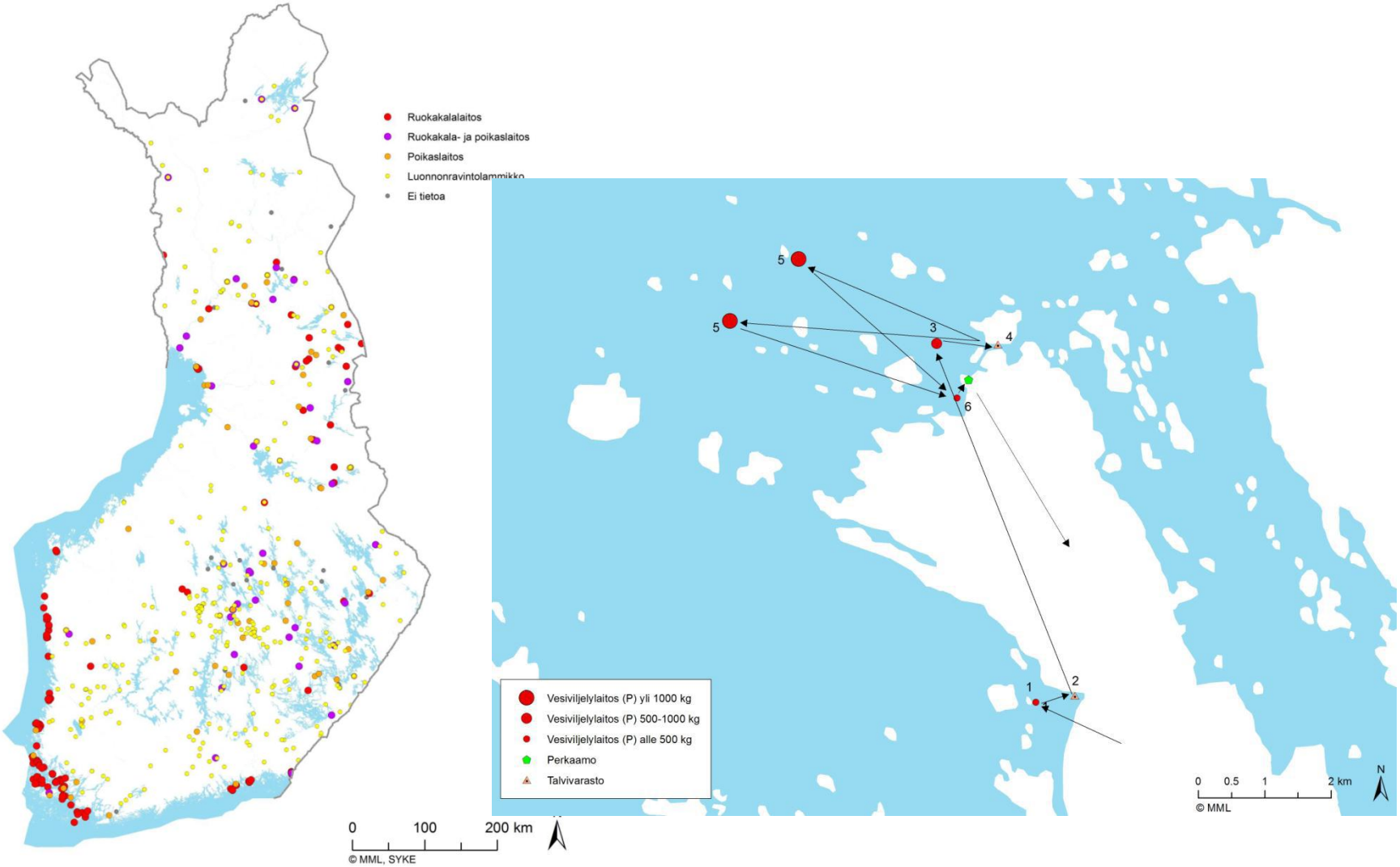
GAME AND FISHERIES RESEARCH

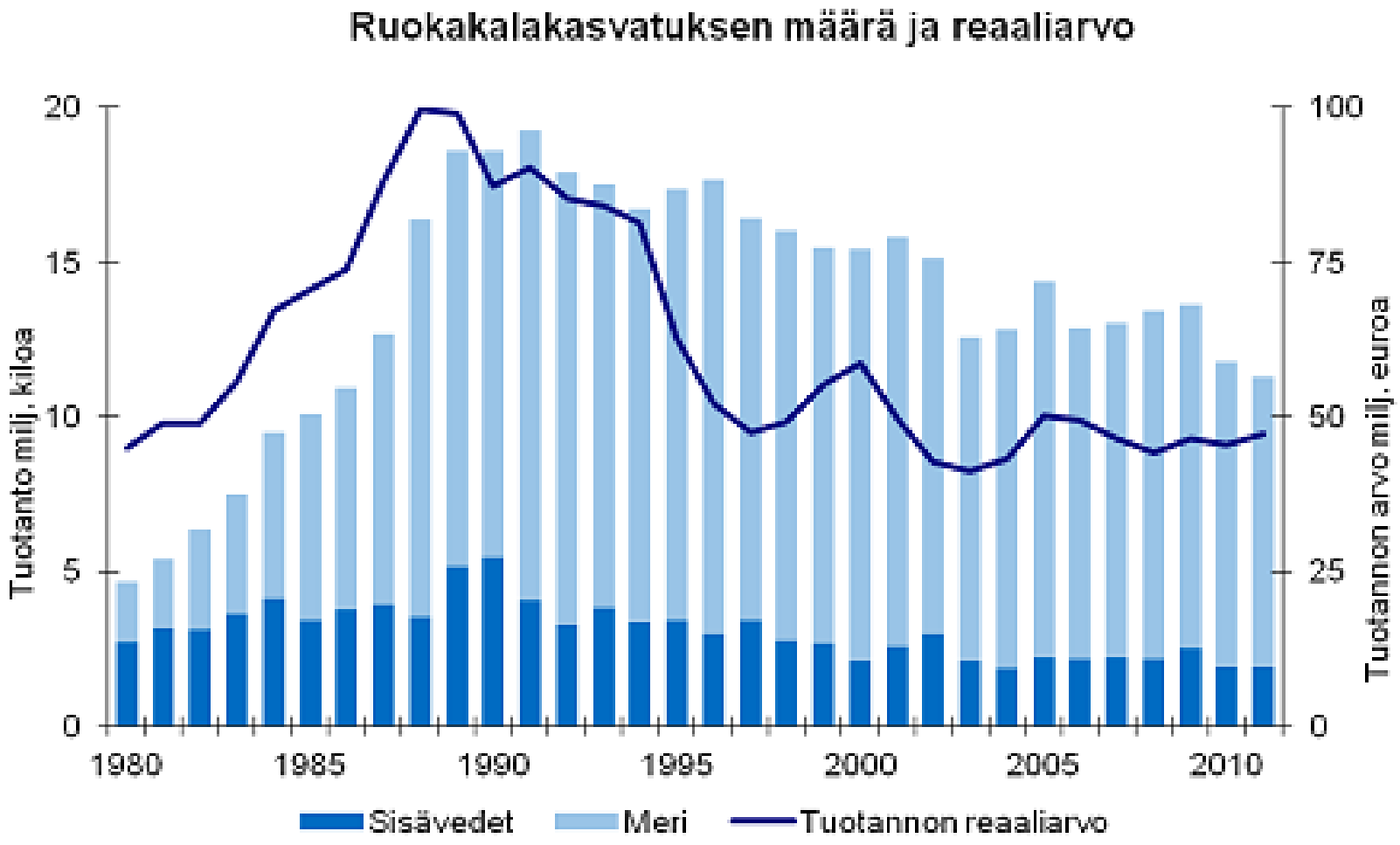
Aquaculture site selection plan in Finland

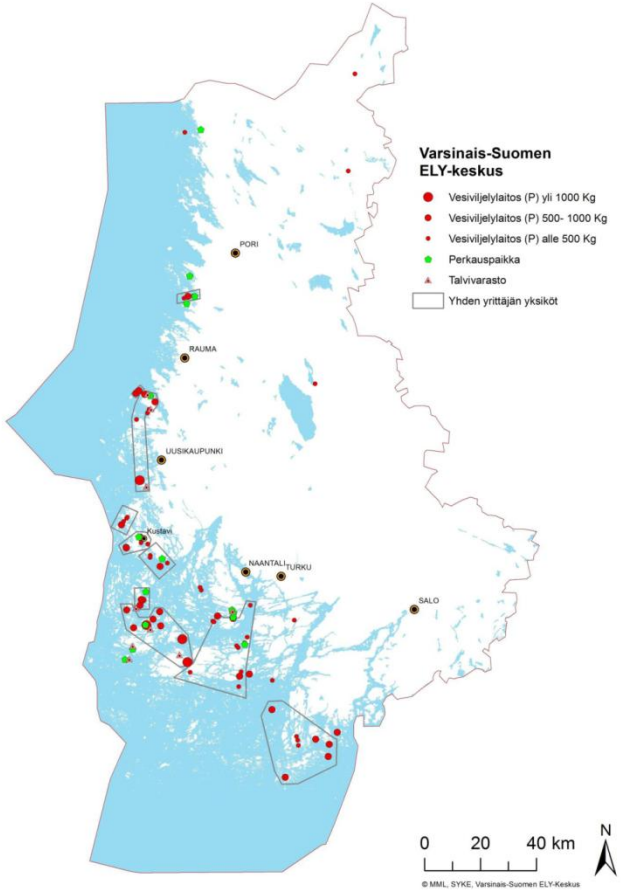
- Results of a national site selection project
- Coexist, Governance, LCA
- Aquabest

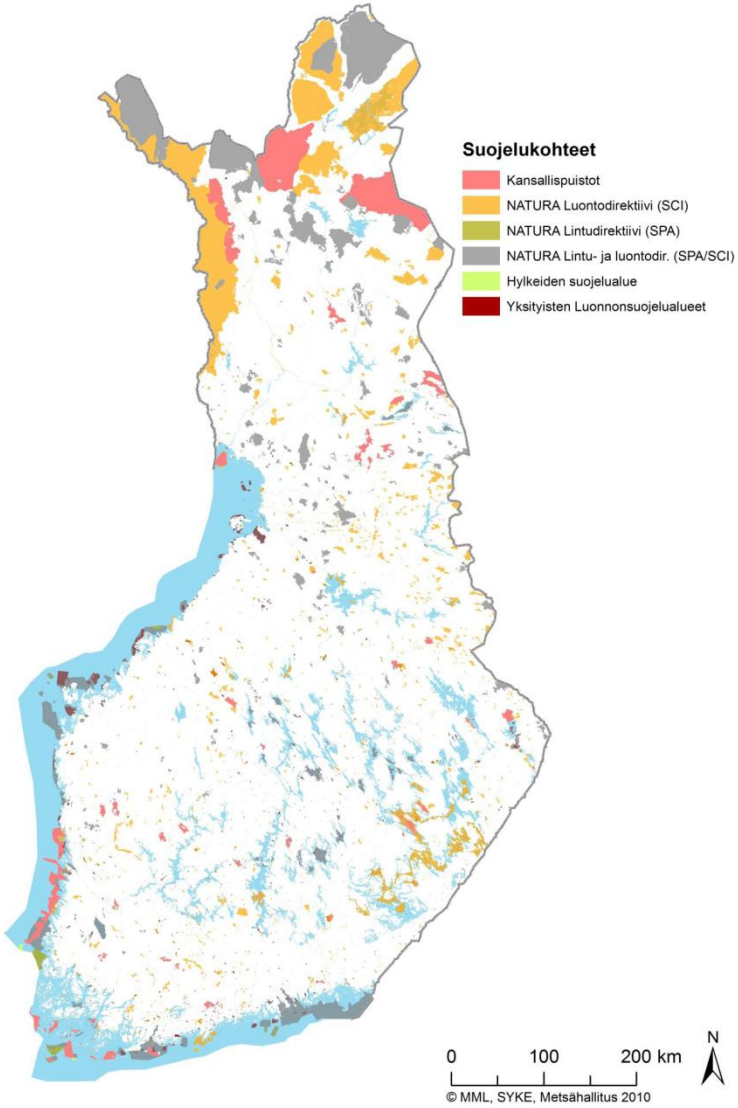
Mäkinen Timo[1], Setälä Jari[1], Grönroos Juha[2] & Vielma Jouni[1]

