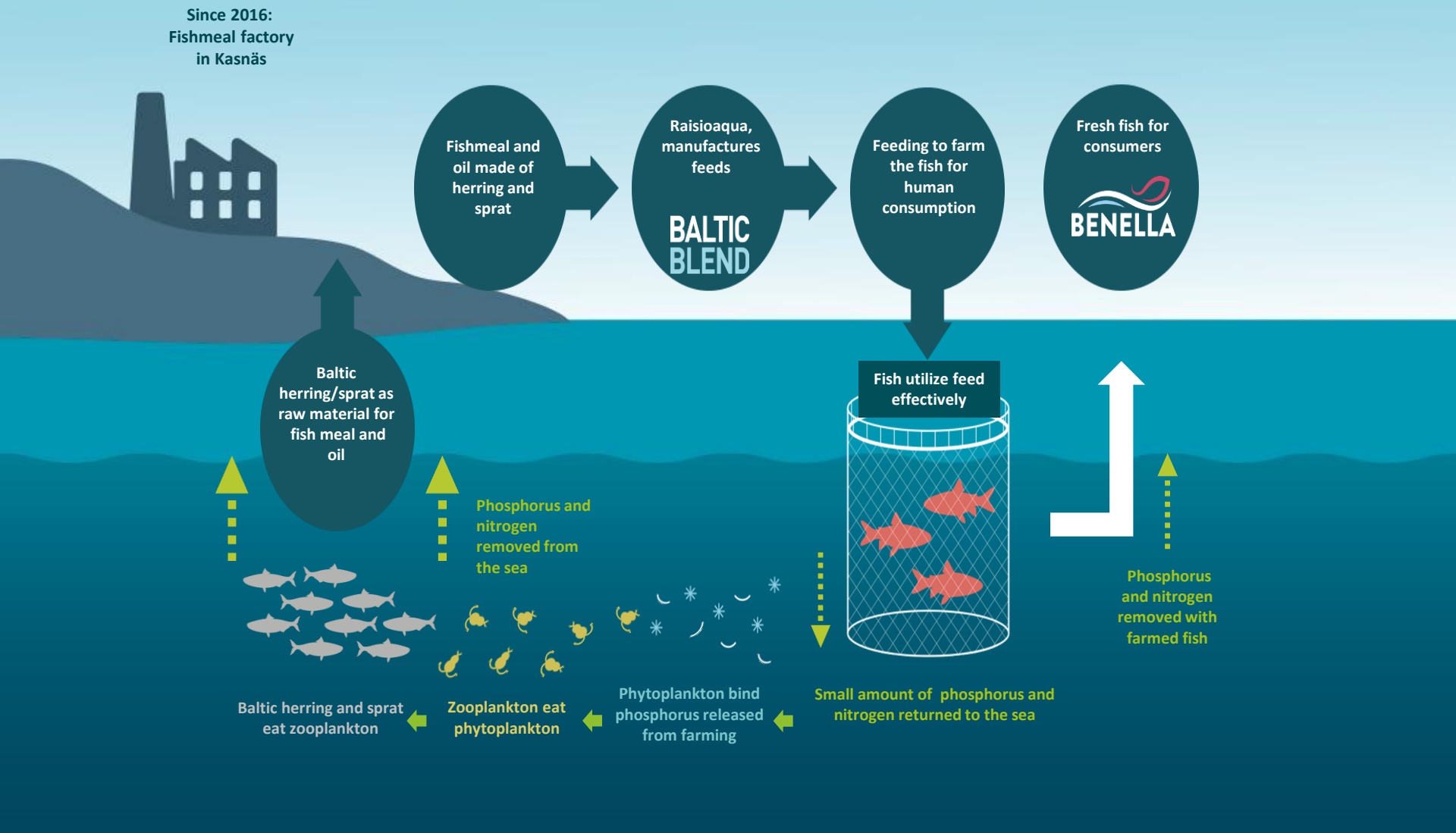
RAISIO aqua

Baltic Blend feed innovation

”Eat the Baltic Sea to better condition”



Application problems

No legal status:

- Use of compensatory tools are not directly mentioned in legislation and not necessarily taken into account in licensing procedure

> No strong incentive to use Baltic Sea Fish Feed (BSFF)

Recycling fish feed concept has not been totally accepted

- New complex consept, varying knowledge base
- Baltic Sea Fish Feed has not been clearly defined
- Licensing procedure concentrates on local impacts and takes not into account wider impacts on the Baltic Sea
- It is difficult to fully verify that use of BSFF increases fish catches and removal of nutrients

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How to proceed?

1) Environment protection law does not forbid compensatory tools. Licenses could according to present Finnish law include permit orders about indirect measures like BSFF to prevent environmental harm and secure the water quality
    - Permit orders could be based on fish farmers voluntary license application and include definitions of BSFF, impact and fishing areas and monitoring of the system etc.
    - Fish farms should be anyway located on water areas, which tolerate local loading and BSFF could be taken into account, when considering coastal environmental loading reduction and good water quality goals

2) Improve legislation to include compensation

2) Voluntary agreement to promote use of BSFF in the Baltic Sea: Blue Deal

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Thank you!

