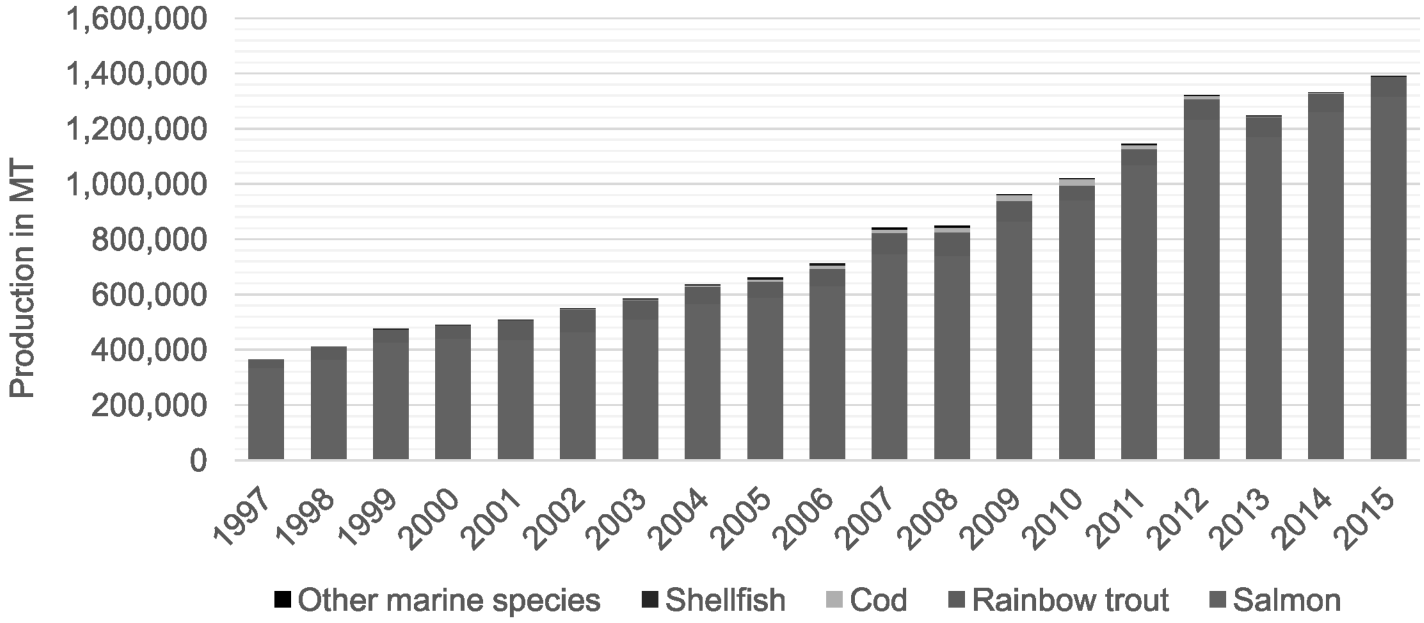
The Norwegian Aquaculture Industry

- A young industry (approx. 45 years old)
- +/- 120 companies – mix of small, medium and large companies
- Creates about 24 000 jobs, including spin-off effects, in coastal areas
- Production volume of 1,34 million MT in 2014 (99 % salmon/trout)
- Export value of 46,2 billion NOK in 2014 (5,7 billion USD)

Norwegian aquaculture production



Primary legislative objectives

Aquaculture Act

Profitability and competitive power	Sustainability
Simplification of legislation and administration	Access to coastal areas - production facilities

Food Law

Safe food	A viable food production industry and market access
Ensure health, quality and comsumers interests throughout the production chain	Good plant- and animal health

Biodiversity Act

Protect and maintain biodiversity

Regulatory framework – Aquaculture Act

- Based on a license system
  - New licenses allocated by the government

1. Aquaculture license
   - limited in numbers
   - can be transferred and mortgaged

2. Aquaculture site
   - Size/production capacity of each site is set based on assessments of the sites carrying capacity.

Case handling of aquaculture applications

Applicant
Sends an application to the County.