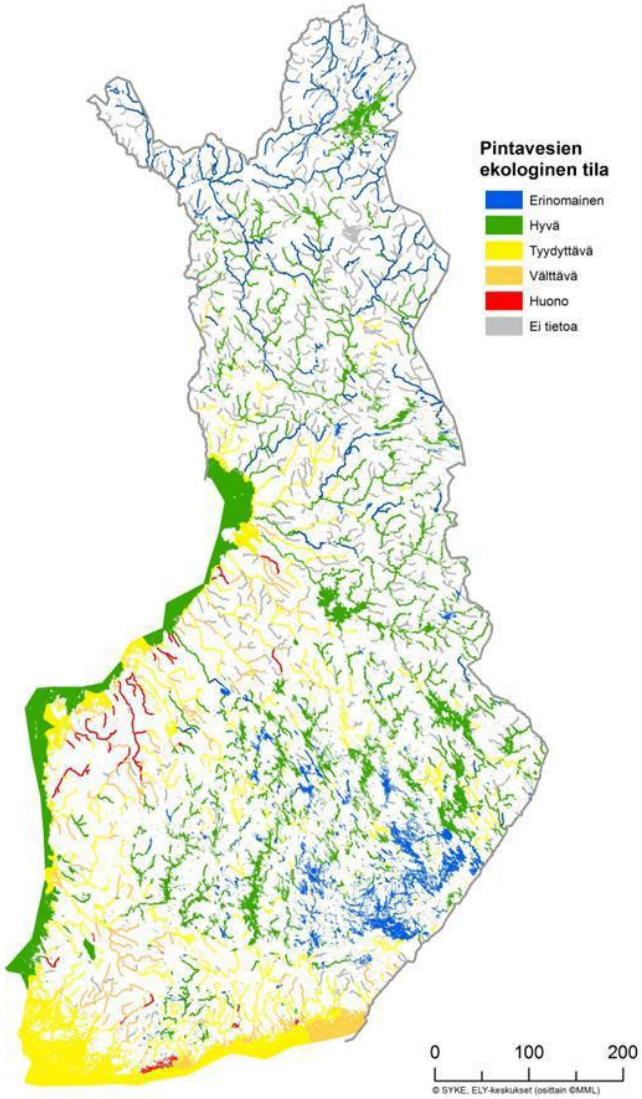
1) Finish Game and Fisheries Research Institute, 2) Finnish Environment Institute

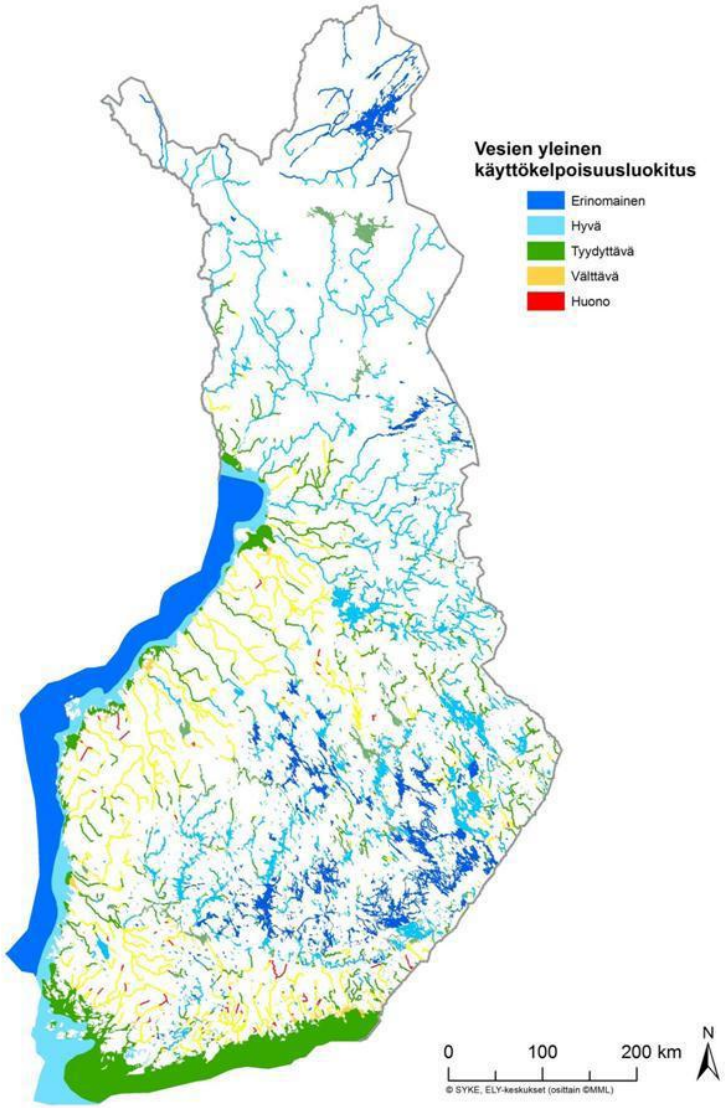

Ruokakalalaitos
Ruokakala- ja poikaslaitos
Poikaslaitos
Luonnonravintolammikko
Ei tietoa
0 100 200 km
© MML, SYKE
5
5
3
4
6
1
2
Vesiviljelylaitos (P) yli 1000 kg
Vesiviljelylaitos (P) 500-1000 kg
Vesiviljelylaitos (P) alle 500 kg
Perkaamo
Talvivarasto
0 0.5 1 2 km
N
© MML

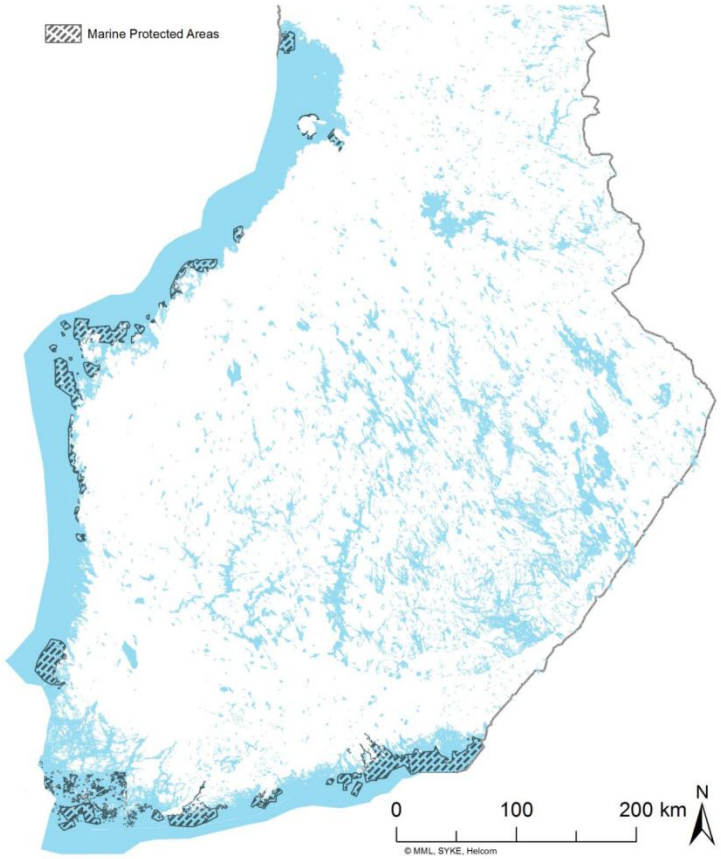

Ruokakalakasvatuksen määrä ja reaaliarvo
Tuotanto milj. kiloa
Tuotannon arvo milj. euroa
20
15
10
5
0
100
75
50
25
0
1980
1985
1990
1995
2000
2005
2010
Sisävedet
Meri
Tuotannon reaaliarvo

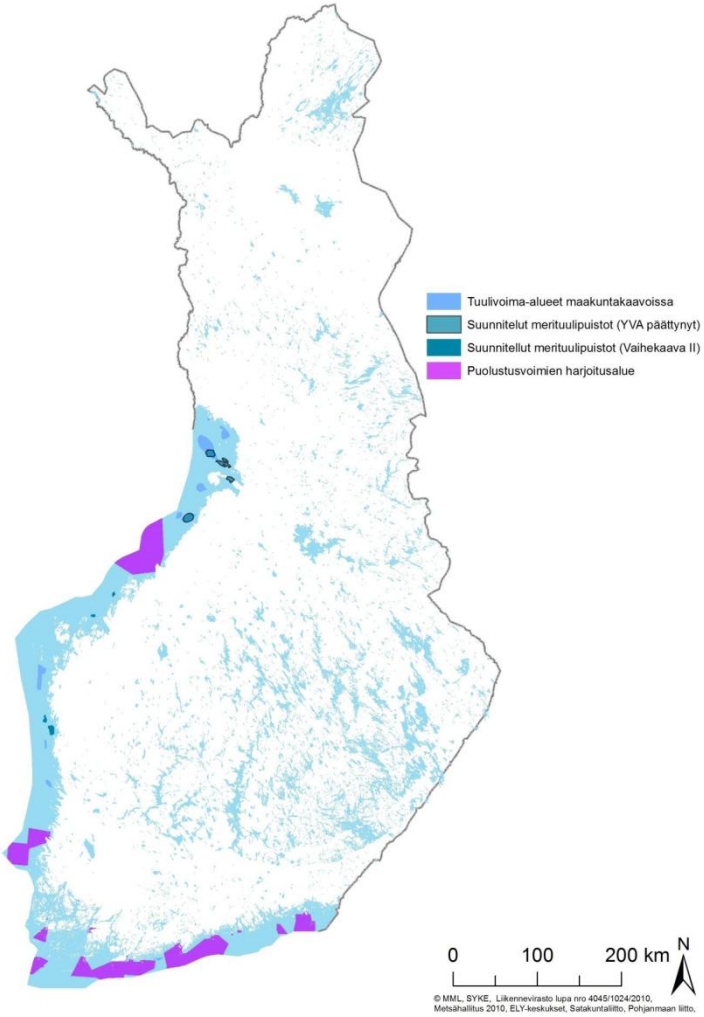

Varsinais-Suomen
ELY-keskus
Vesiviljelylaitos (P) yli 1000 Kg
Vesiviljelylaitos (P) 500- 1000 Kg
Vesiviljelylaitos (P) alle 500 Kg
Perkauspaikka
Talvivarasto
Yhden yrittäjän yksiköt
PORI
RAUMA
UUSIKAUPUNKI
Kustavi
NAANTALI
TURKU
SALO
0 20 40 km
N
© MML, SYKE, Varsinais-Suomen ELY-Keskus


Suojelukohteet
Kansallispuistot
NATURA Luontodirektiivi (SCI)
NATURA Lintudirektiivi (SPA)
NATURA Lintu- ja luontodir. (SPA/SCI)
Hylkeiden suojelualue
Yksityisten Luonnonsuojelualueet
0 100 200 km
N
© MML, SYKE, Metsähallitus 2010


Pintavesien
ekologinen tila
Erinomainen
Hyvä
Tyydyttävä
Välttävä
Huono
Ei tietoa
0
100
200
© SYKE, ELY-keskukset (osittain ©MML)

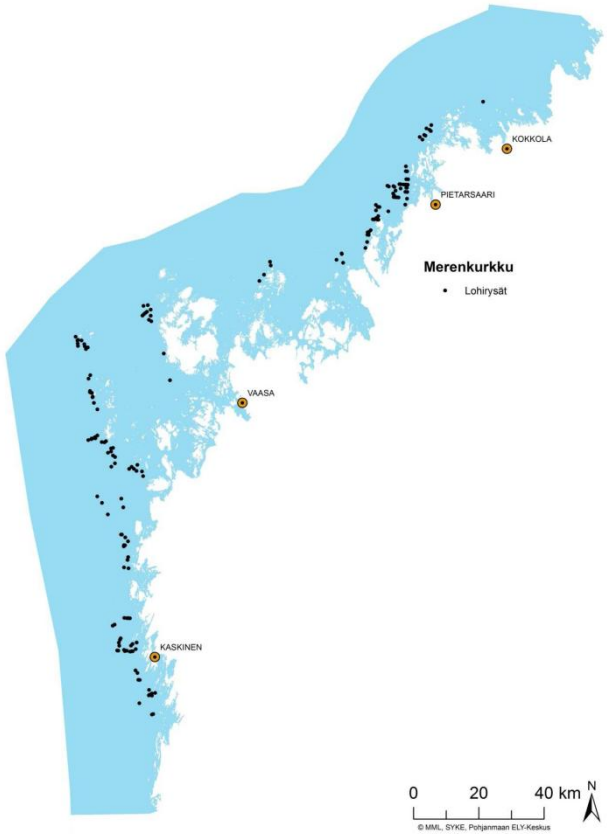

Vesien yleinen
käyttökelpoisuusluokitus
Erinomainen
Hyvä
Tyydyttävä
Välttävä
Huono
0
100
200 km
N
© SYKE, ELY-keskukset (osittain ©MML)

