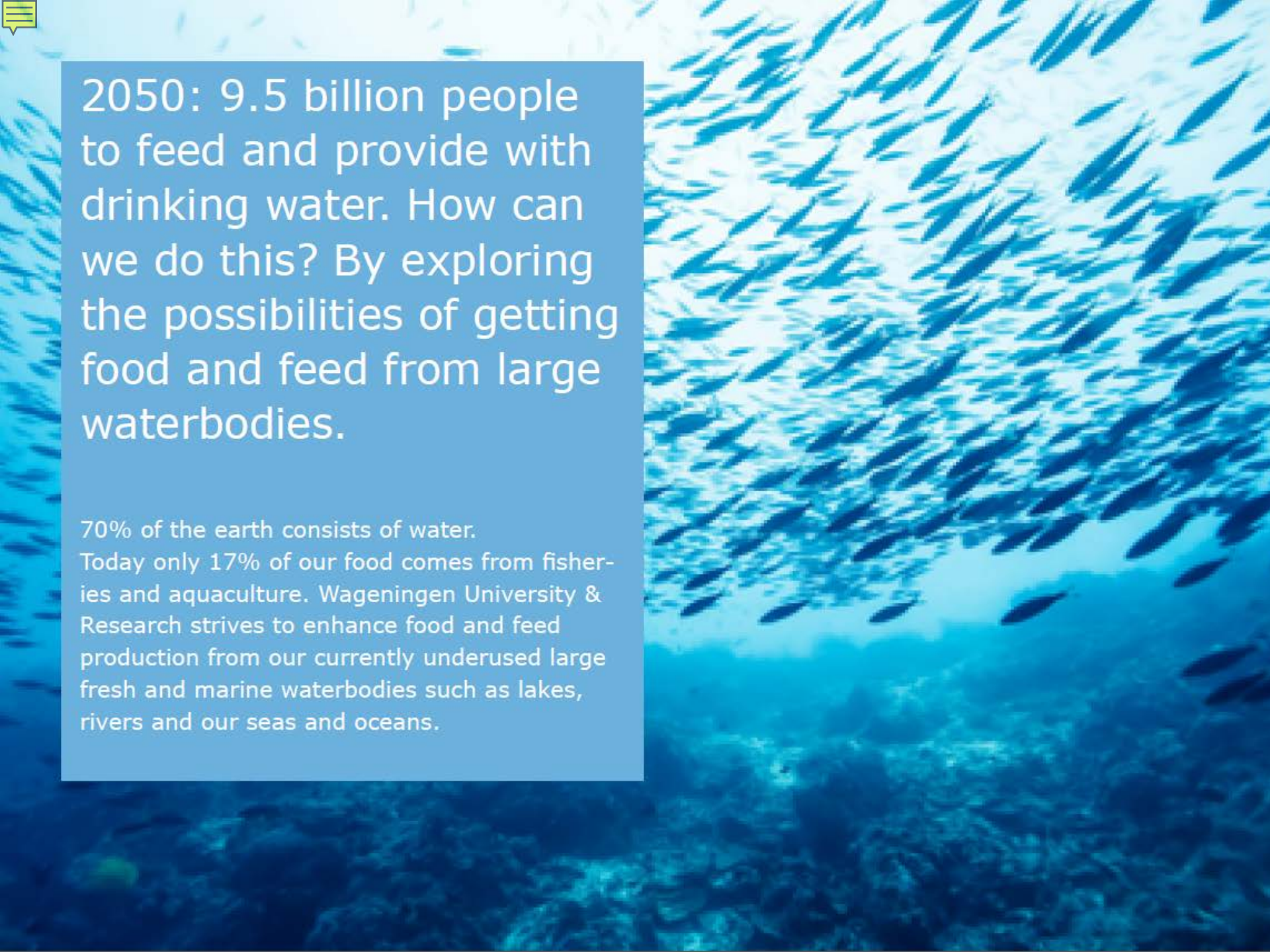
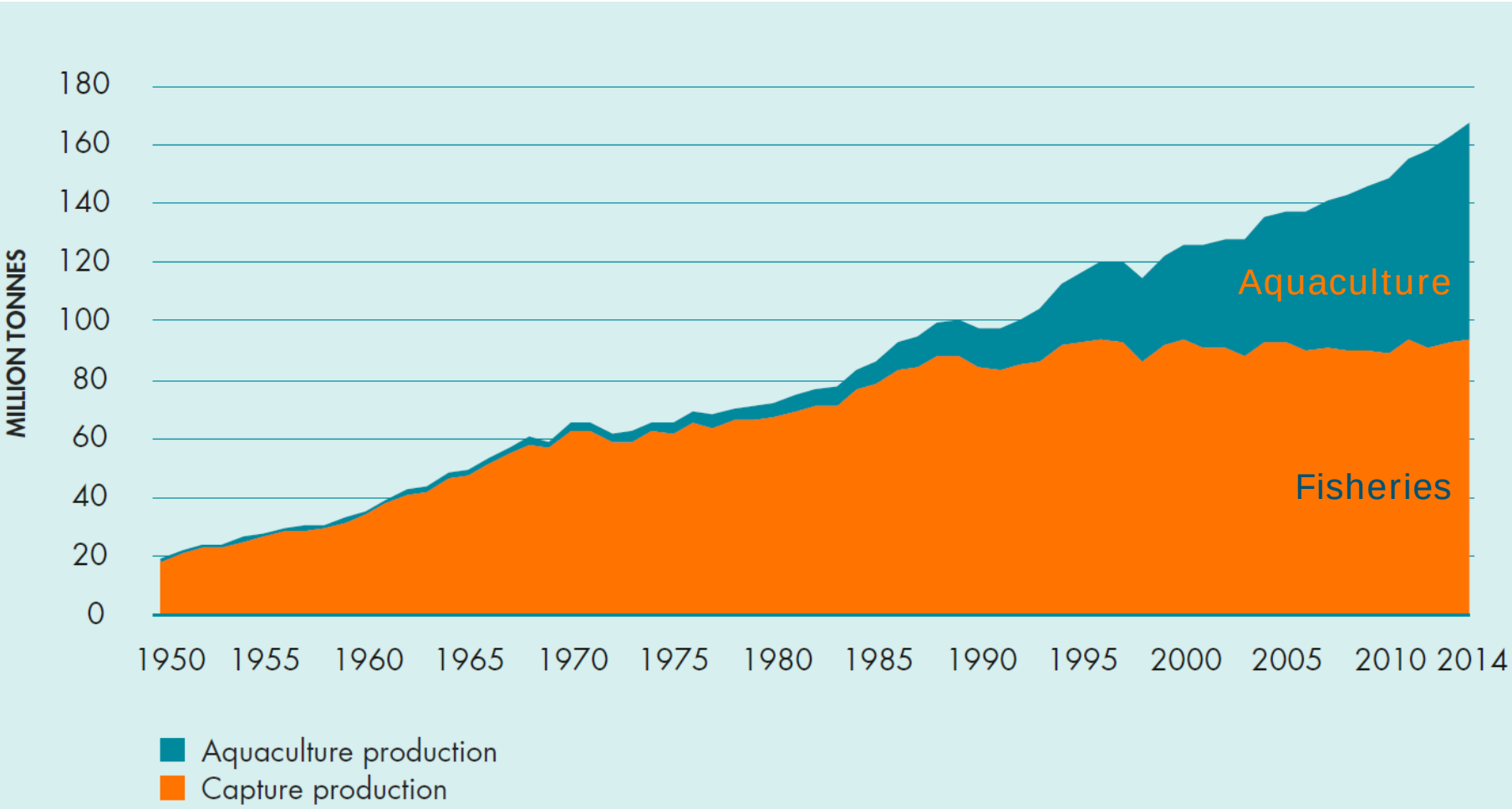