The County

Sends the application to relevant sector authorities and the municipality

Receives invited comments

Decides on the application pursuant to the Aquaculture Act

The municipality

Registers an announces the application to the public

Clarifies the relationship to area plans (time limit)

Directorate of Fisheries regional office

Comments on traditional fisheries interests. (time limit)

Norwegian Food Safety Authority

Decides on the application pursuant to the Food Safety Act and the Animal Welfare Act. (time limit)

Norwegian Coastal Administration

Decides on the application pursuant to the Harbor Act. (time limit)

County Governor

Decides on the application pursuant to the Pollution Control Act. (time limit)

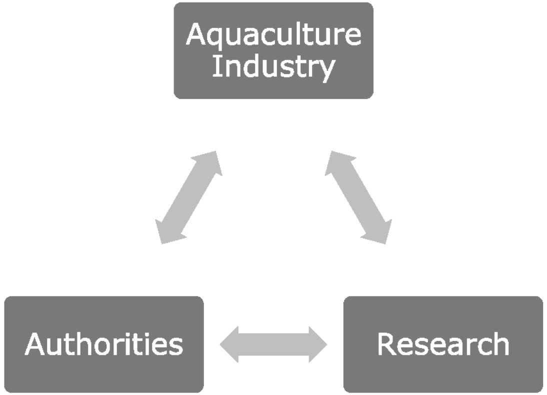
Comments on nature conservation, recreational-, fishing- and game interests. (time limit)

Norwegian water resources and energy directorate

Only involved in cases that involve extraction of water

Decides on applications/issue statements

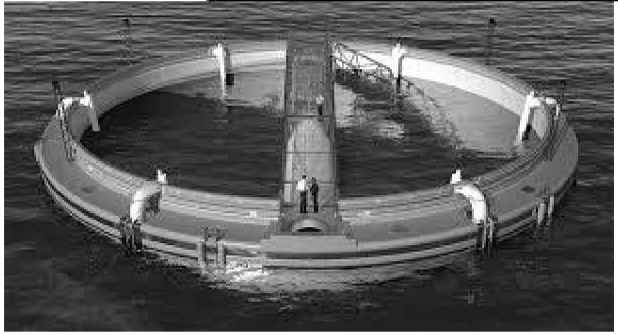
Key factors for the development of Norwegian aquaculture



Tradition for strong regulations

Norway - technical development

Norway - technical development



Some visions for sustainable Norwegian Salmon farming

Genetic interaction:

Aquaculture does not contribute to permanent changes in the genetic characteristics of wild fish stocks

Pollution:

All aquaculture sites operate within acceptable environmental conditions, and do not have higher effluence of nutrient salts and organic material than the carrying capacity of the recipient

Diseases:

Diseases in fish farming do not have a regulating effect on stocks of wild fish, and as many farmed fish as possible grow to slaughter age with minimal use of medicines

Spatial planning:

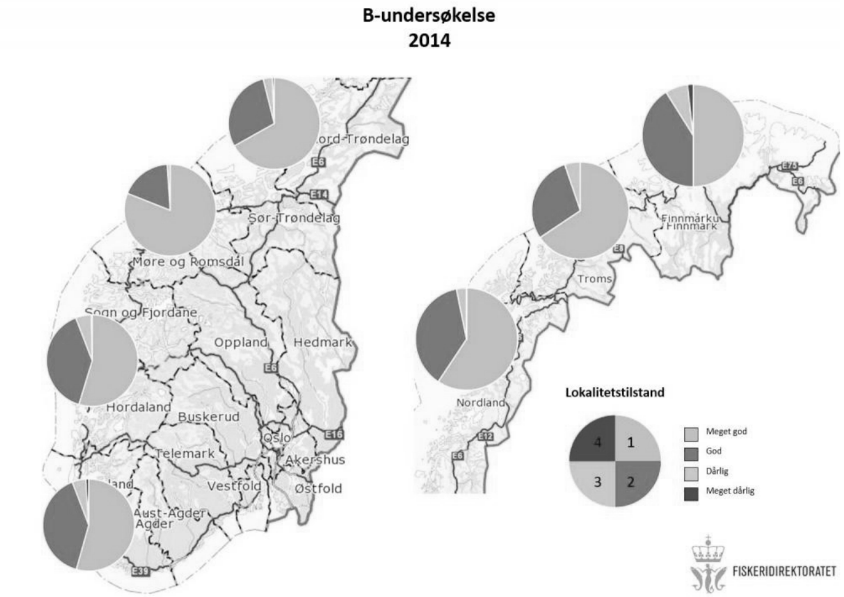
The aquaculture industry has a site structure and area utilisation which reduces the impact on the environment and the risk of infection