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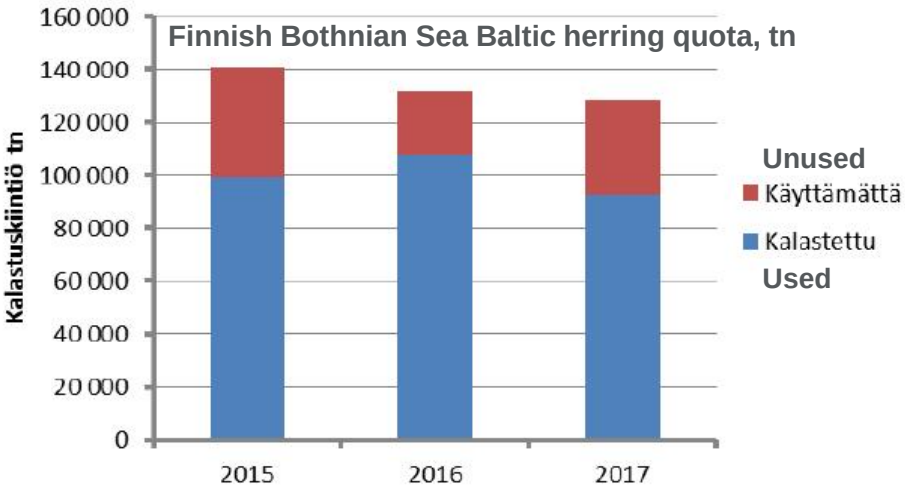
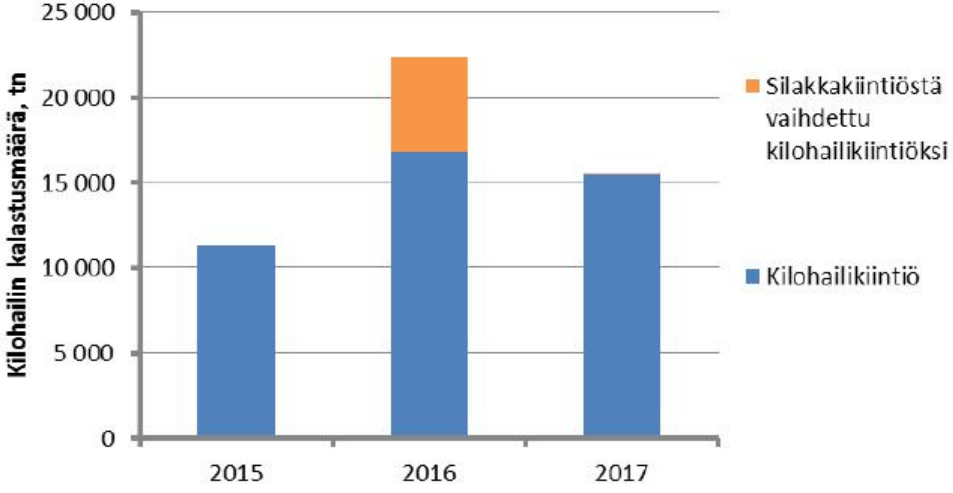
Silakkakiintiötä jäi käyttämättä – kilohailikiintiö loppui kesken

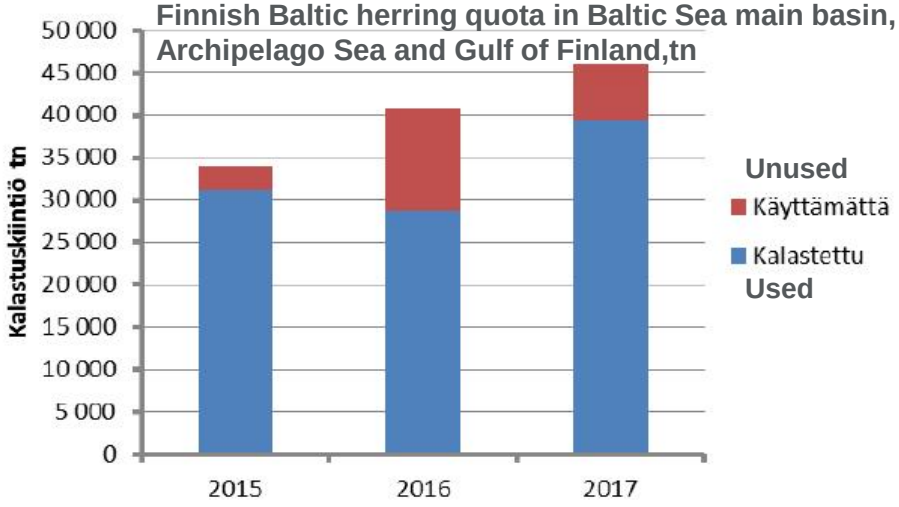
Pohjanlahden silakan kalastus 2015-2017



Kilohailin kalastus 2015-2017



Itämeren pääaltaan, Saaristomeren ja Suomenlahden silakan kalastus 2015-2017



Lähde: SAKL, kiintiöissä mukana myös mahdolliset siirrot edellisen vuoden kiintiöstä tai valtioiden välillä, Kuva: Jari Setälä

BSFF-calculation

Table 2. *Parameters used in nutrient mass balance calculation in Finnish marine salmon trout farming.*

Parameter		Unit
Phosphorus load from fish farming	4.2	Kg/tonne edible production
Nitrogen load from fish farming	39.0	Kg/tonne edible production
Phosphorus in Baltic herring	4.3	Kg/tonne edible production
Nitrogen in Baltic herring	23.3	Kg/tonne edible production
Feed conversation rate (FCR)	1.15	Fish feed kg/kg fish
Fish meal in fish feed	17 or 29	% of fish feed
Fish meal from Baltic herring	20	% of kg Baltic herring

These parameter values are estimated based on the interviews with representatives of Finnish environmental authorities, fish meal and fish feed industry.

Setälä, J., Virtanen, J., Nielsen, R., Hoff, A., Waldo, S. Hammarlund, C. **2019**. Determining the economic value of nitrogen and phosphorus removal from the Baltic Sea derived as a positive externality from fisheries and aquaculture activities. IFRO Report 287.

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