2050: 9.5 billion people to feed and provide with drinking water. How can we do this? By exploring the possibilities of getting food and feed from large waterbodies.

70% of the earth consists of water.
Today only 17% of our food comes from fisheries and aquaculture. Wageningen University & Research strives to enhance food and feed production from our currently underused large fresh and marine waterbodies such as lakes, rivers and our seas and oceans.



Source: FAO

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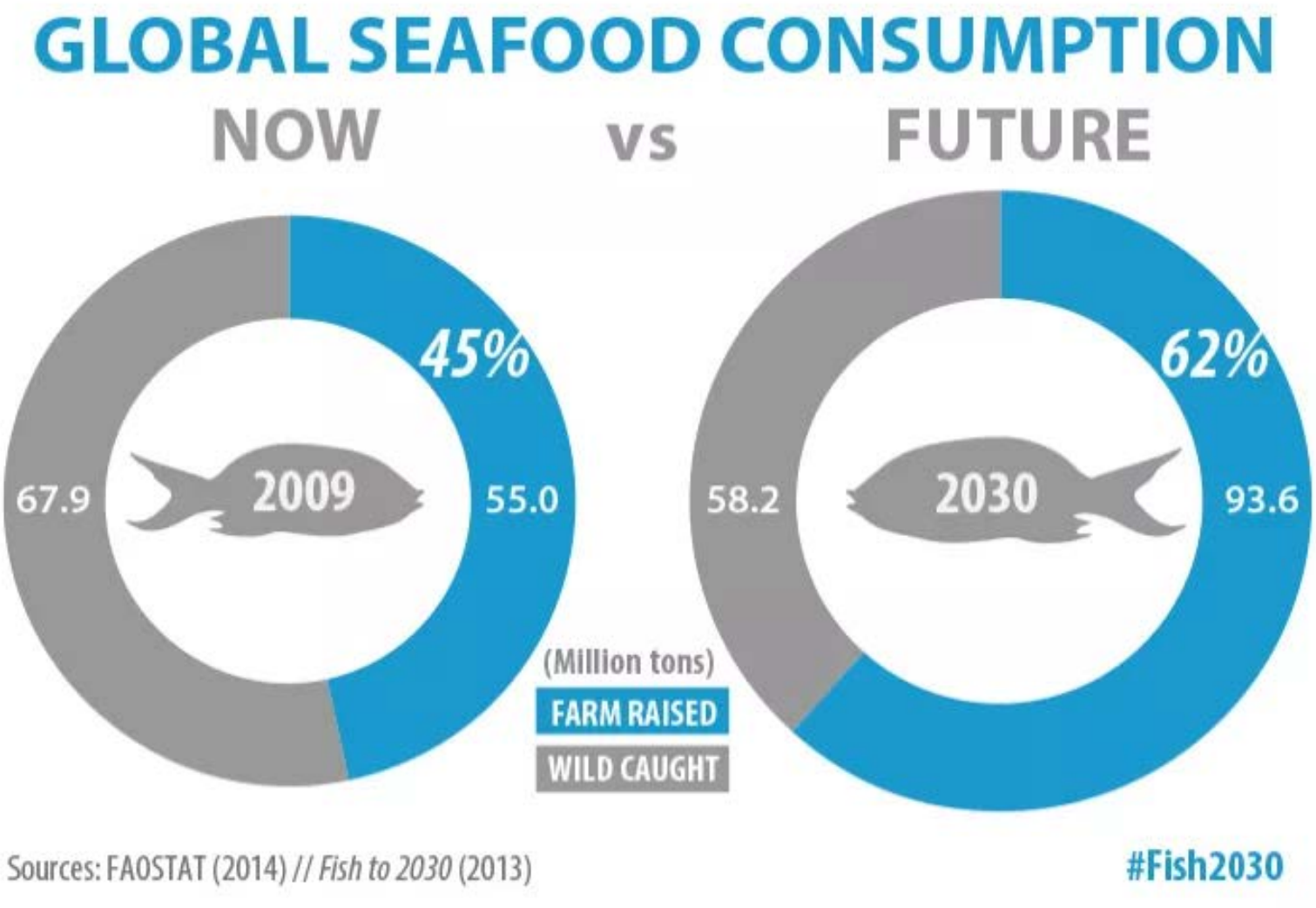