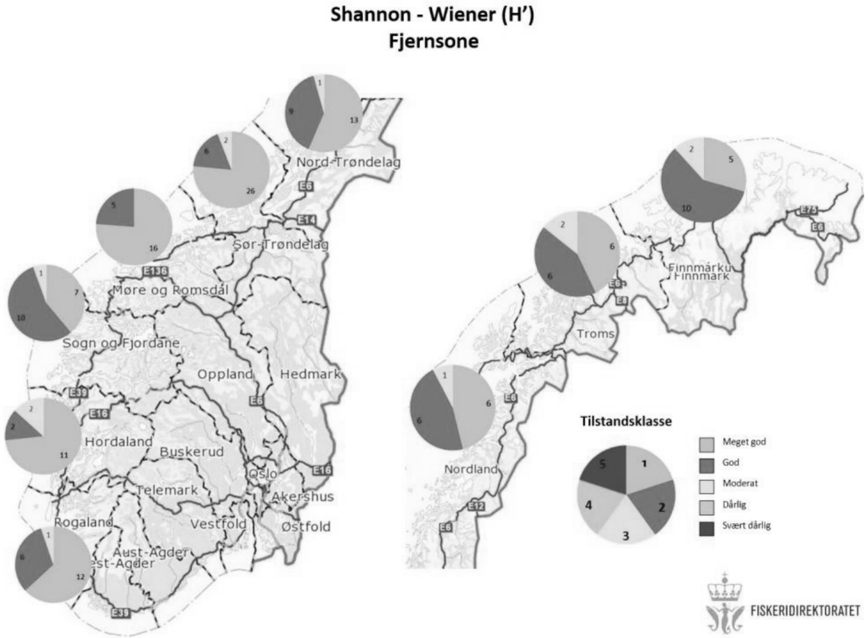
Feed resources:

The aquaculture industry's needs for raw materials for feed is met without over-exploitation of wild marine resources

