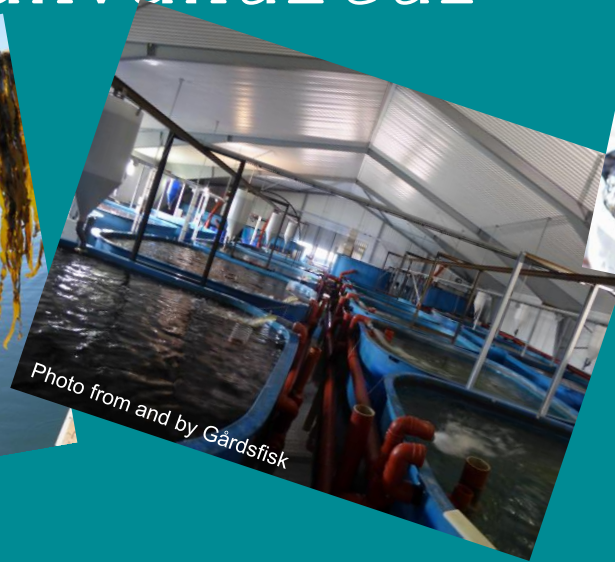


Næringsverdi og klimaaftryk for akvakultur



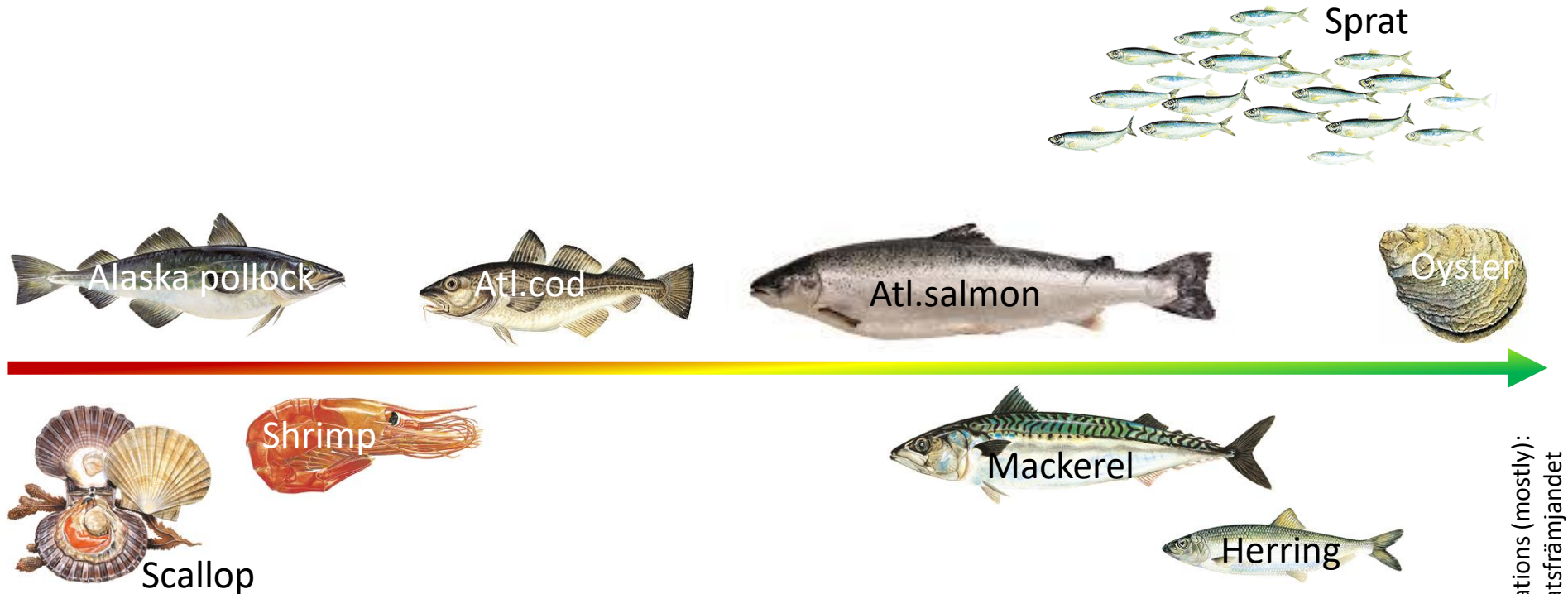
Friederike Ziegler, RISE Research Institutes of Sweden,
Dansk bioøkonomikonference 23 september, 2020