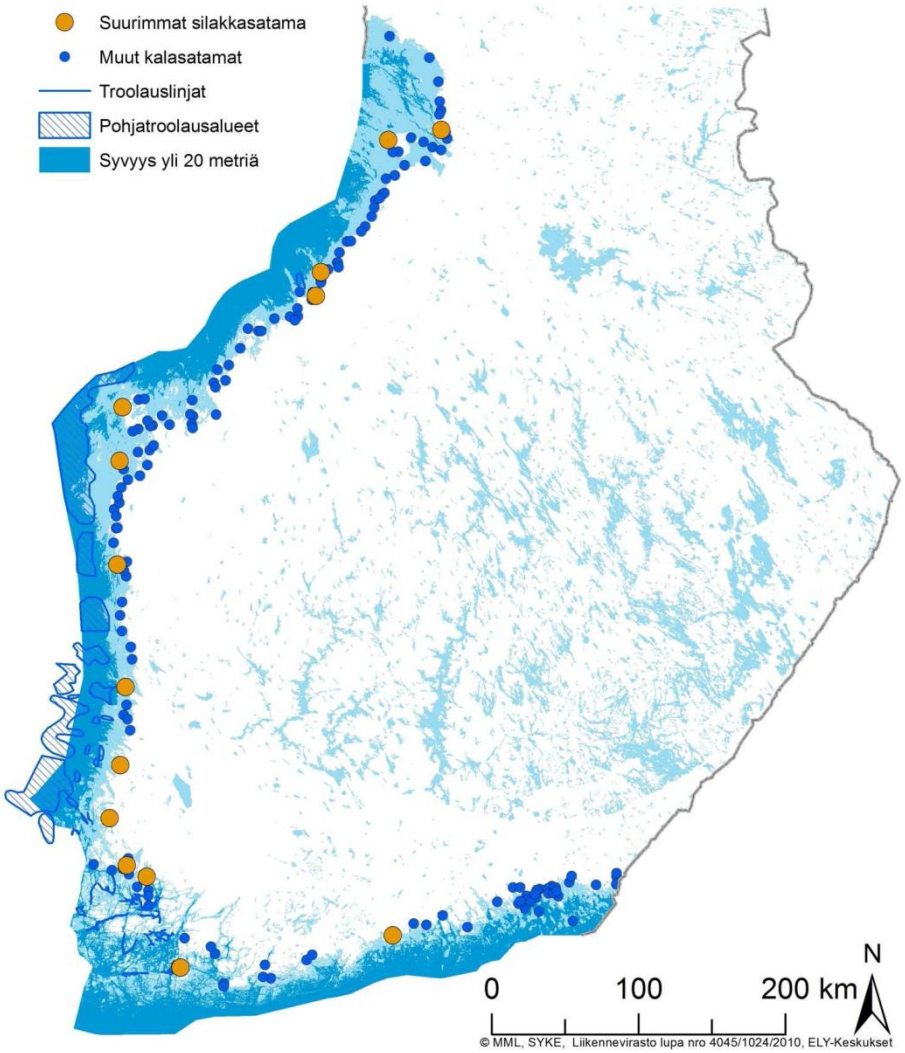

Marine Protected Areas
0
100
200 km
N
© MML, SYKE, Helcom

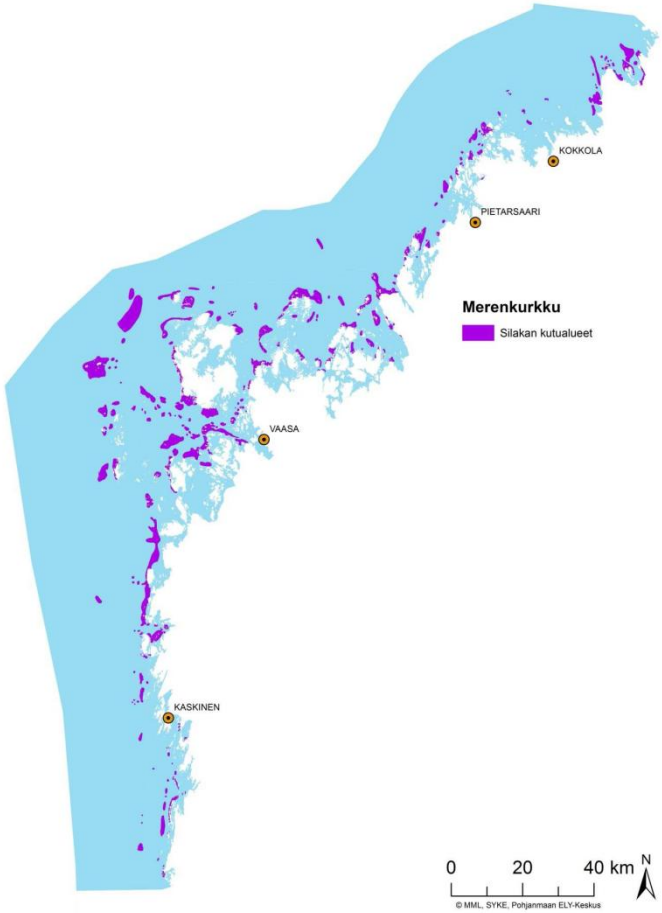

Tuulivoima-alueet maakuntakaavoissa
Suunnitelut merituulipuistot (YVA päättynyt)
Suunnitellut merituulipuistot (Vaihekaava II)
Puolustusvoimien harjoitusalue
0
100
200 km
N
© MML, SYKE, Liikenneviraston lupa nro 4045/1024/2010,
Metsähallitus 2010, ELY-keskukset, Satakuntaliitto, Pohjanmaan liitto,


Lomarakennus-, kaava- ja poikkeamislupapuskuri 500 m
0
100
200 km
N
© MML, SYKE, Varsinais-Suomen ELY-Keskukset, Lounaispaikka, Satakuntaliitto, Uudenkaupungin kaupunki

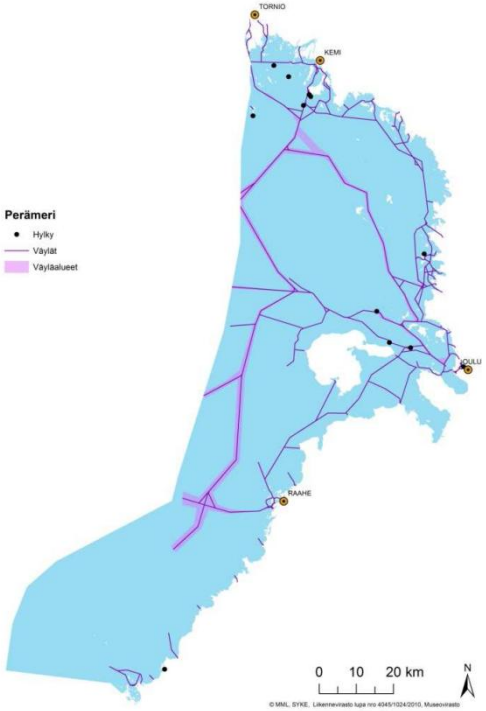

Selkämeri
Lohirysät
PORI
RAUMA
UUSIKAUPUNKI
0 10 20 km
N
© MML, SYKE, Varsinais-Suomen ELY-Keskus

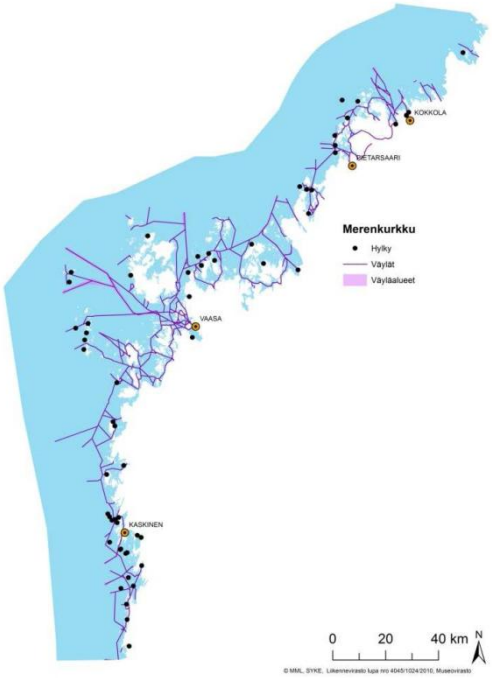

KOKKOLA
PIETARSAARI
Merenkurkku
Lohirysät
VAASA
KASKINEN
0 20 40 km
N
© MML, SYKE, Pohjanmaan ELY-Keskus

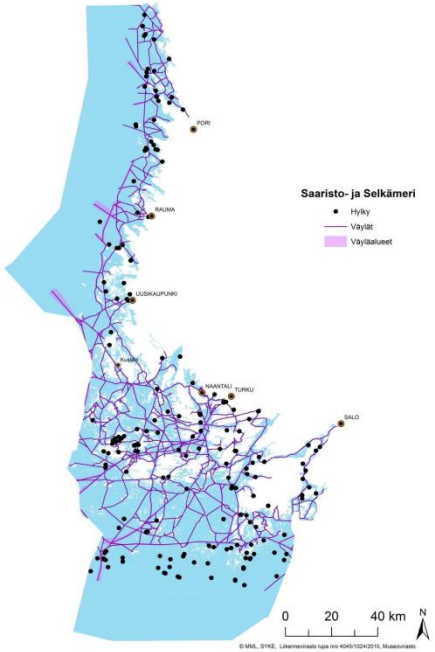

Suurimmat silakkasatama
Muut kalasatamat
Troolauslinjat
Pohjatroolausalueet
Syvyys yli 20 metriä
0
100
200 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, ELY-Keskukset

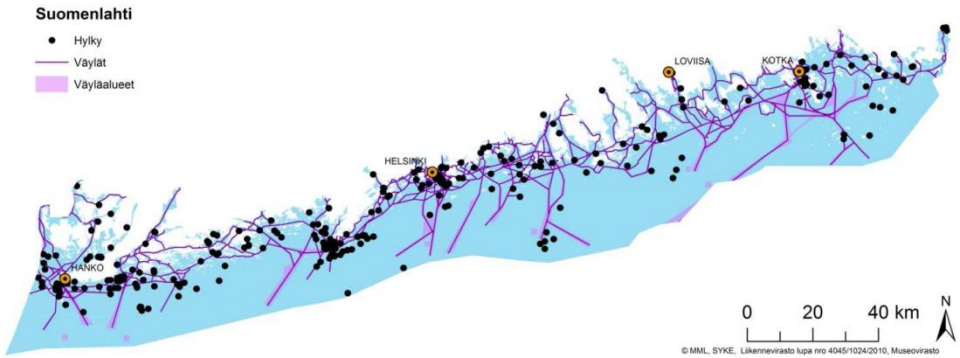

KOKKOLA
PIETARSAARI
Merenkurkku
Silakan kutualueet
VAASA
KASKINEN
0
20
40 km
N
© MML, SYKE, Pohjanmaan ELY-Keskus