NORWEGIAN MINISTRY OF TRADE, INDUSTRY AND FISHERIES

Status pollution 2014



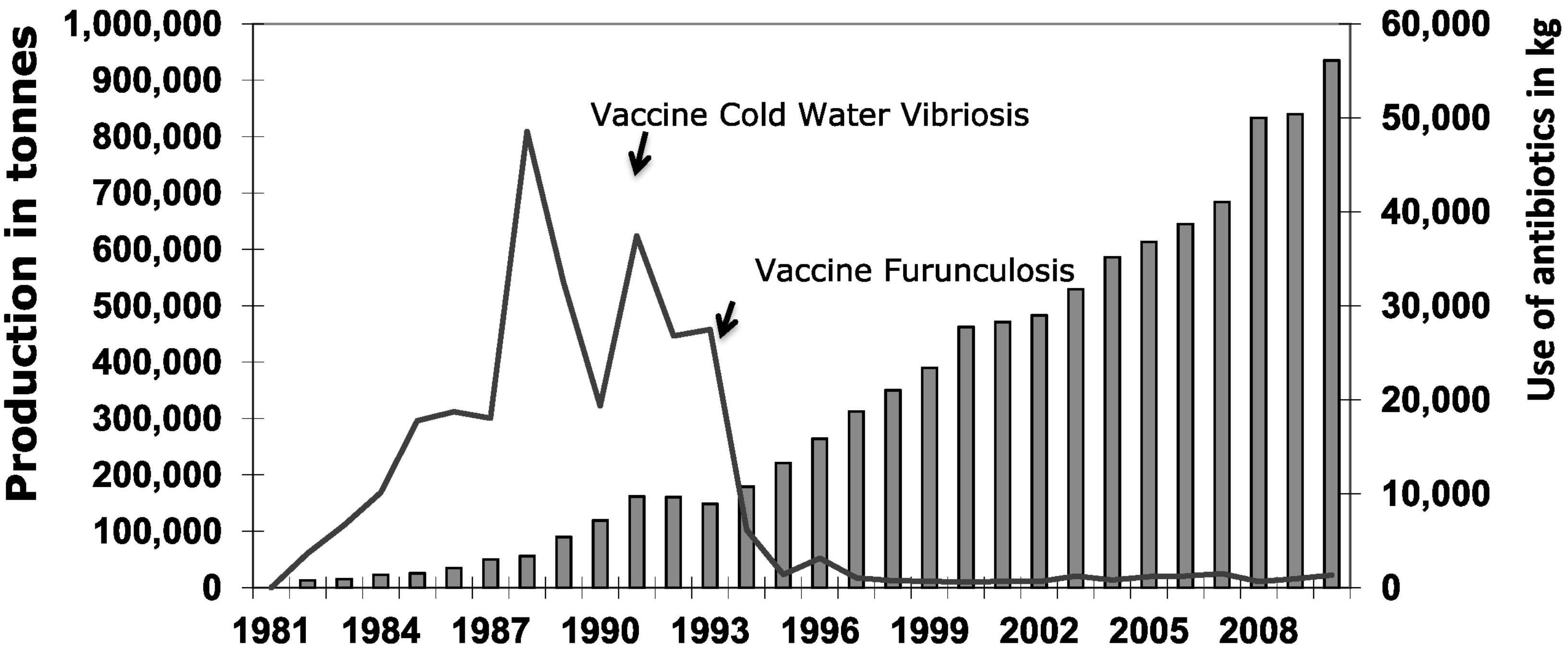


*Sites that report electronically to the Directorate of Fisheries. Source: Directorate of Fisheries

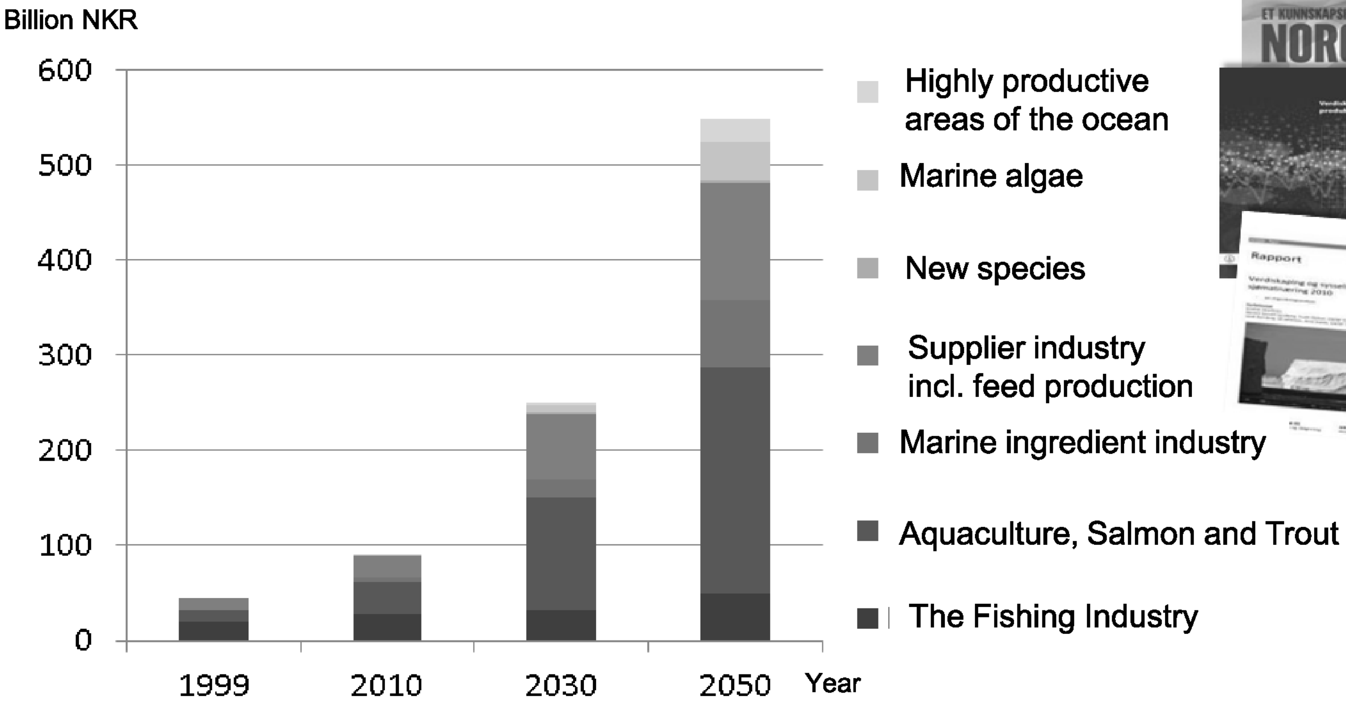
Status diseases

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PD	45	58	98	108	75	88	89	137	99	142
HSMB	83	94	162	144	139	131	162	142	134	181
IPN	208	207	165	158	223	198	154	119	56	48
CMS	71	80	68	66	76	53	74	89	100	107
ILA	11	4	7	17	9	7	1	2	10	10