GLOBAL SEAFOOD CONSUMPTION
NOW
vs
FUTURE
45%
67.9
2009
55.0
62%
58.2
2030
93.6
(Million tons)
FARM RAISED
WILD CAUGHT
Sources: FAOSTAT (2014) // Fish to 2030 (2013)
#Fish2030

The Sea as Farm: Food (f)or Thought?

Wagening by Sea lectures
17 May 2017

Dr. Henrice M. Jansen
Wageningen Marine Research
Institute of Marine Research (Norway)
European Aquaculture Society (board)

Prof. Johan Verreth
Aquaculture and Fisheries
Wageningen University

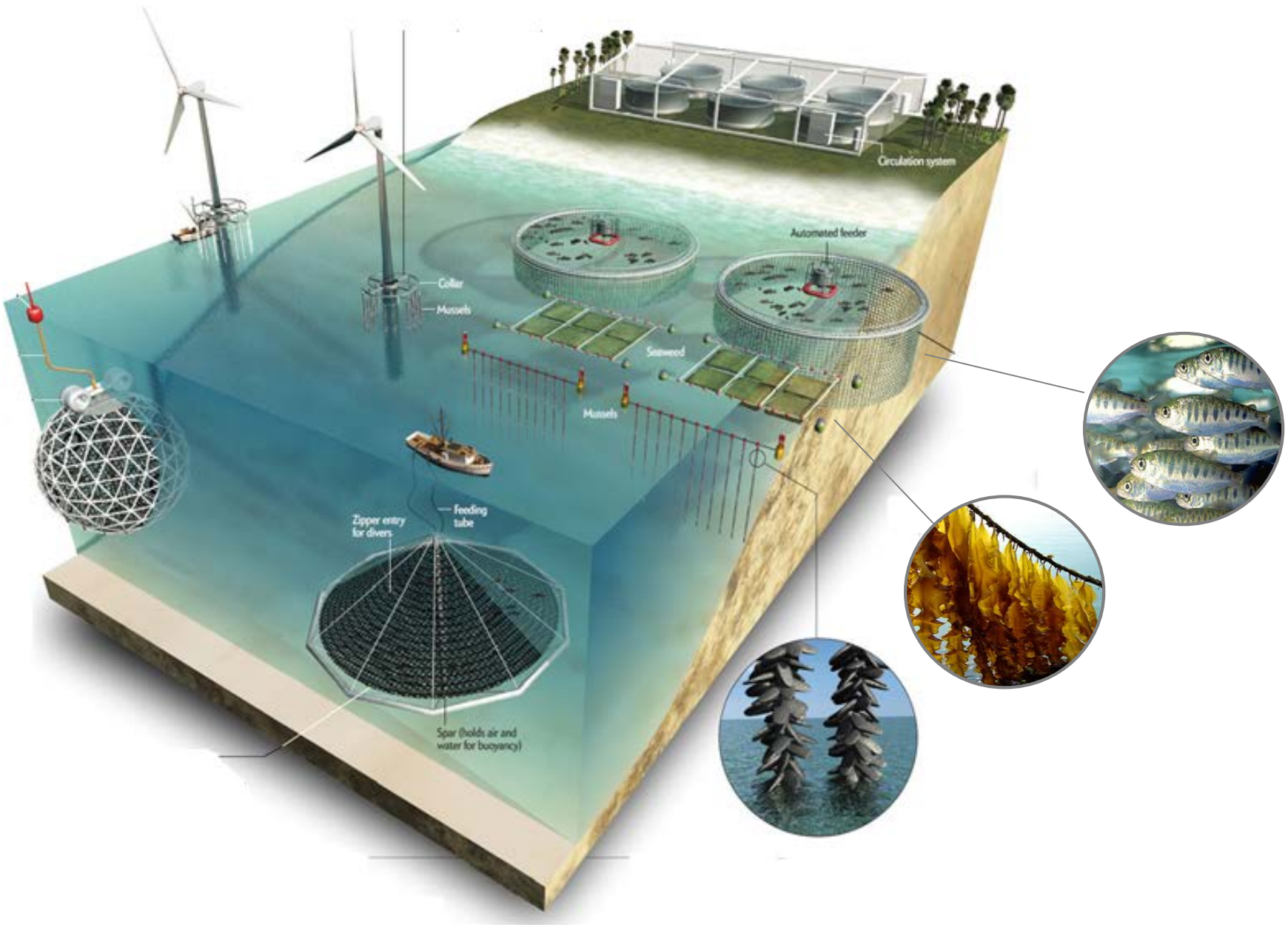
The challenge!

Worldwide demand for seafood:

- in 2022: 161 million ton (OECD-FAO Agriculture Outlook 2014)
- In 2030: ~160 million ton (Worldbank Fish to 2030 report)
- In 2030: ~ 235 million ton (Subasinghe 2014)

In 2030, we must produce between ~30 and ~100 million MT above current level of 136 million MT

Blue revolution: offshore production needed



What do/should we farm?