GAME AND FISHERIES RESEARCH

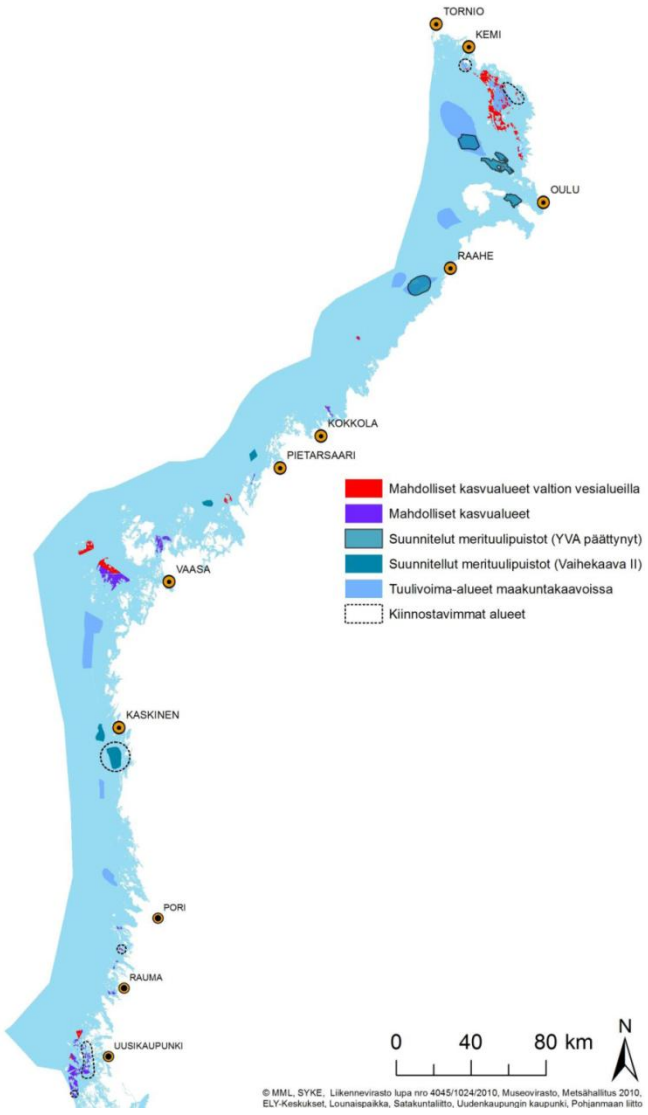


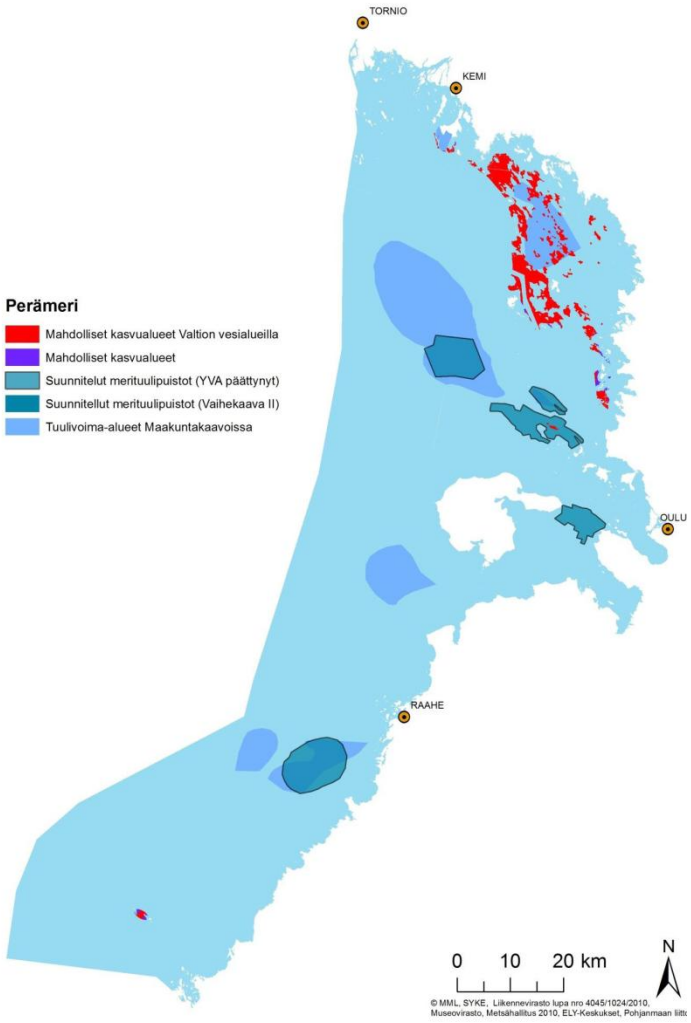


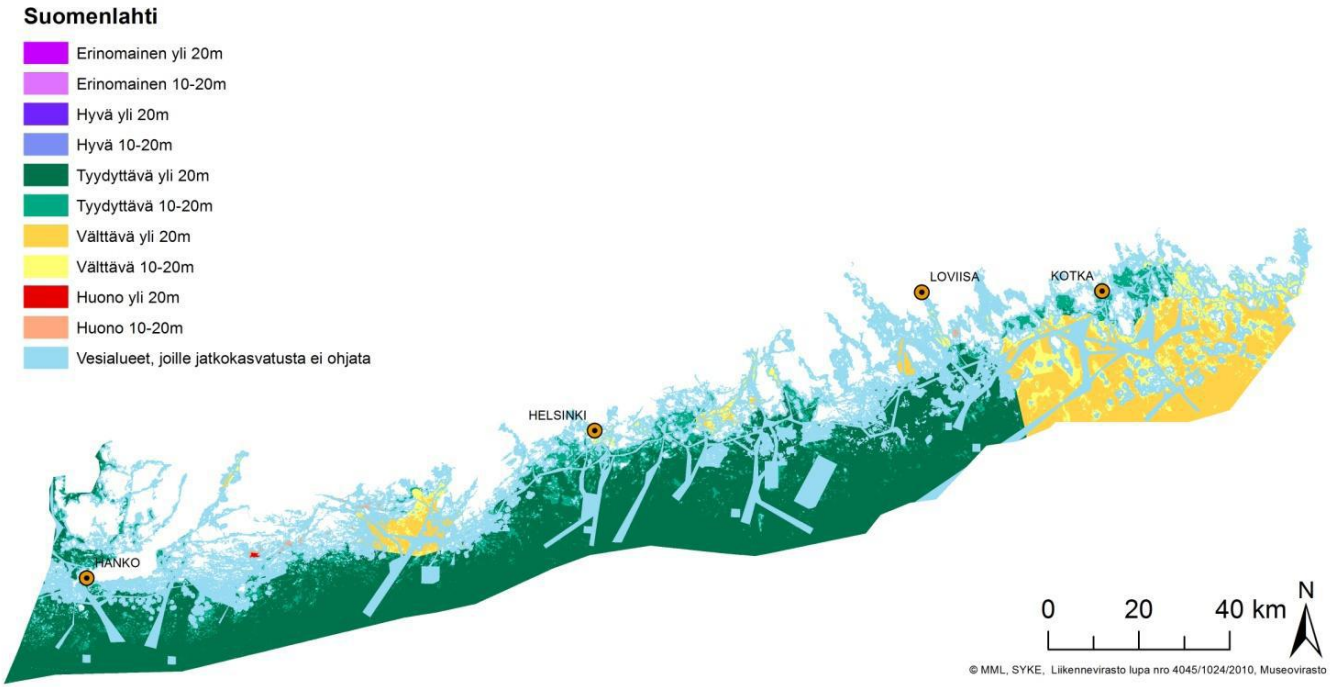


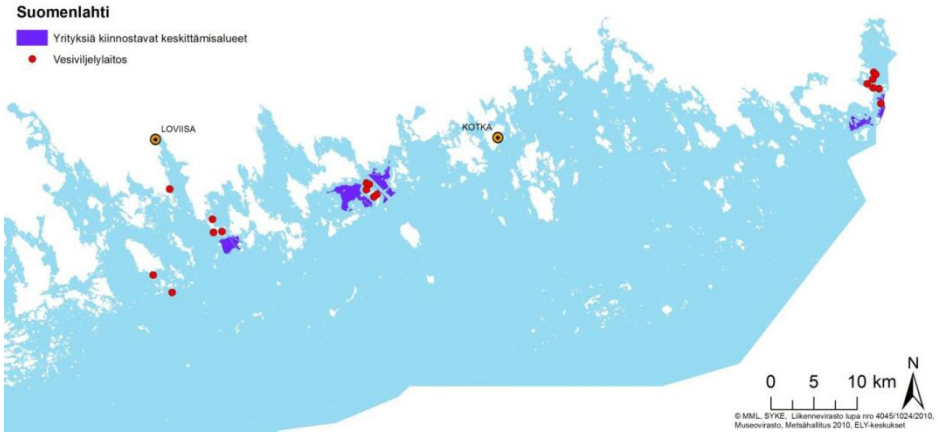


Knowledge-based solutions, for sustainable choices

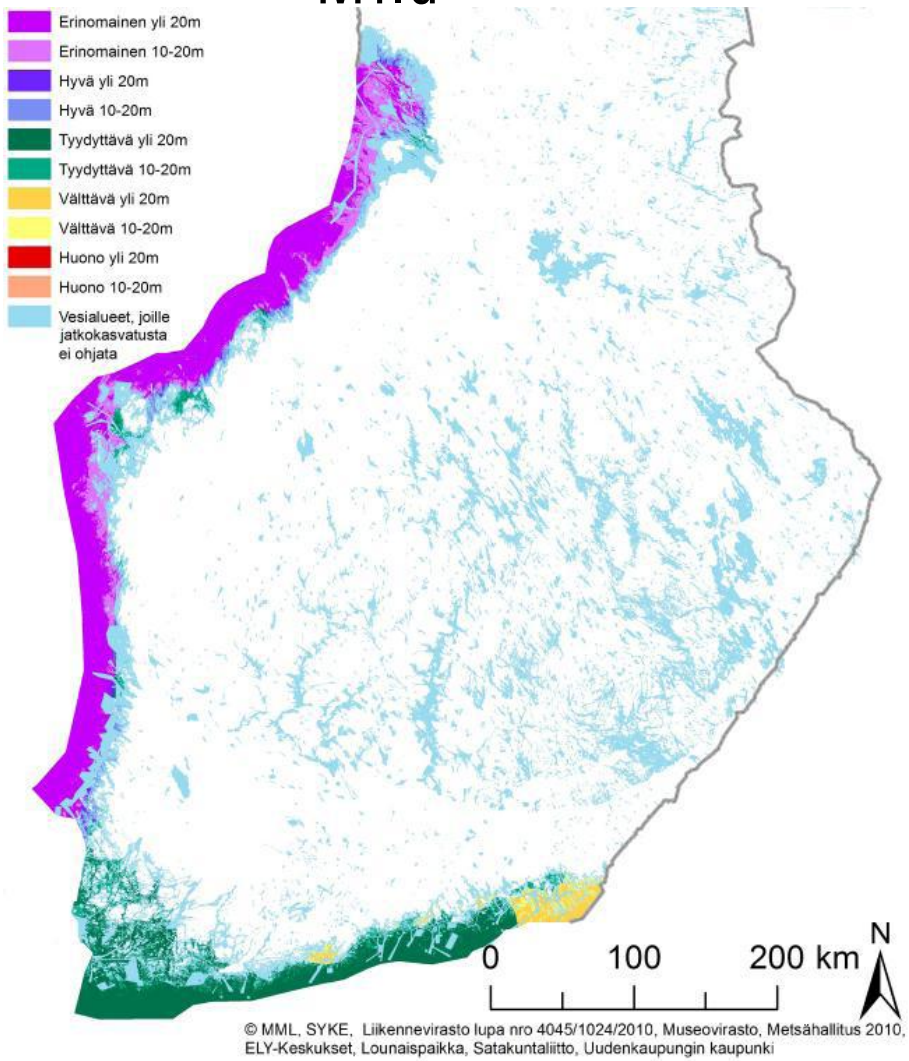

TORNIO
KEMI
OULU
RAAHE
KOKKOLA
PIETARSAARI
VAASA
KASKINEN
PORI
RAUMA
UUSIKAUPUNKI
Mahdolliset kasvualueet valtion vesialueilla
Mahdolliset kasvualueet
Suunnitelut merituulipuistot (YVA päättynyt)
Suunnitellut merituulipuistot (Vaihekaava II)
Tuulivoima-alueet maakuntakaavoissa
Kiinnostavimmat alueet
0 40 80 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, Museovirasto, Metsähallitus 2010, ELY-Keskukset, Lounaispaikka, Satakuntaliitto, Uudenkaupungin kaupunki, Pohjanmaan liitto


TORNIO
KEMI
OULU
RAAHE
Perämeri
Mahdolliset kasvualueet Valtion vesialueilla
Mahdolliset kasvualueet
Suunnitelut merituulipuistot (YVA päättynyt)
Suunnitellut merituulipuistot (Vaihekaava II)
Tuulivoima-alueet Maakuntakaavoissa
0 10 20 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, Museovirasto, Metsähallitus 2010, ELY-Keskukset, Pohjanmaan liitto