Importance of R&D



The vision


Billion NKR
600
500
400
300
200
100
0
1999
2010
2030
2050
Year
Highly productive areas of the ocean
Marine algae
New species
Supplier industry incl. feed production
Marine ingredient industry
Aquaculture, Salmon and Trout
The Fishing Industry


ET KUNNSKAPSBASERT
NORGE
Rapport

Potential

- There is a potential for future development and growth
- Broad support in Parliament for further growth, provided environmental footprint is within acceptable limits
- Public perception is necessary
- Export not only the fish, but technology and know-how

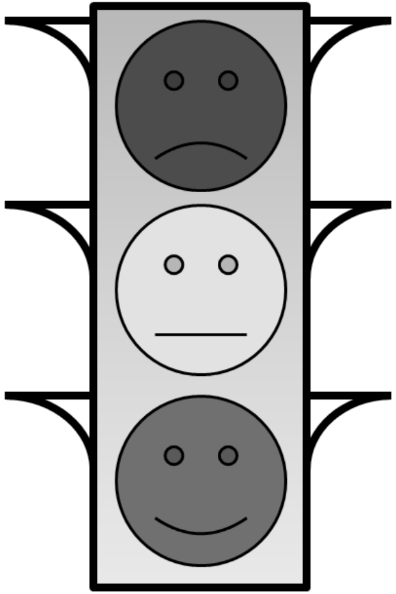
The marching order

- <u>Create a system that:</u>
  - Ensures stable growth over time (10-20 years +)
  - Takes into account environmental impact
  - Creates incentives for investments in R&D and new production technology
  - Is predictable to the industry

The Solution

- Establish a rule-based system
  - Indicators on environmental impact
  - Establish production areas
  - Create a "traffic light system" supporting decisions
- Predictability:
  - Known criteria
  - How often growth is considered
  - How much increase/decrease in production capacity each time

Main principle to decide on changes in production capacity



- Unacceptable environmental footprint: The productive capacity should be reduced

- Moderate environmental footprint: Freezing of the productive capacity

- Acceptable environmental footprint: Growth should be offered

Possible indicators

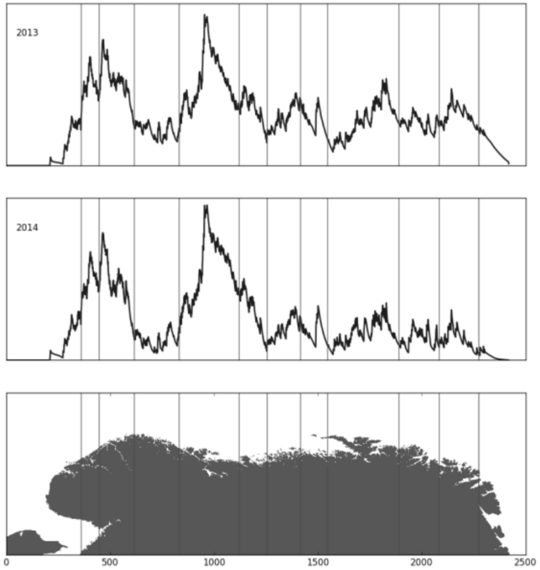
Issue	Can an indicator be designed, i.e. impact measured in the environment?	Is there a good correlation between biomass and the size of the indicator?	Is there a good correlation between source and where impact is measured?
Escapes	Yes (prevalence at breeding grounds and genetic drift in wild populations	No	No
Pollution/Effluent	Yes (level of dissolved nutrients and organic material)	Yes	Yes
Diseases/parasites	Yes (mortalities in wild stocks)	Yes	Yes
Feed resources	No	Yes	No