I will talk about

- Seafood, nutrition and climate impact
- Reduction opportunities
- Differences between farming systems

Question: Is farmed
seafood less nutritious than
wild-caught?

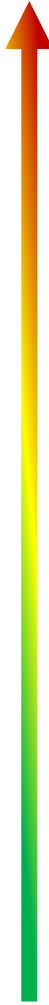
Nutrient density



From Hallström et al. 2019 Combined climate and nutritional performance of seafoods J CI Prod

Illustrations (mostly):
Sjömatfrämjandet

Greenhouse gas emissions



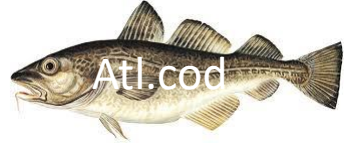
Shrimp



Scallop



Oyster



Atl.cod



Atl.salmon



Mackerel

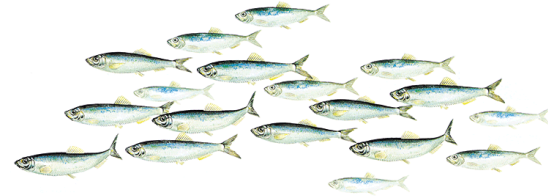


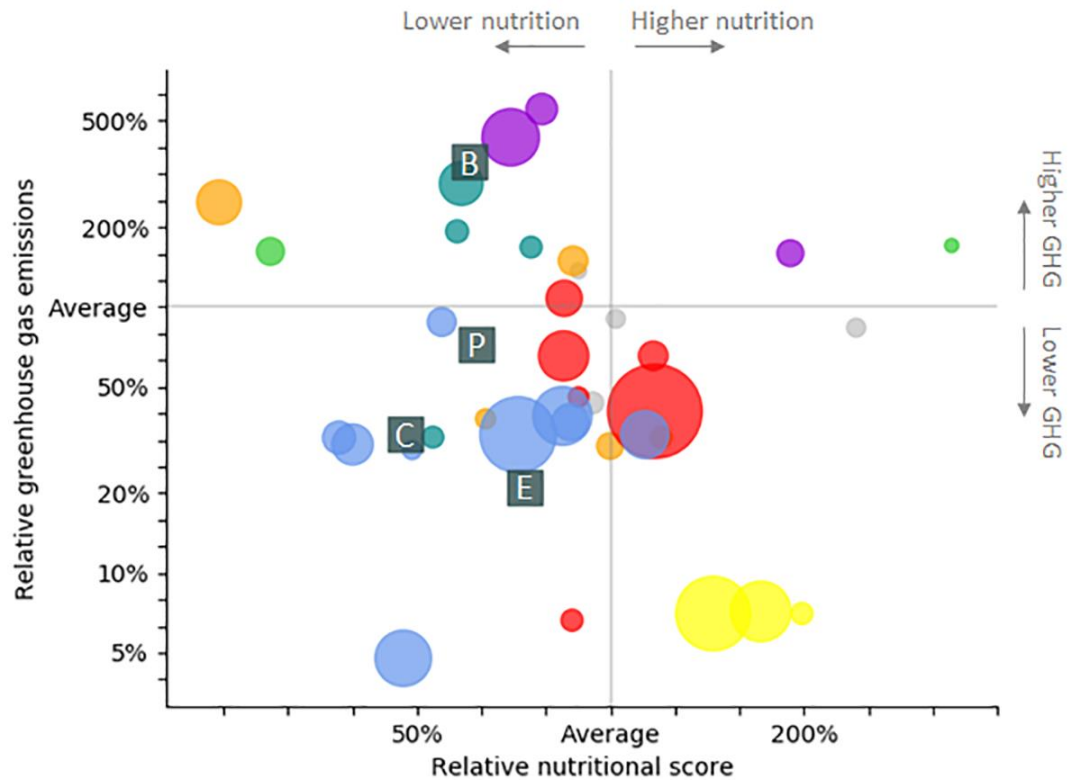
Herring



Alaska pollock

Sprat

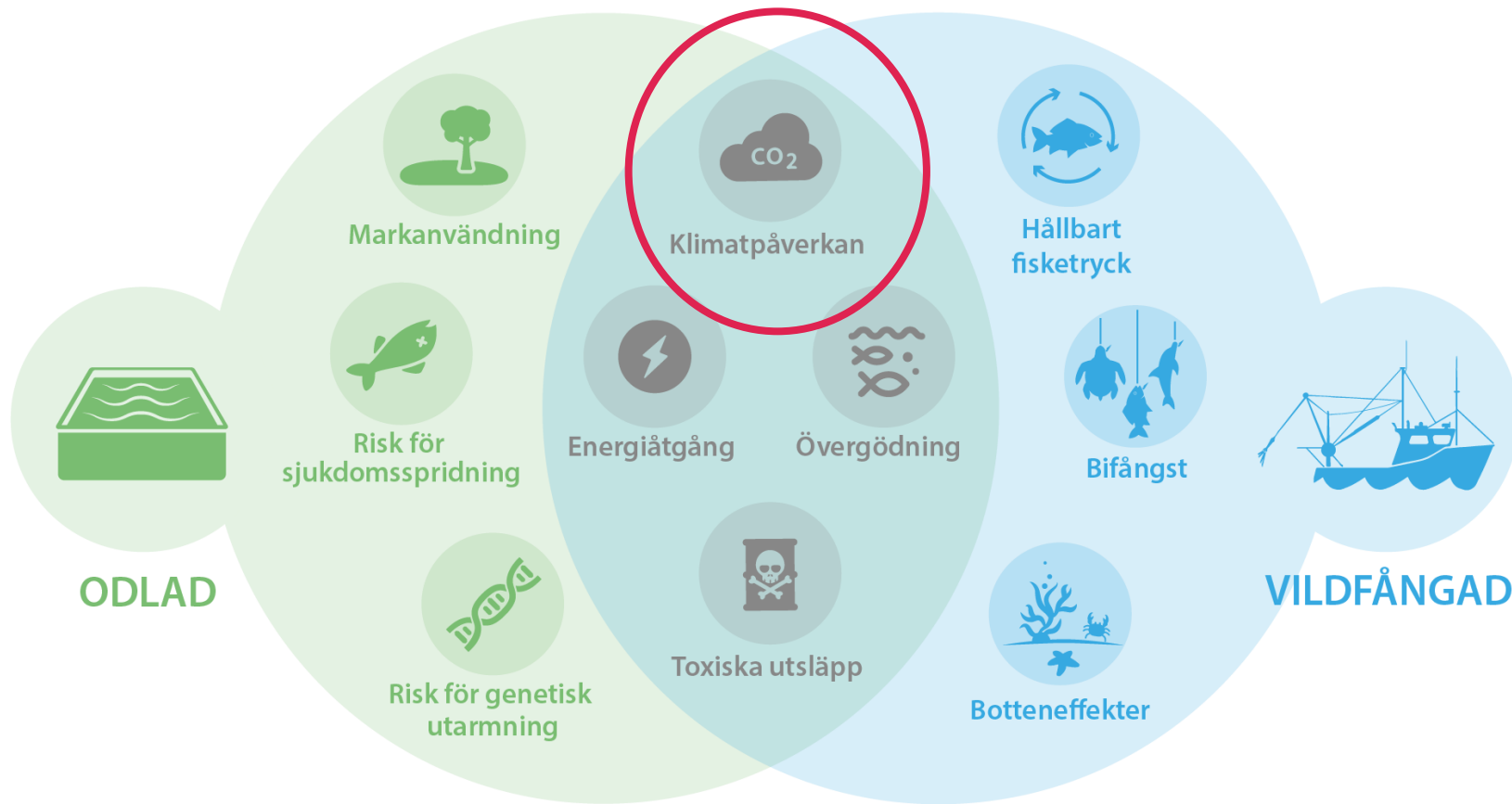




(Question: Is farmed seafood less nutritious than wild-caught?)