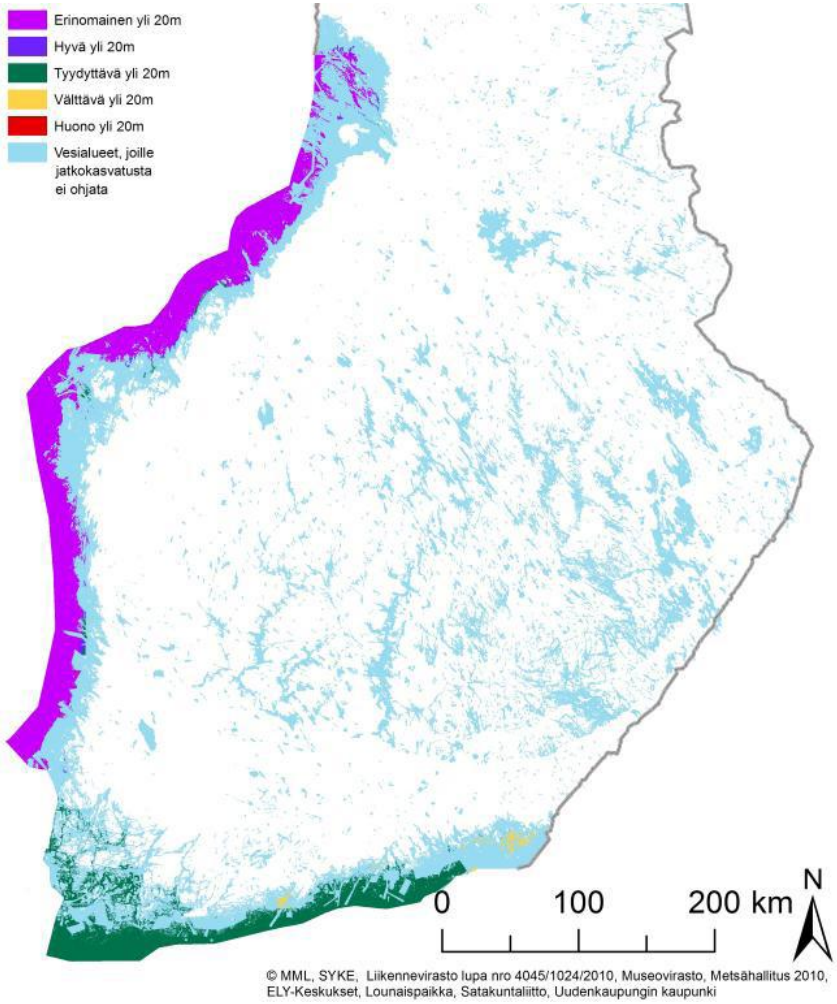

Suomenlahti
Erinomainen yli 20m
Erinomainen 10-20m
Hyvä yli 20m
Hyvä 10-20m
Tyydyttävä yli 20m
Tyydyttävä 10-20m
Välttävä yli 20m
Välttävä 10-20m
Huono yli 20m
Huono 10-20m
Vesialueet, joille jatkokasvatusta ei ohjata
LOVIISA
KOTKA
HELSINKI
HANKO
0 20 40 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, Museovirasto

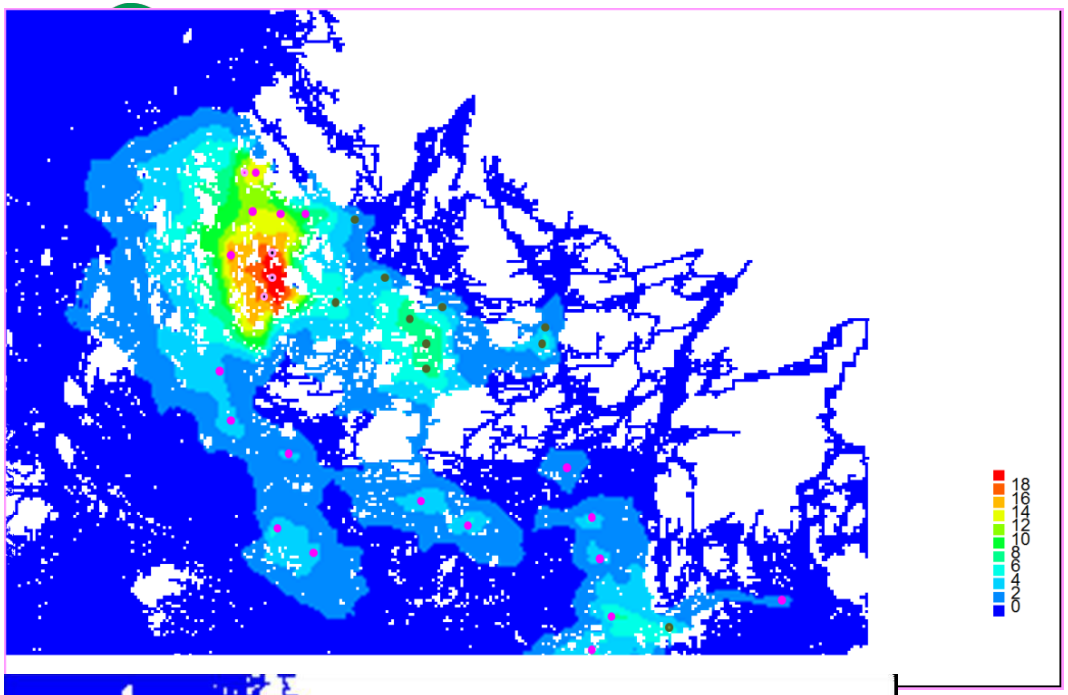

Suomenlahti
Yrityksiä kiinnostavat keskittämisalueet
Vesiviljelylaitos
LOVIISA
KOTKA
0 5 10 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, Museovirasto, Metsähallitus 2010, ELY-keskukset

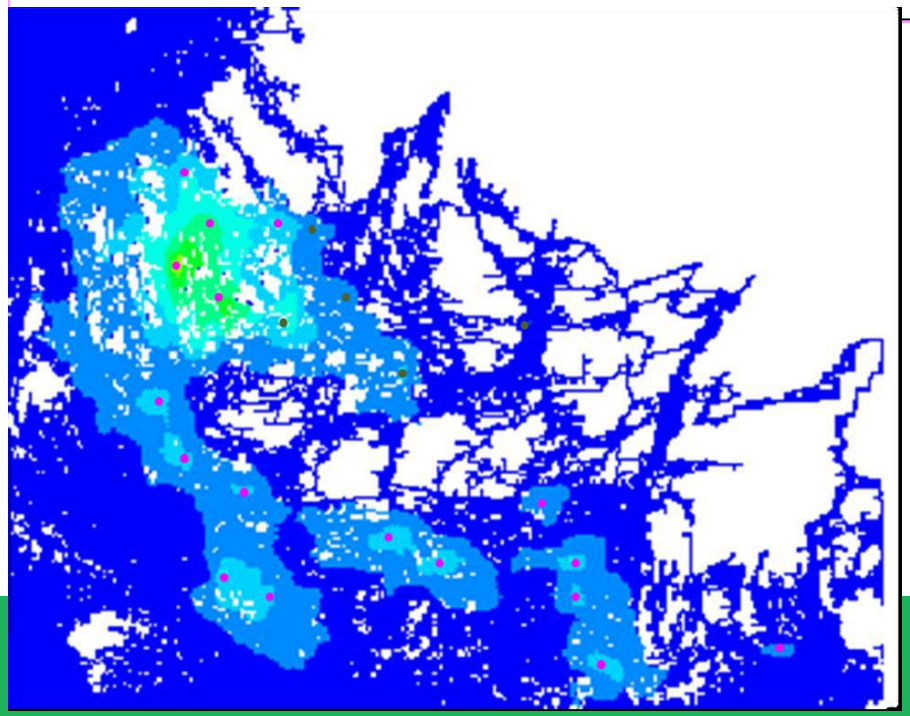
Mild

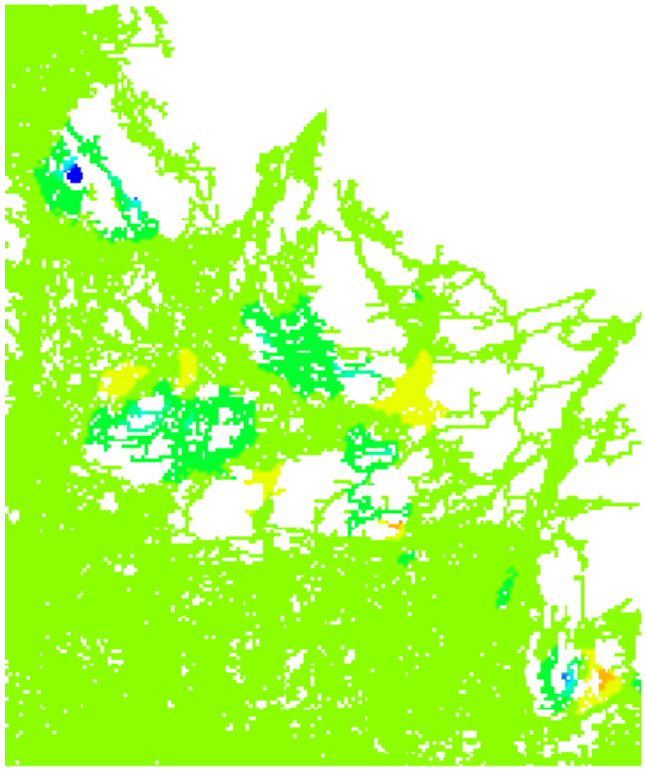

Erinomainen yli 20m
Erinomainen 10-20m
Hyvä yli 20m
Hyvä 10-20m
Tyydyttävä yli 20m
Tyydyttävä 10-20m
Välttävä yli 20m
Välttävä 10-20m
Huono yli 20m
Huono 10-20m
Vesialueet, joille jatkokasvatusta ei ohjata
0
100
200 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, Museovirasto, Metsähallitus 2010, ELY-Keskukset, Lounaispaikka, Satakuntaliitto, Uudenkaupungin kaupunki