		World	Europe
	Fish - Freshwater	45%	16%
Marine	Fish	7%	**62%**
	Shellfish	**16%**	21%
	Crustaceans	4%	<1%
	Seaweeds	**28%**	<1%

High price

but

Challenges with sustainability

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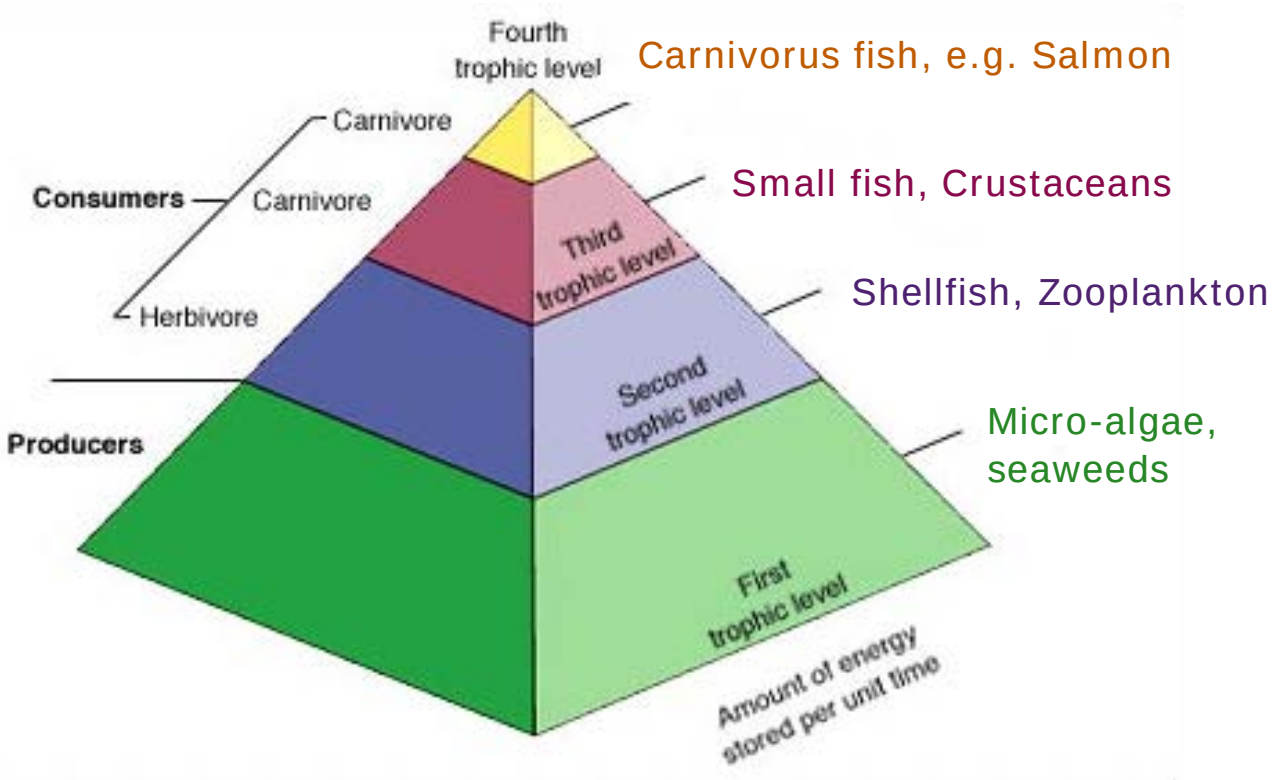
Low trophic production

- Farming down the food chain to increase total production
- Seaweed and Shellfish important



Why is offshore farming not happening yet?