Answer: No, it is the species more than production method that determines nutrition. Farmed seafood spans the range from lowest to highest nutritional content. The nutritional content of fed farmed seafood can to some extent be influenced through the feed.

Aquaculture versus Fisheries



How reduce
climate impact
of seafood?

How reduce climate impact of seafood?

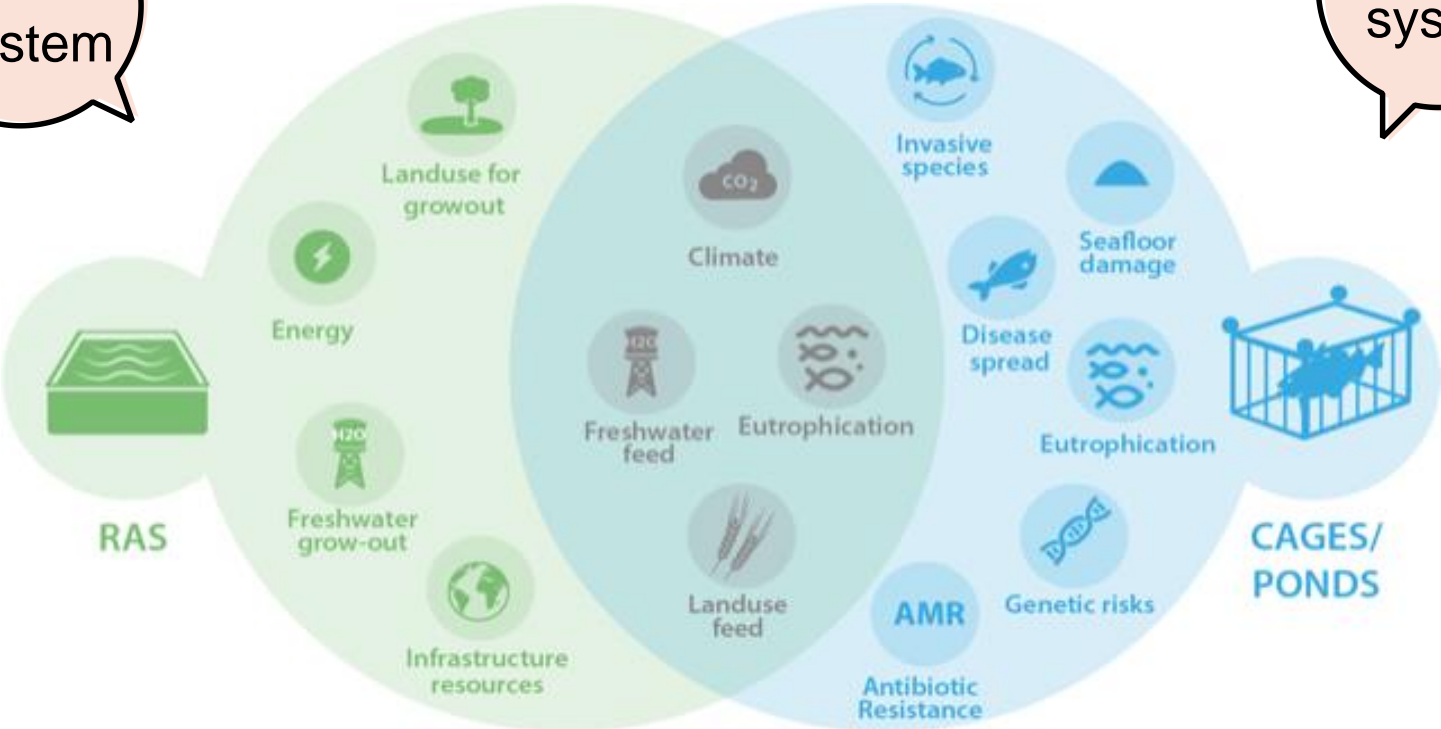
1. *Reduce feed and fuel use*

2. *Select low impact feeds*

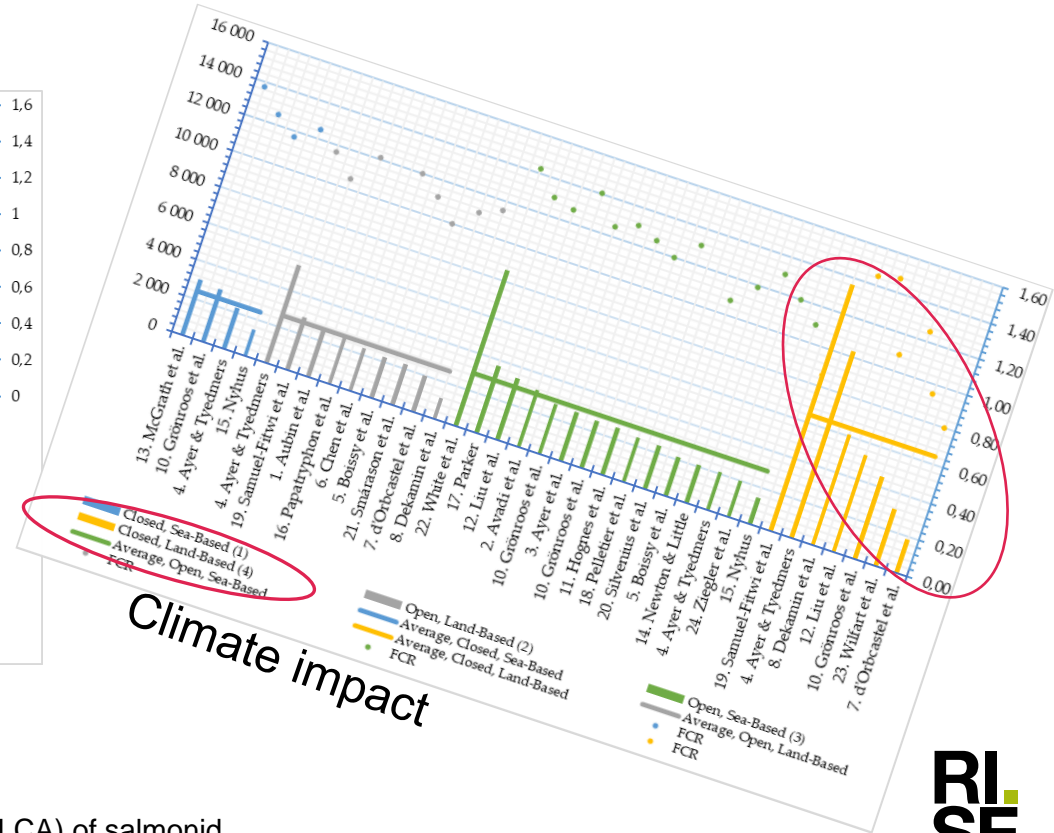
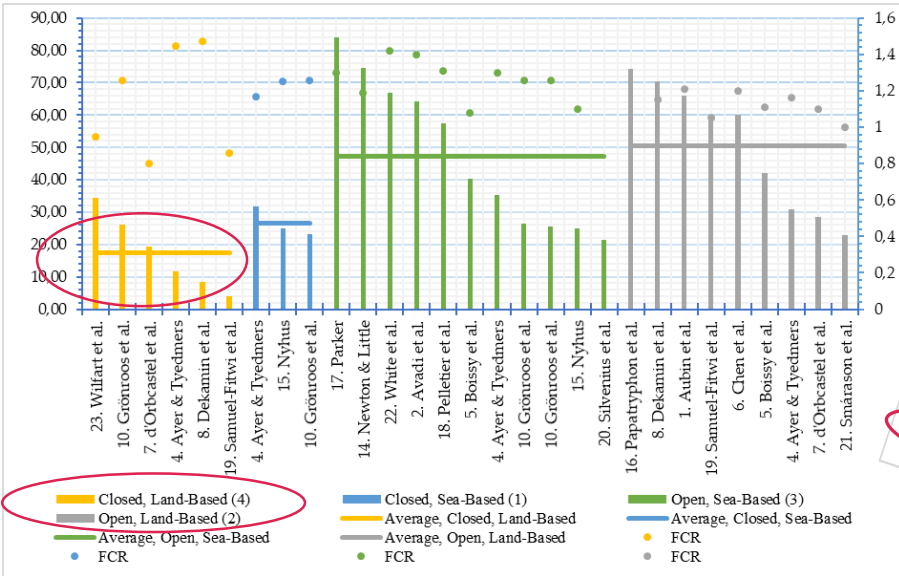
 3. *Select/develop/optimize low impact fishing and farming technologies*