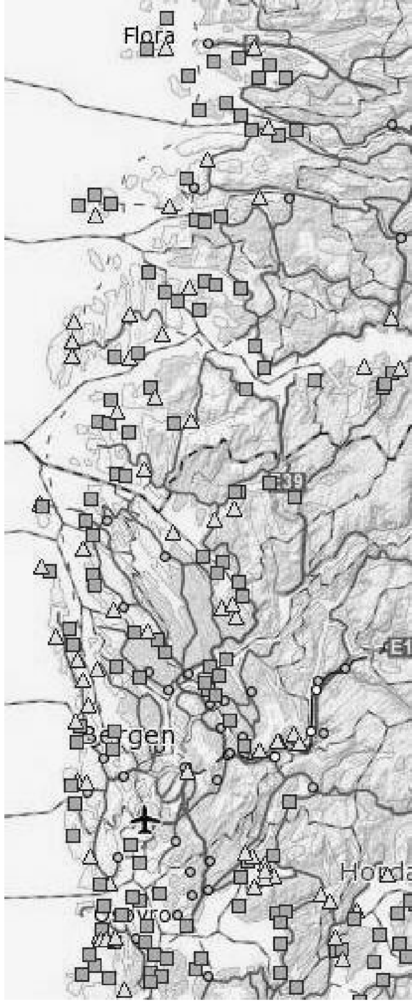
Production areas

- Each licence bound to a specific production area

- 10 to 15 areas in total along the coast has been recommended by the Institute of Marine Research

- Specific boundaries to be decided



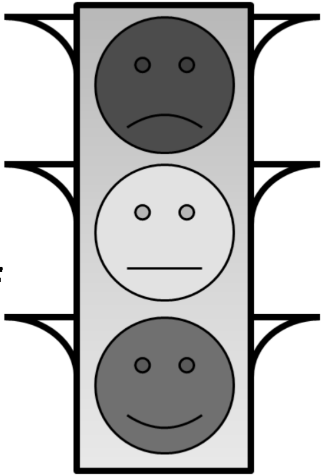


A closer look at the rule-based system

- <u>A moderate risk profile:</u>
  - Adjustment of the production capacity of 6 % is assessed every second year

- <u>Environmental indicators:</u>
  - Salmon lice is well suited as an indicator in a rule-based system for growth
  - Work will be started to investigate a possible indicator using effluents

Salmon lice indicator
What will we measure?



- Reports from each individual location regarding number of lice in the net cage, biomass, temperature and salinity
- The reports are then used to estimate the risk of negative influence on wild salmon and sea trout
- This is the traffic light
- Then…
- Verification and calibration of the model using field research (assessments of wild salmonids)

Low risk/influence	Moderate risk/influence	High risk/influence
Probable that < 10 percent of the wild population has an increased death-rate probability	Probable that 10 – 30 percent of the wild population has an increased death-rate probability	Probable that > 30 percent of the wild population has an increased death-rate probability

Decision year 0	Probable outcome year 1	Possible outcome year 2	Assessment of growth
Growth	Green	Green	Growth offered again
Growth	Green	Yellow	Consider freeze or growth
Growth	Green	Red	Consider reduction or freeze

Decision year 0	Probable outcome year 1	Possible outcome year 2	Assessment of growth
Freeze	Yellow	Green	Consider freeze or growth
Freeze	Yellow	Yellow	Freeze
Freeze	Yellow	Red	Consider reduction or freeze

Decision year 0	Probable outcome year 1	Possible outcome year 2	Assessment of growth
Reduction	Red	Green	Consider freeze or growth
Reduction	Red	Yellow	Consider reduction or freeze
Reduction	Red	Red	Further reduction

How to control other issues

- Genetic interaction
  - Compulsory membership in organisation responsible for removal of fish from rivers with unacceptable prevalence of farmed fish
  - Incentives for sterile fish
  - Incentives for tagging
- Effluents
  - Further develop benthic monitoring system to encapsulate level of nutrient salts and organic material in larger areas
- Diseases
  - Develop indicators on new diseases emerges having same impact on wild fish as sea-lice, if and when they occur
  - Consider incentives to reduce "production losses" i.e. mortalities at site
- Feed
  - Ensure marine feed ingredients are sustainable harvested
  - Develop new sources of marine feed ingredients
  - Find new sources for nutrients incl. C, S, N and P sources