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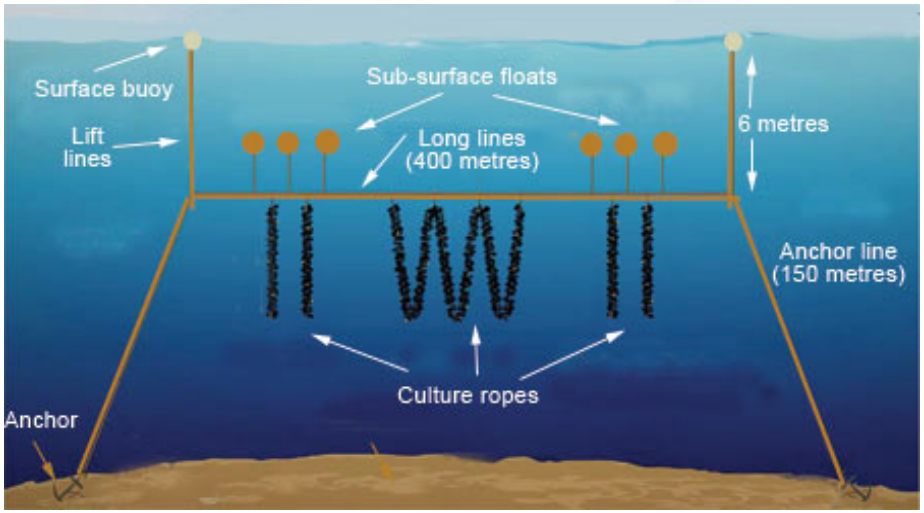
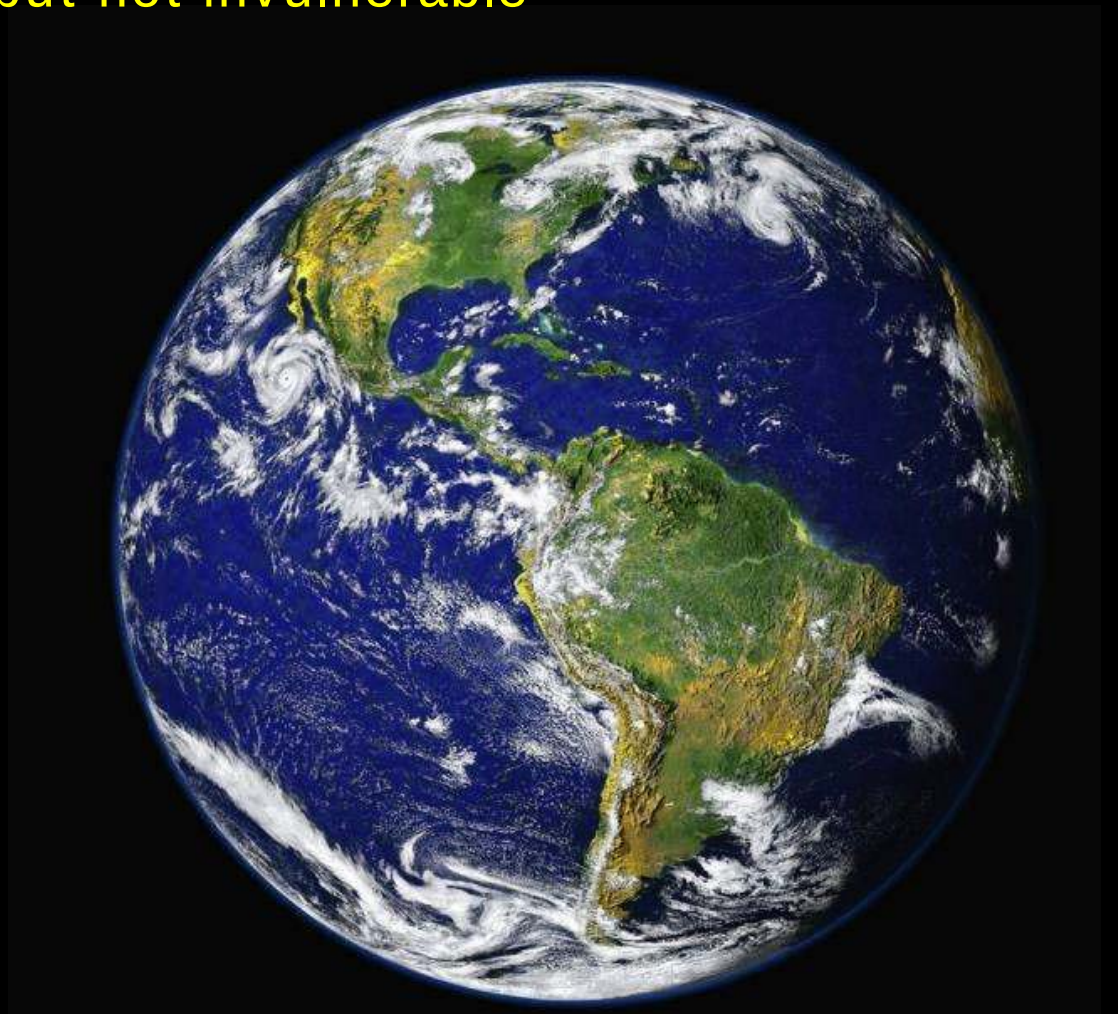
Technical innovations