Closed system

Open system



Environmental tradeoffs in aquaculture



Eutrophication

Philis et al. 2019 Comparing Life Cycle Assessment (LCA) of salmonid aquaculture production systems: Status and perspectives

But not always...
welcome to Gårdsfisk



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ENVIRONMENTAL
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pubs.acs.org/est

Article

Recirculating Aquaculture Is Possible without Major Energy Tradeoff: Life Cycle Assessment of Warmwater Fish Farming in Sweden

Kristina Bergman,* Patrik J. G. Henriksson, Sara Hornborg, Max Troell, Louisa Borthwick, Malin Jonell, Gaspard Philis, and Friederike Ziegler



Cite This: <https://dx.doi.org/10.1021/acs.est.0c01100>



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Article Recommendations



Supporting Information

ABSTRACT: Seafood is seen as promising for more sustainable diets. The increasing production in land-based closed Recirculating Aquaculture Systems (RASs) has overcome many local environmental challenges with traditional open net pen systems such as

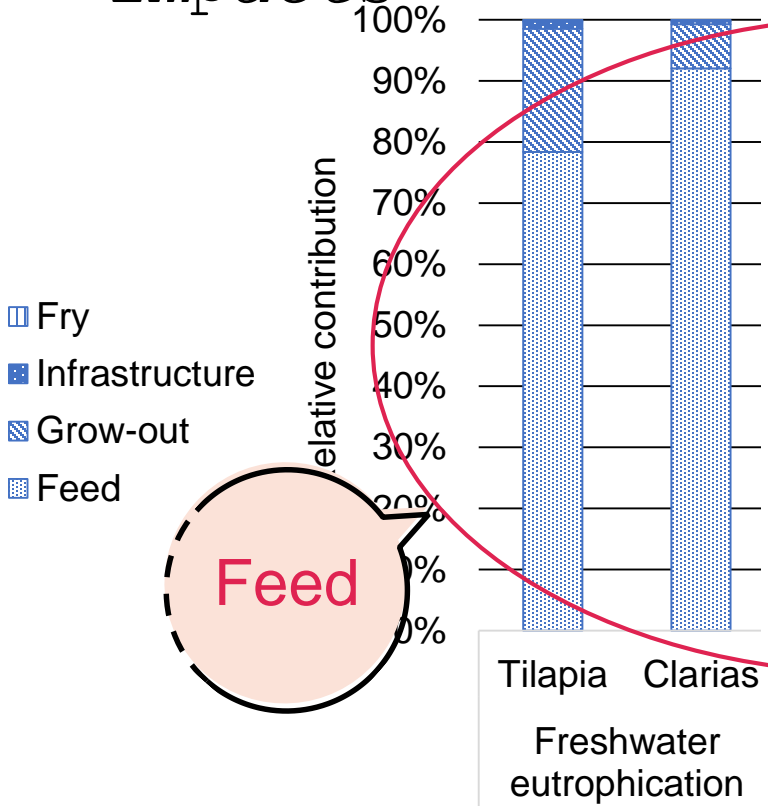
Environmental pressures associated with different aquaculture systems



Bergman et al. 2020

(UTC)
are published articles.