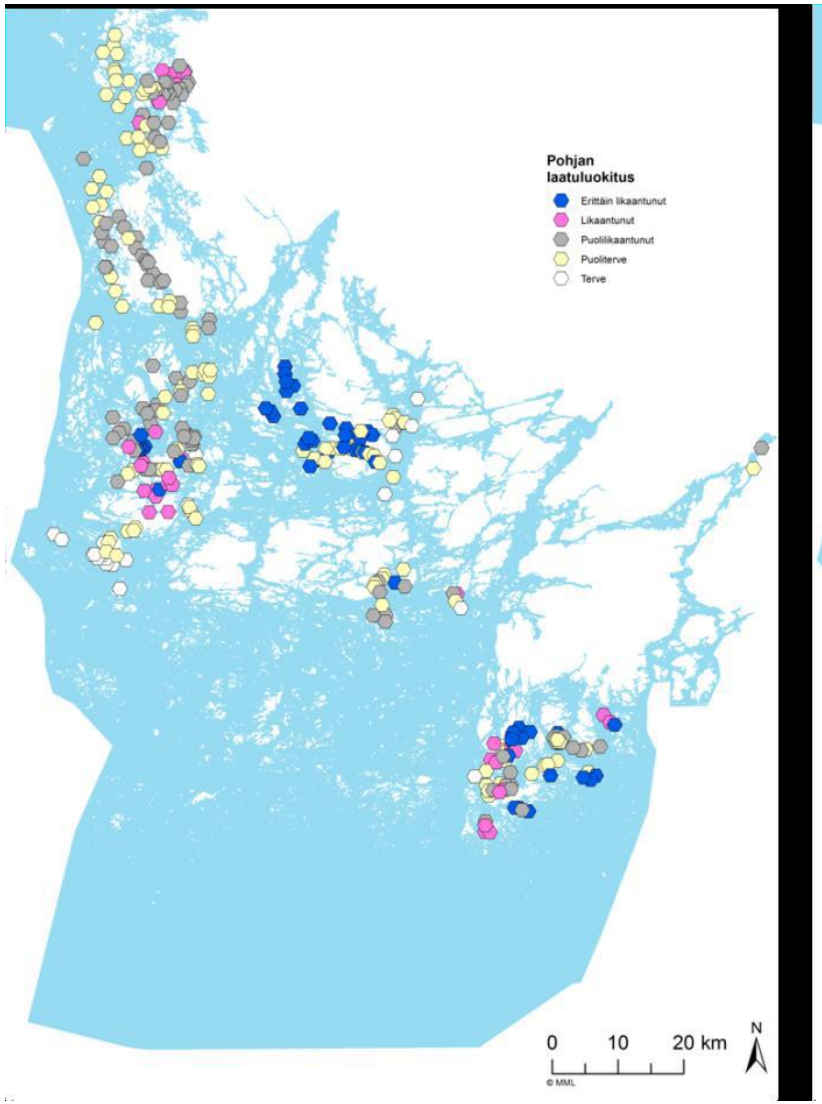
Tight

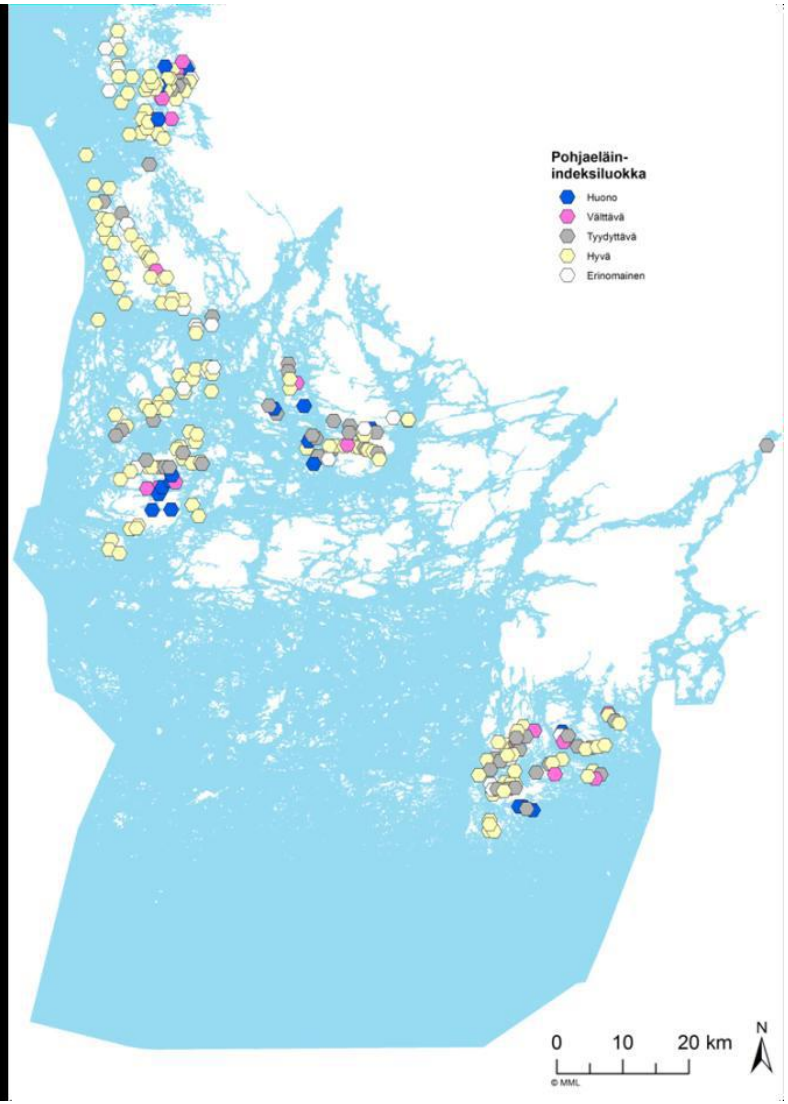

Erinomainen yli 20m
Hyvä yli 20m
Tyydyttävä yli 20m
Välttävä yli 20m
Huono yli 20m
Vesialueet, joille jatkokasvatusta ei ohjata
0
100
200 km
N
© MML, SYKE, Liikennevirasto lupa nro 4045/1024/2010, Museovirasto, Metsähallitus 2010, ELY-Keskukset, Lounaispaikka, Satakuntaliitto, Uudenkaupungin kaupunki

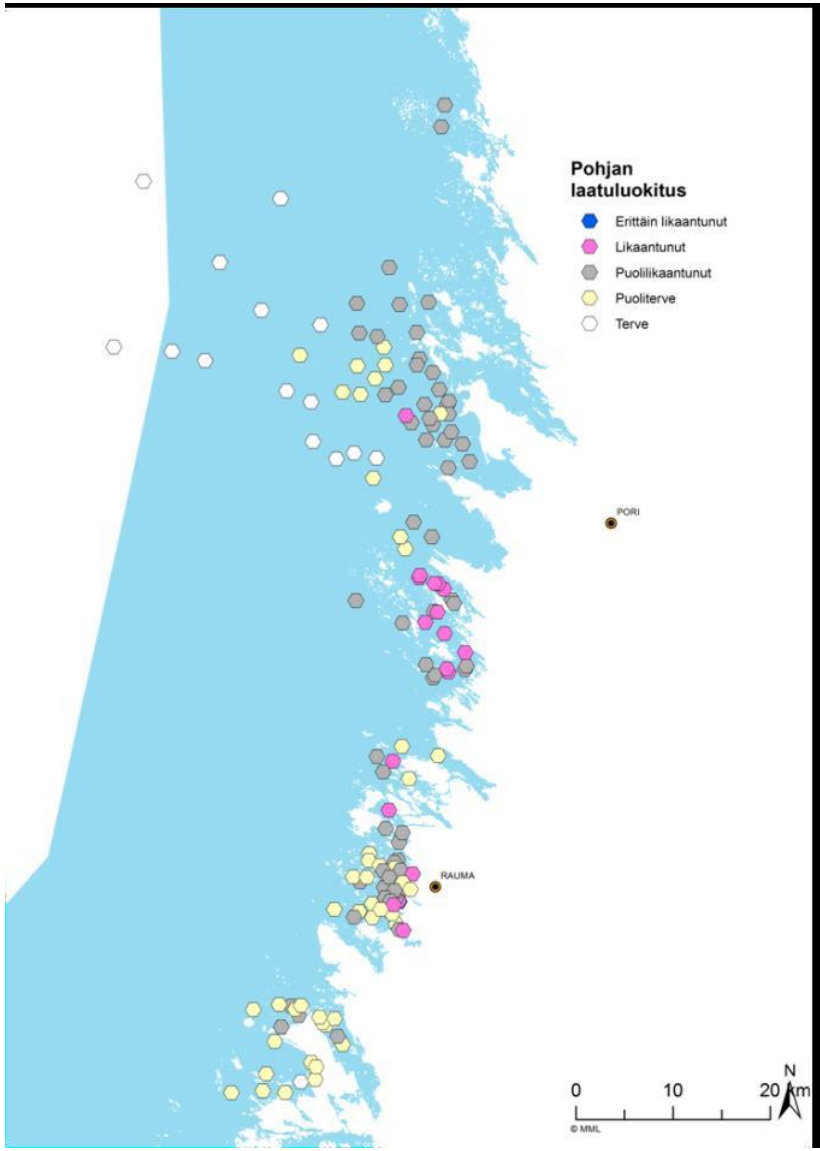

18
16
14
12
10
8
6
4
2
0

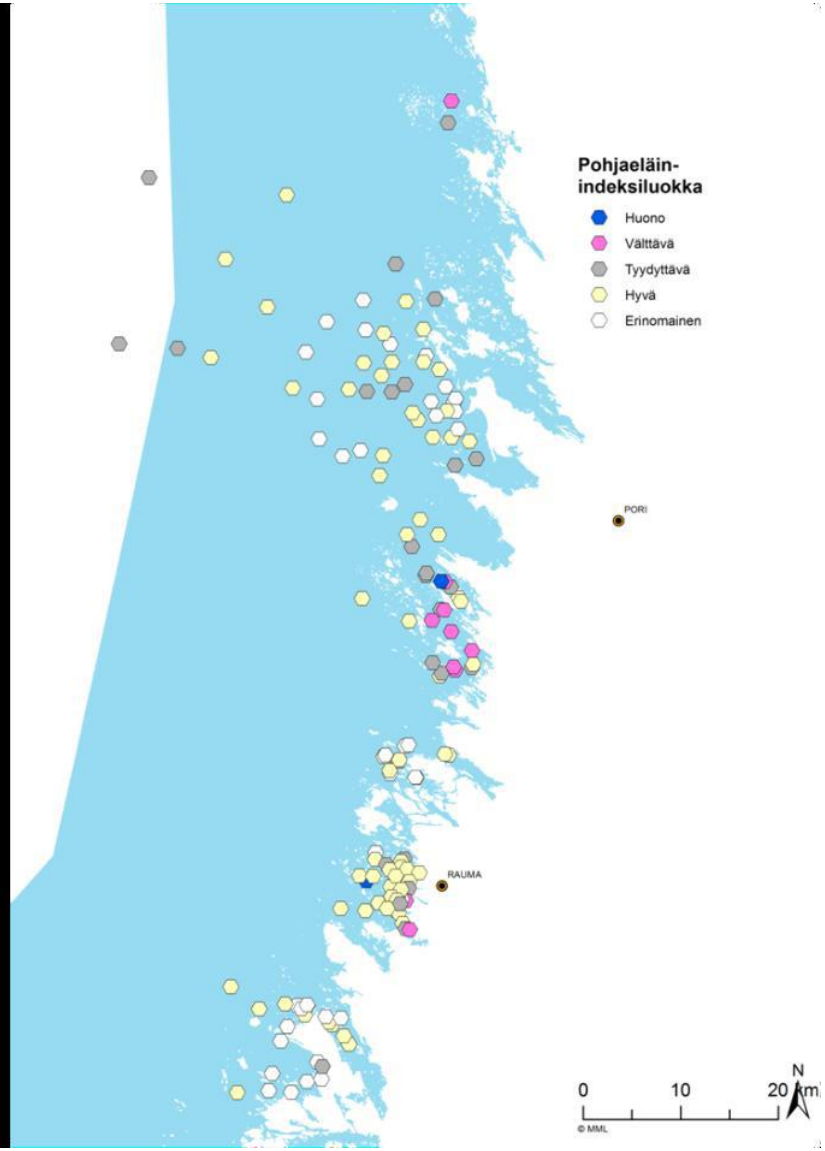





Pohjan laatuluokitus
Erittäin likaantunut
Likaantunut
Puolilikaantunut
Puoliterve
Terve
0 10 20 km
N
© MML


Pohjaeläin-indeksiluokka
Huono
Välttävä
Tyydyttävä
Hyvä
Erinomainen
0 10 20 km
N
© MML


Pohjan laatuluokitus
Erittäin likaantunut
Likaantunut
Puolilikaantunut
Puoliterve
Terve
PORI
RAUMA
0
10
20 km
N
© MML

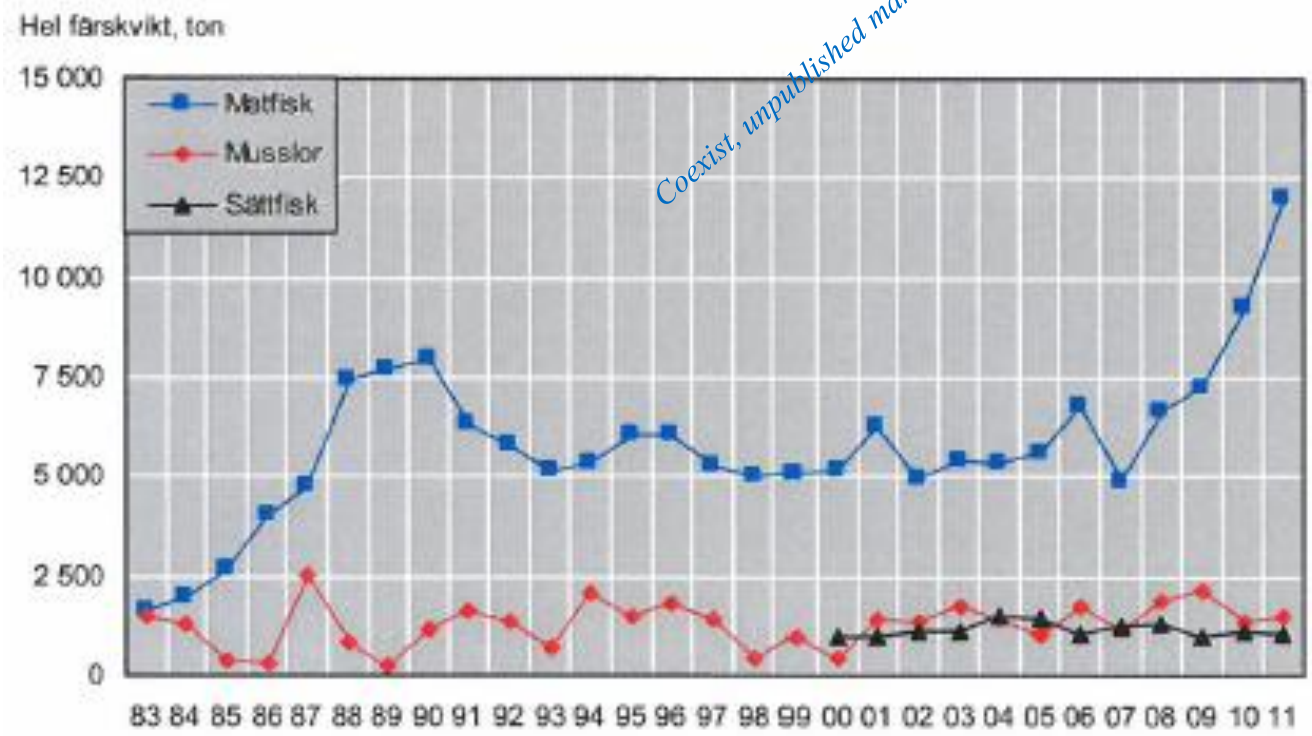

Pohjaeläin-indeksiluokka
Huono
Välttävä
Tyydyttävä
Hyvä
Erinomainen
PORI
RAUMA
0
10
20 km
N
© MML