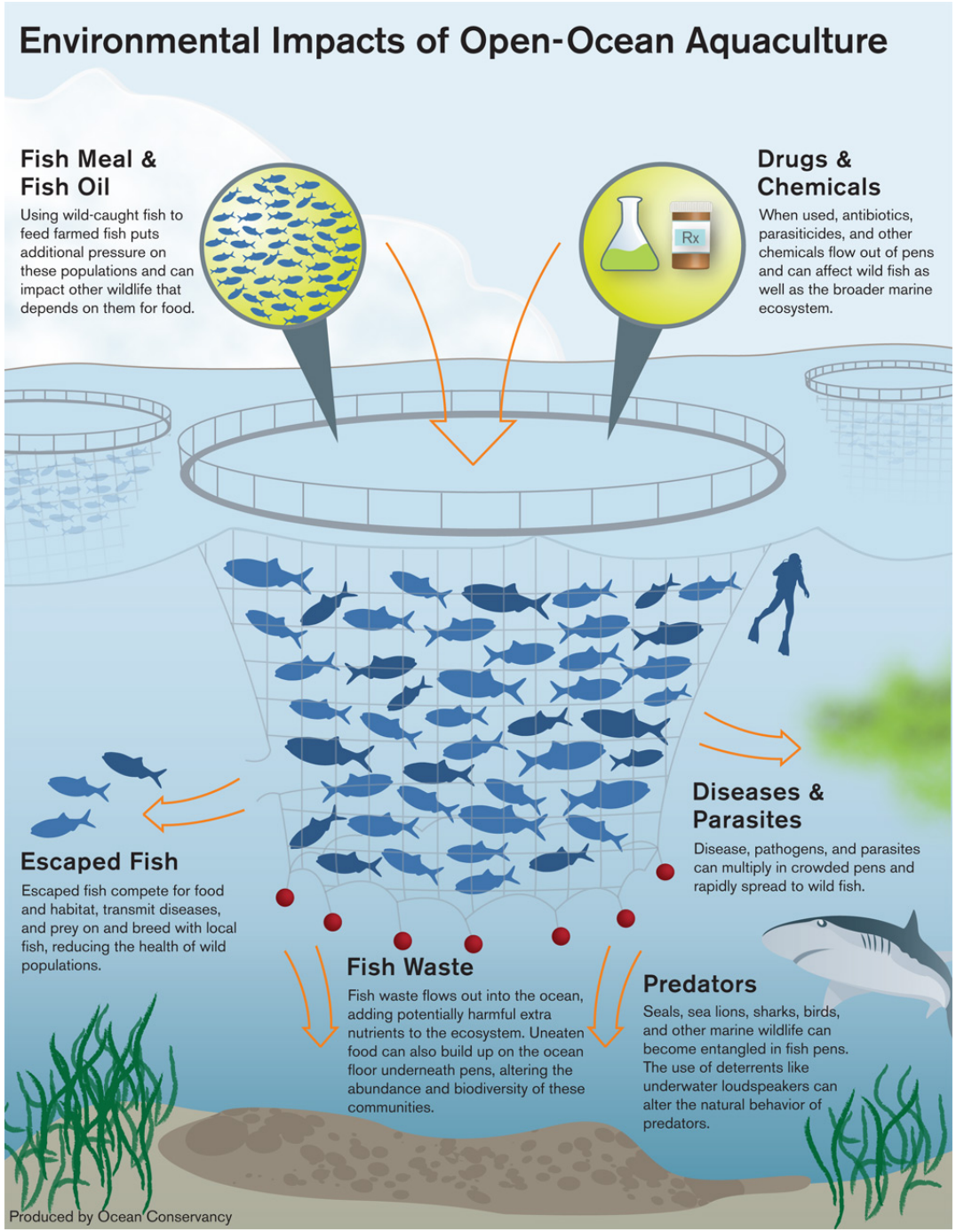


Sustainable development

The ocean is immense – but not invulnerable



Adverse effects Fish culture



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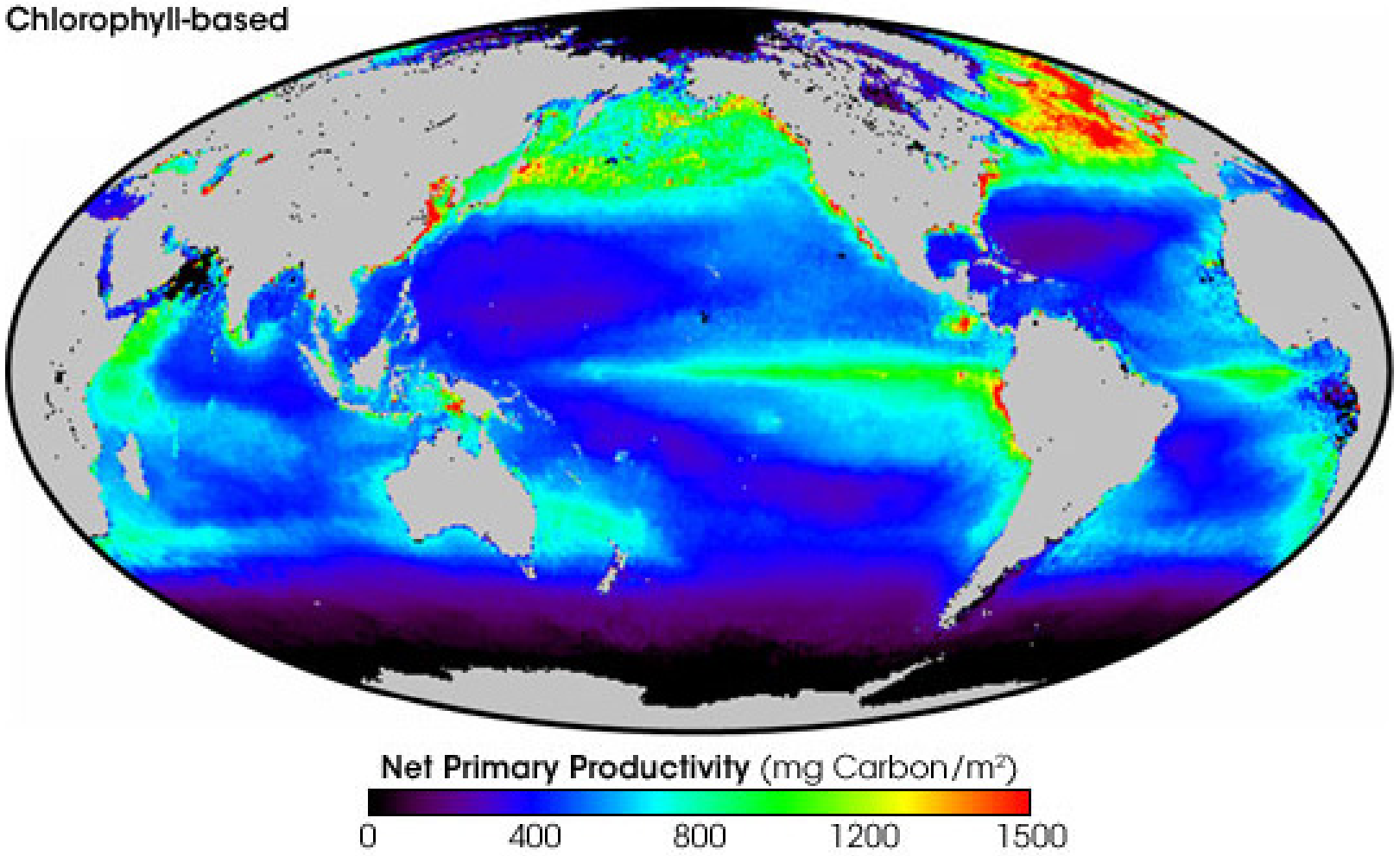
Extraction by shellfish & seaweed