Contribution of different steps to total impacts

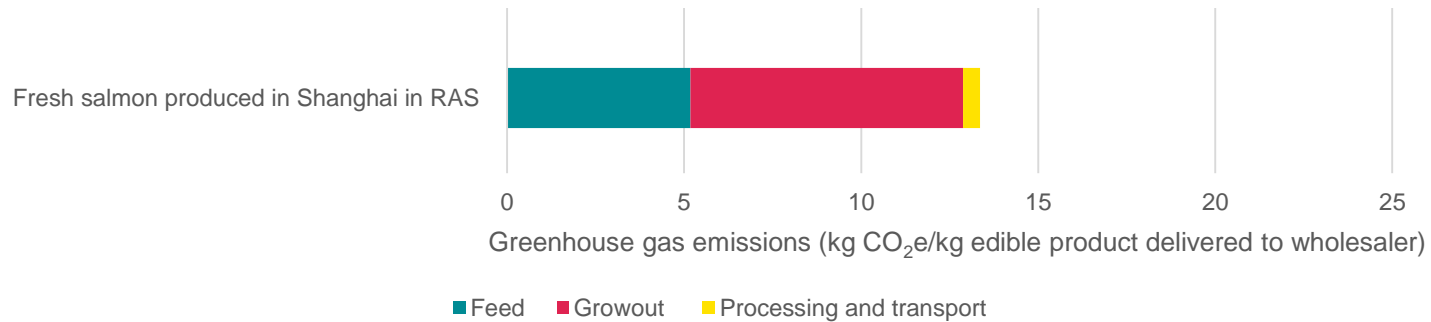


Feed

Grow-out

Supply chain
thinking

What do we compare?



Sources: Winther et al. 2020 and Skontorp Hognes et al. 2017

Conclusions

- Nutrition depends more on species than production technology
- Feed dominates the climate impact of fed aquaculture
- Landbased aquaculture has many advantages- and to minimise climate impact- choose feed, energy source and materials carefully! And use as much as possible of your product for food

Thank you! Questions?

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46 704 205609

What is "low impact feed"

- Feed that does not require intensive feed itself (!)
- ...is not produced in an energy-intensive fishery or farming system
- ...uses renewable energy
- ...gives a high yield
- ...has a high nutrient content, especially of critical nutrients (e.g. fatty acids, minerals)
- ...has a high palatability and positive health effects on the fish