Production 2011

	Sweden	Finland
Production (million kg)	12.0	11.3
Value of production, (million €)	36.8	47.1
Share of rainbow trout of the production	89.8 % The rest mainly arctic char	87.6 % The rest mainly whitefish
Number of farms (food fish)	79	178
of which in the Baltic Sea coast	18 (only rainbow trout)	111
Farms producing more than 100 tons/a	15 Producing 95 % of the Swedish production	only few

(Statistics Sweden (SCB), Statistics Finland (SVT))

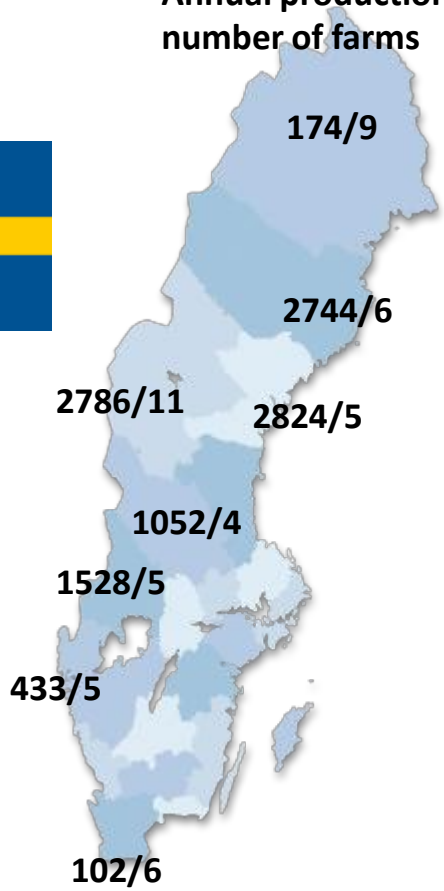
Swedish Production 1983-2011



Coexist, unpublished manuscript

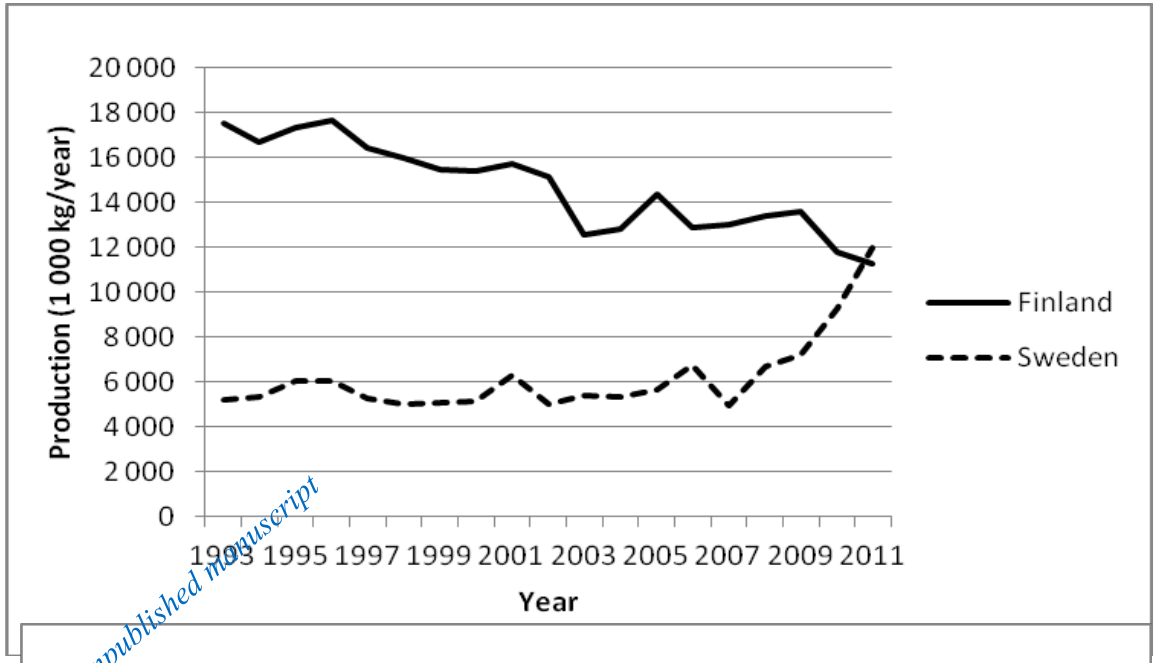
Swedish production and number of farms in 2011

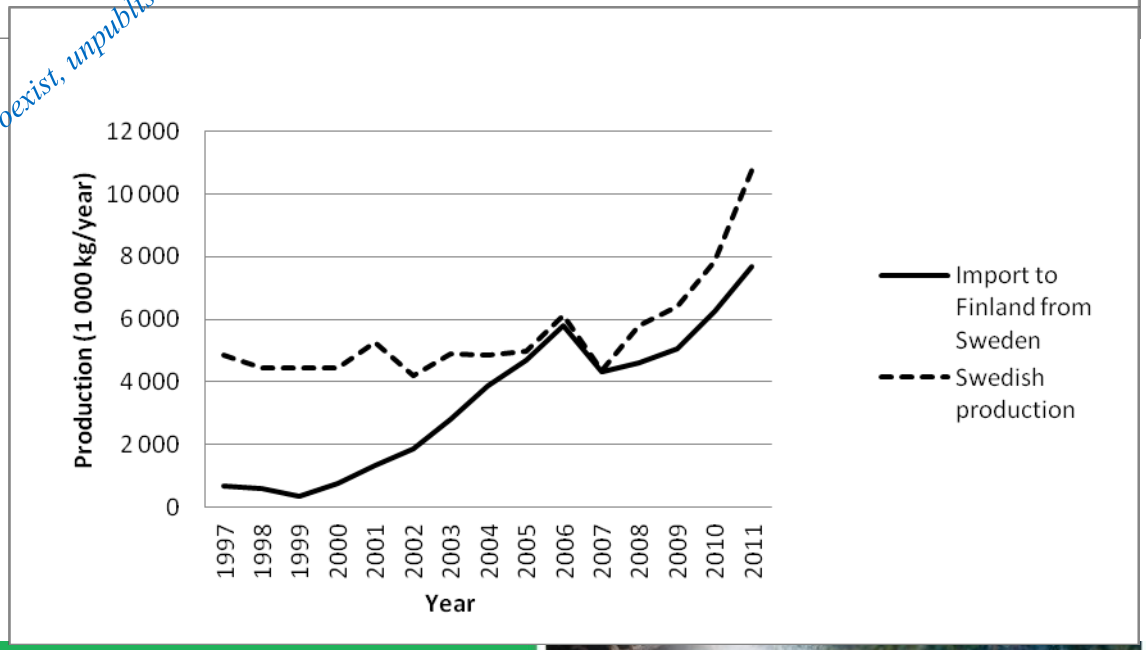
Coexist, unpublished manuscript



Counties with production >100 tons:
Norrbotten
Västerbotten
Västernorrland
Jämtland
Dalarna
Värmland
Västrä Götaland
Skåne

Statistics Sweden (SCB)





Swedish application system

Consultations	•County Administrative Board •Regulatory authority (municipality) •Individuals speciallay affected by the project
Environmental impact?	•County Administrative Board makes a decision whether an application can be prepared and sent forward
Broader Consultations	•County Administrative Board •Supervisory/regulatory authorities •Individuals specially affected by the project •Other state authorities, municipalities, organizations, groups affected by the project
Application with MKB	•Application •MKB (Environmental Impact Description) including report of consultations •Information to the general public
Decision	•County Administrative Board decides if MKB is valid •County Administrative Board accepts the application

Sweden according to Jens Andersson

Finnish application system

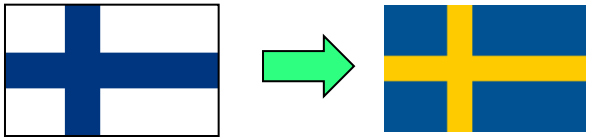
Application	• Regional State Administrative Agencies
Possible supplements and consultations	•Regional State Administrative Agencies •Centre for Economic Development, Transport and the Environment management (ELY-central) •Information to general public
Comments	•Regulatory authority (ELY-center, 2 departments) •Municipality •Individuals speciallay affected by the project
Possible consultations	•Regulatory authority (ELY-center) •Regional State Administrative Agencies
Decision	•Regional State Administrative Agencies

The Swedish governance practice*:

- Large farms in Sweden (over 1000 tons) in the lake area,
- In the sea area the capacity of the farms owned by Finns are 400-600 tons
- Farm sites are excellent, oligotrophic areas, depth 40-60m, no registered complains although the farms are located near shores
- More difficult to get permits for sea than for lake areas,
  - for sea areas permits are usually for 10-15 years,
  - -for lake areas permits are for an indefinite time
- Spatial plan is generally not yet in use in Sweden as it is going to be in Finland in 2013

*interview of a Chief executive of a Fish farming enterprise in Åland islands

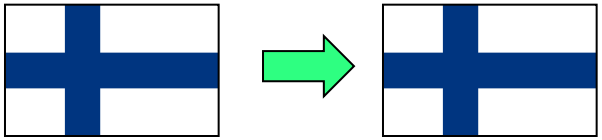
Finnish farmers going ”to exile” into Sweden*



- Over 5 million kg annually ”Finnish” production in Sweden
- Big farms, big plans:
  ”We have now a million kg farm but it is planned to produce 4 million kgs on that farm in the near future. This plan is prepared in understanding with the local environmental authorities and with their consultative help.”
- The Production exported to Finland
  ”There is no market for big rainbow trout in Sweden”
- Sometimes the fish goes first to Estonia to be processed before exportation to Finland

*The chief executive of a Finnish fish farming company

Finnish farmers going ”to exile” into Sweden*



- Over 5 million kg annually ”Finnish” production in Sweden
- Big farms, big plans:
  ”We have now a million kg farm but it is planned to produce 4 million kgs on that farm in the near future. This plan is prepared in understanding with the local environmental authorities and with their consultative help.”
- The Production exported to Finland
  ”There is no market for big rainbow trout in Sweden”
- Sometimes the fish goes first to Estonia to be processed before exportation to Finland

*The chief executive of a Finnish fish farming company

Finnish paradox

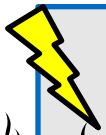
- The Finnish environmental permit policy has not benefited the ecological status of the sea, but moved the production volumes and employment opportunities to other locations in the Baltic Sea drainage area.
- While the Swedish society seems to be able to recognize a development opportunity for the aquaculture in Sweden offered by the Finnish fish farmers, the Finnish society does not recognize the danger to lose their fish farmers.
- For the Finnish governance the road to sustainable development for aquaculture seems to be unknown and, thus, a paradox where the suffering of both livelihood and the environment is caused.