Greenhouse gas emissions

Nutrient density



Scallop



Shrimp



European lobster



Oyster



Alaska pollock



Atl. cod



Atl. salmon



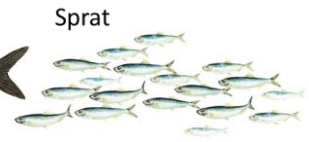
Perch



Herring

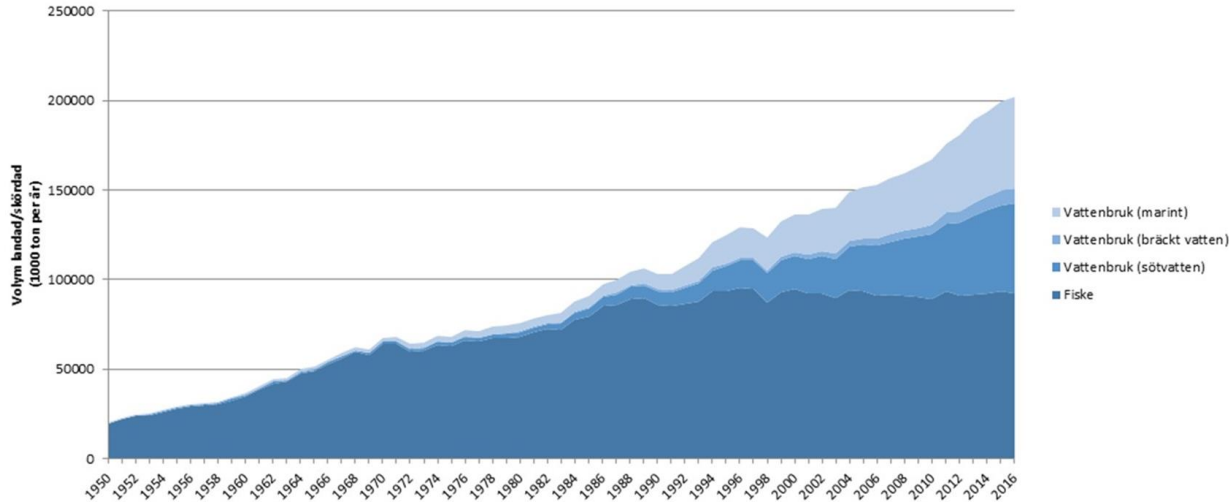


Mackerel



Sprat

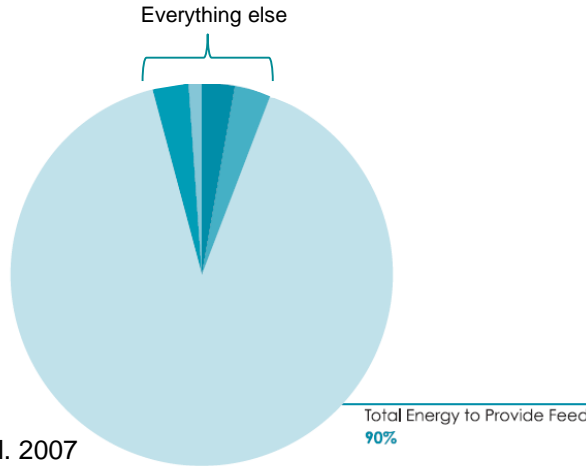
Seafood is growing- and could grow more (much more)



Costello et al. 2019 The future of food from the sea <https://oceanpanel.org/blue-papers/future-food-sea>
Costello et al. 2020 The future of food from the sea <https://www.nature.com/articles/s41586-020-2616-y>

Drivers of seafood climate impact

Mc Grath et al. 2015 ES&T
 cycle Impact of Solid
 ults of the contribution analysis ind
 ed production was the most important dri
 and BRU, with major contributions to CEU (39.7%)



Tyedmers et al. 2007

non to the maint

n of fuel used on
 en identified as the
 id source of GHG
 eutrophying emis-
 abiotic resource
 g in industrialized
 As typically shows
 tes by 75-95% of
 t, primarily driven
 act categories, abi-

Ziegler et al. 2016

	CEU (GJ)	BRU (kg C)	GHG Em. (kg CO ₂ -e)	Acid. Em. (kg SO ₂ -e)	Eut. Em. (kg PO ₄ -e)
Norway	26.2	111,100	1,790	17.1	41.0
UK	47.9	137,200	3,270	29.7	62.7
Canada	31.2	18,400	2,370	28.1	74.9
Chile	33.2	56,600	2,300	20.4	51.3
Average ¹	31.1	89,400	2,160	20.4	49.3

Feeds Smolts Farm Energy Farm N/P Emissions

Pelletier et al. 2009

being standardised, and fuel use in fishing op-
 mental impacts. Energy efficiency was found to be >>

Avadi et al. 2013

major differential
 required by carnivorous species like
 an farms and capture fisheries all over the
 producing raw materials that are processed and trans-
 ported to a feed producer and then processed into aquafeeds,
 completely dominates the up-to-the-dock results for sale

Ziegler et al. 2013 J CI Prod

The most important contributors to the carbon footprint of
 chains originating in capture fisheries were the onboard use of
 fuel and refrigerants (figure 2). Inventory results can be found

Ziegler et al. 2013 J CI Prod