LCA based comparation of alternatives

- Standardised method
- Different products and services can be compared,
  - for example different food stuffs or food production branches like aquaculture products versus other meat products
- Impact size and classes may help to find points to be developed

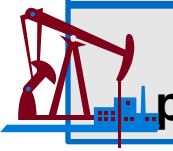
GAME AND FISHERIES RESEARCH

Materials production



Electricity production

Heat production



Fuels production

Chemicals production

fertilisers

pesticides

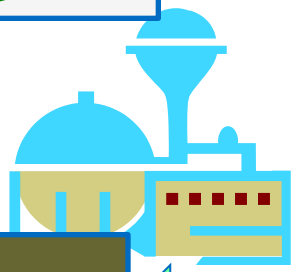
antifouling

Fishing

Fish meal and oil production

Soy, wheat, rape seed production

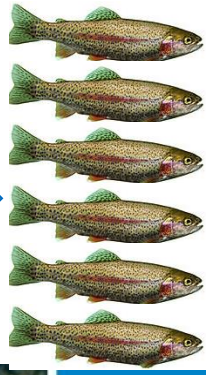
Processing⇨
-Soy meal & concentrate
-Wheat flour
-Rape seed oil



Feed manufacturing

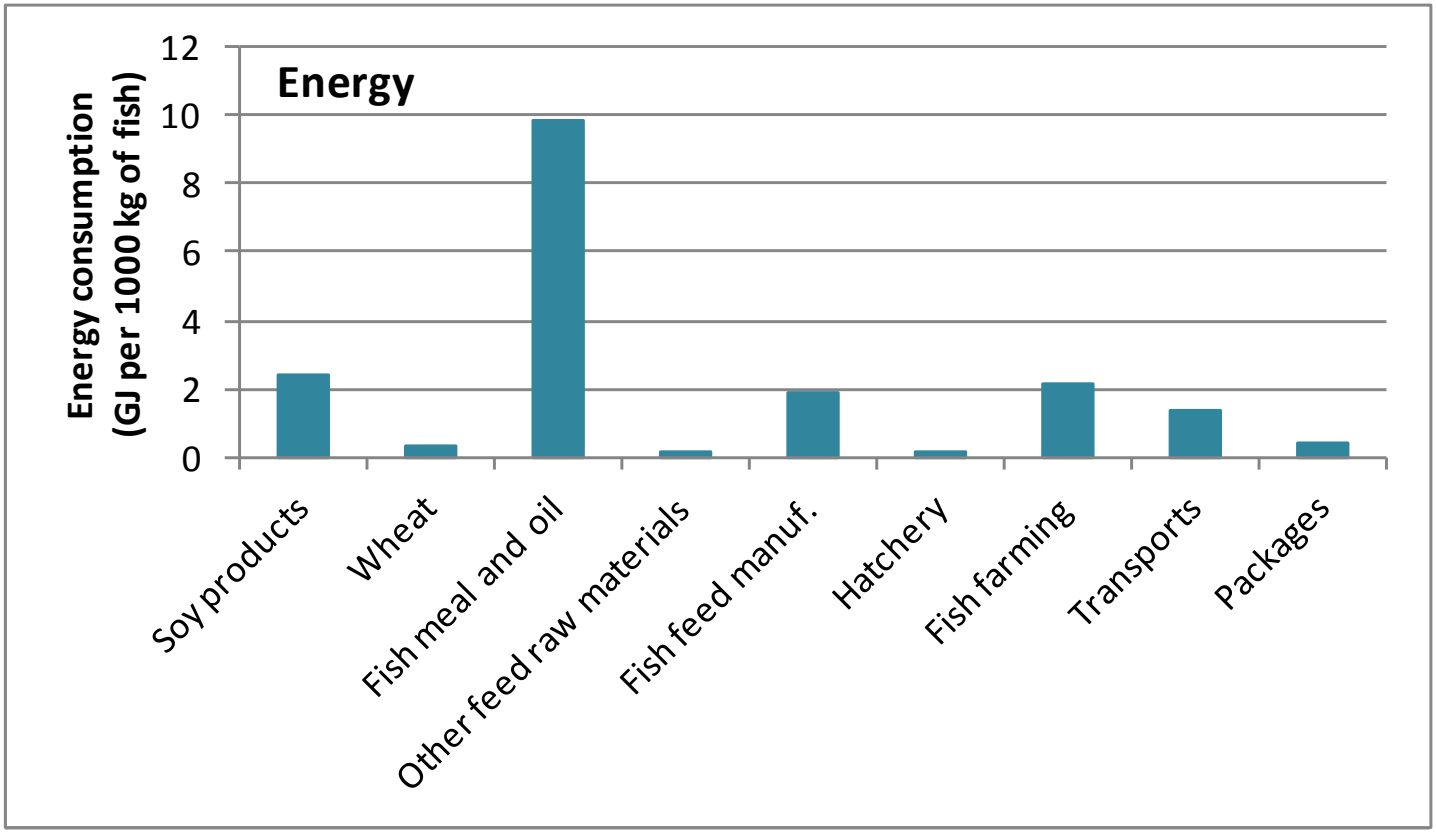
Smolt production

Fish farming

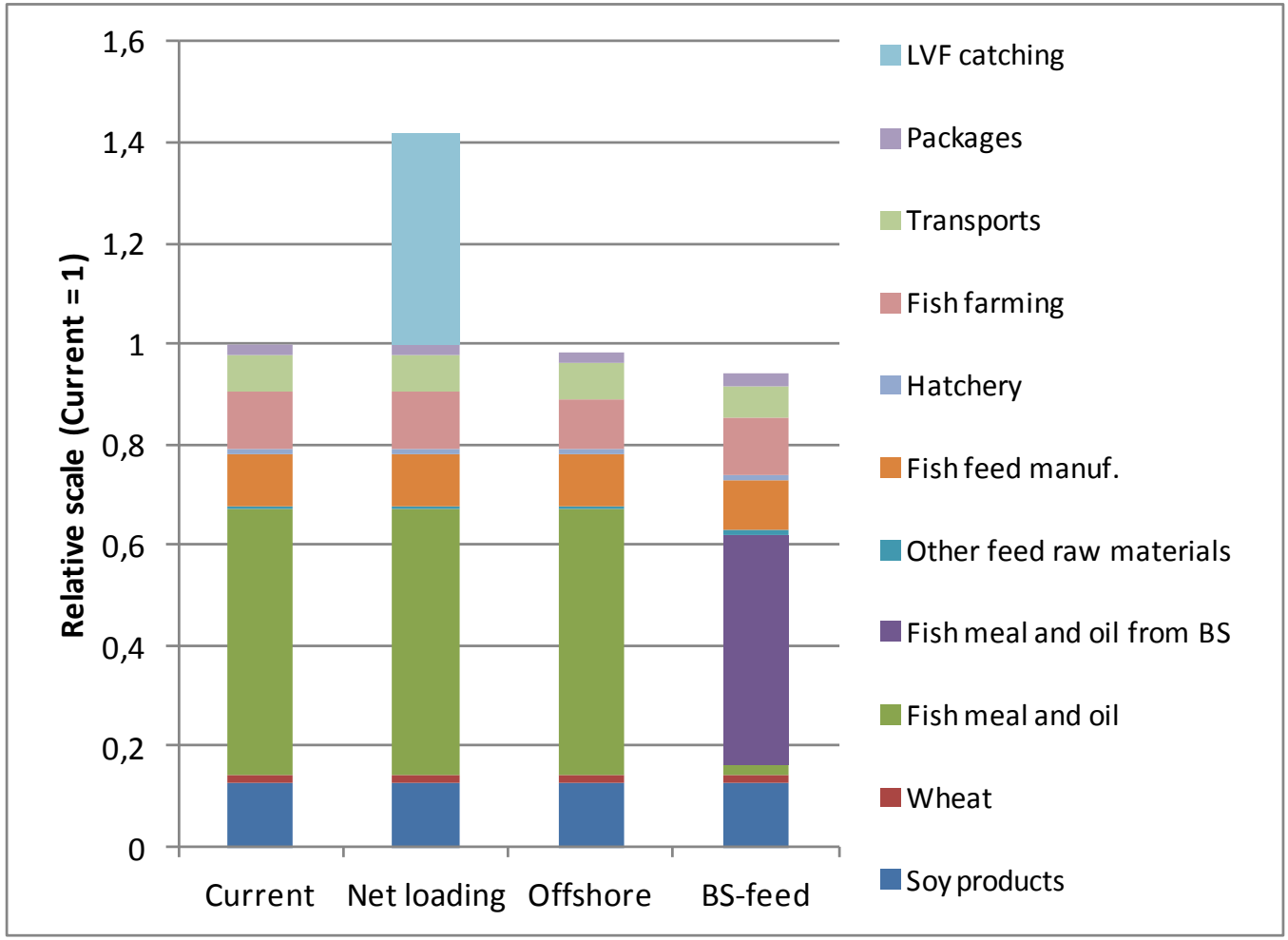


Knowledge-based solutions, for sustainable choices

BAU: results

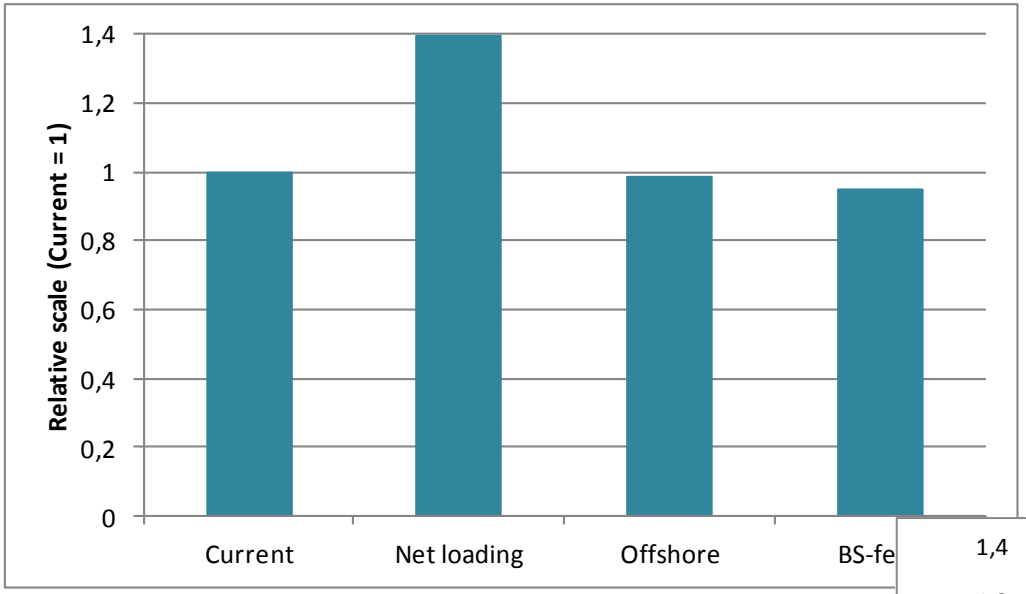

Energy
Energy consumption
(GJ per 1000 kg of fish)
12
10
8
6
4
2
0
Soy products
Wheat
Fish meal and oil
Other feed raw materials
Fish feed manuf.
Hatchery
Fish farming
Transports
Packages

Comparison: energy consumption



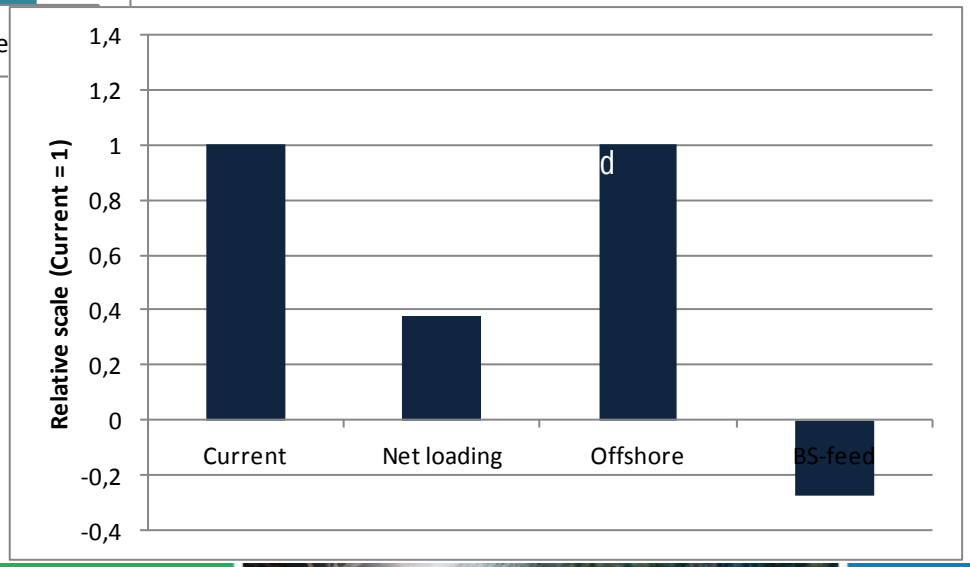
GAME AND FISHERIES RESEARCH

Comparison: climate and eutrophication



0,03 %

0,8 %



LCA Conclusions

- Present system:
  - Decrease nutrient load from fish farming (practically & techically)
  - Use renewable energy and utilize organic wastes maximally
  - Be awake to the environmental impacts of feed raw materials production
- Net loading: present system and…
  - Result is very sensible for the end use of LVF: if just replaces fish used in fur animal feeding ⇨ net effect ≤ 0
  - Minimise fuel consumption of LVF fishing
- Offshore: see present system
- BS feed: see present system, and…
  - Minimise fuel consumption of fishing
  - A new alternative ⇨ composition of the fish feed is not known yet ⇨ may (significantly) affect to the final results

General conclusions

- The most sustainable way to produce animal protein is fish farming using Baltic Sea Feed in more open farm locations
- The environmental impacts can be smaller compared to chicken, cow or pig meat production
- Fish as food has positive effects on national health status
- There are no direct production subsidies for fish farming – world market prices in use

GAME AND FISHERIES RESEARCH

coexist

The research leading to these results has received funding from the European **Community's Seventh Framework Programme (FP7/2007**-2013) under grant agreement no 245178. This publication reflects the views only of the author, and the European Union cannot be held responsible for any use which may be made of the information contained therein.

Thank you for your attention

Email: timo.makinen@rktl.fi

Website: www.coexistproject.eu

Knowledge-based solutions, for sustainable choices