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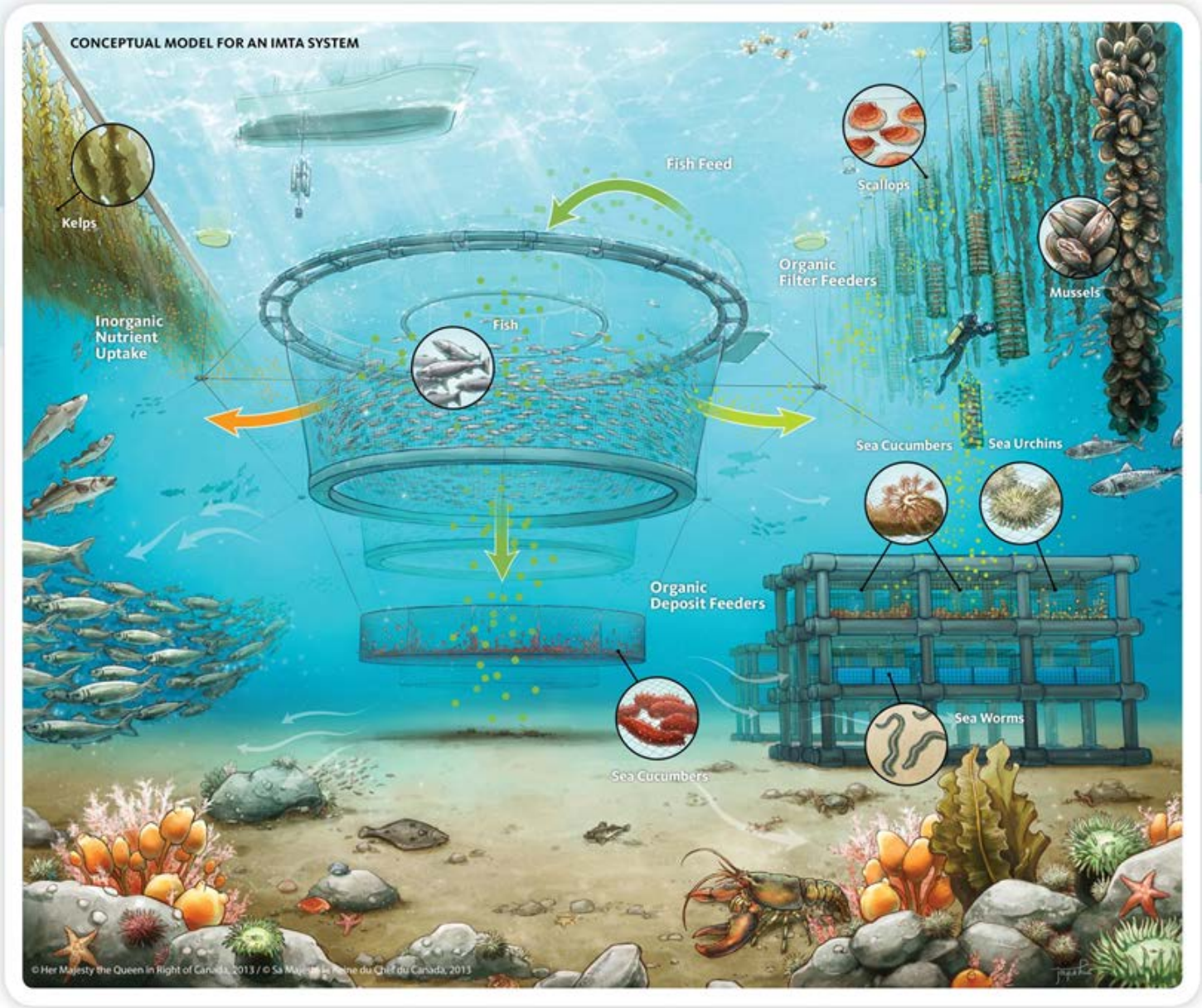
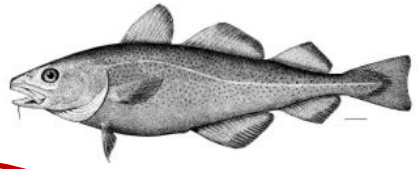
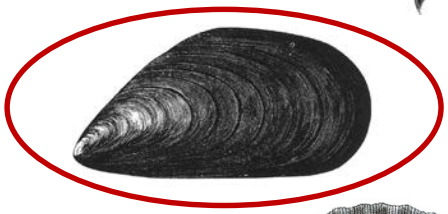
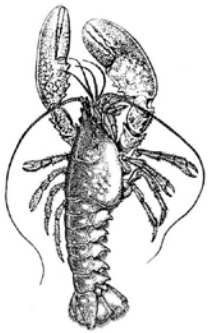
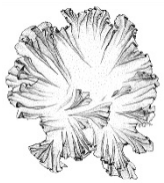
IMTA: an ecological puzzle











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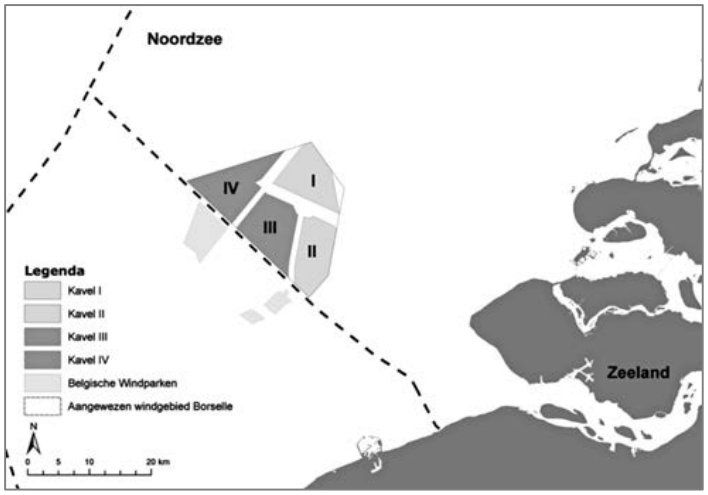
Mussel case study

- 344 km^2 > 2.5 km^2 mussels
- Annual production:
  - 5.5 thousand MT seed,
  - 4 thousand MT of juveniles
  - 2.8 thousand MT consumption

- Investment: 63 million €
- Operational: 67 million €
- Savings combination: 0.3 million €
- IRR: 18.2% (7.2 year)



Challenges:

Investment

Licencing

Stakeholder dialogue

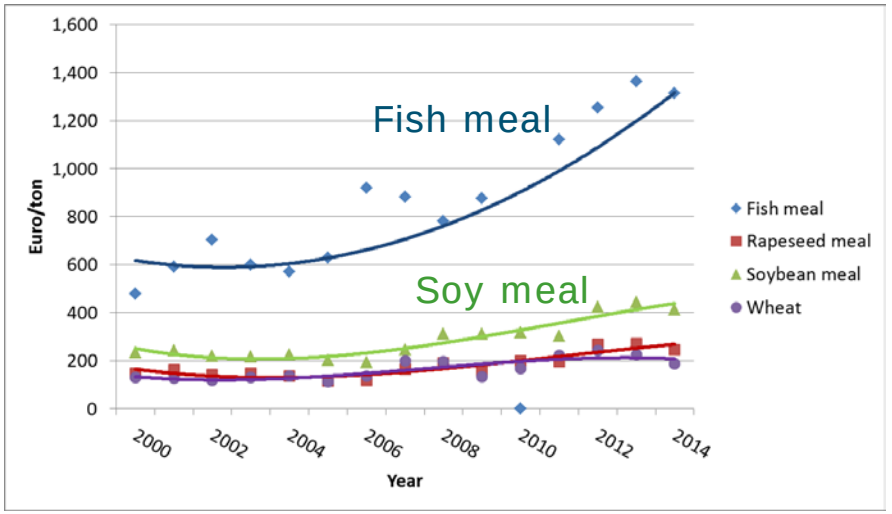
Seaweed – A range of products



- Food & non-food application
- Extraction of valuable components

Seaweed as **feed ingredient**

- Price proteins
- Said to boost immunity in fish
- reduce methane production by cows



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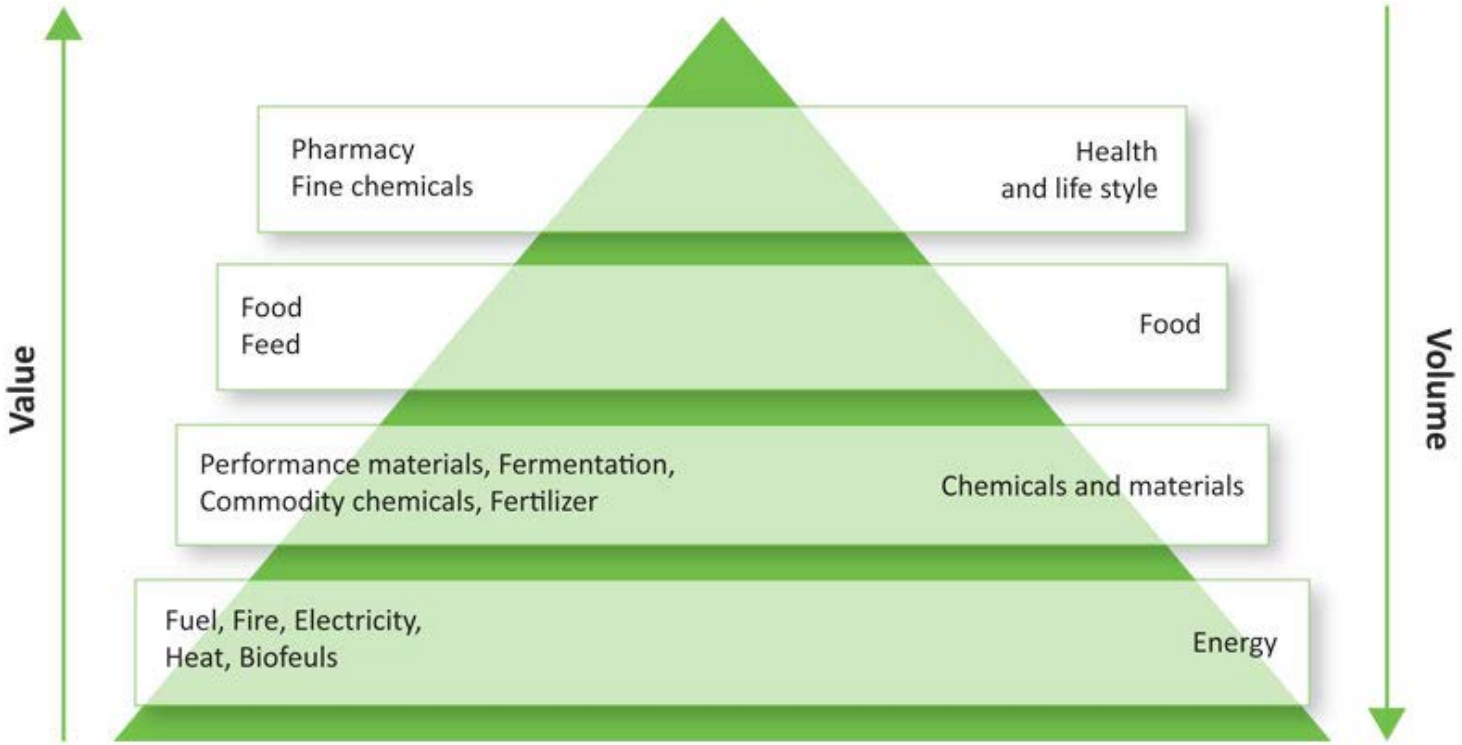
Seaweed case study



1. Current situation: value seaweed too low
2. Integrated development: Processing, Harvesting & Cultivation

To conclude - SWOT offshore aquaculture

Strengths - Space - Growth potential - Release pressure on land and coastal systems - Efficient compared to livestock production	**Weaknesses** - Investment - Business cases yet insecure
Opportunities - Innovations - Intensification - Processing - Wageningen UR can apply expertise from agriculture to offshore production techniques	**Threats** - Rough conditions - Safety at sea - Regulation - Competing claims


It’s about time for a blue revolution
Food from water to feed the world
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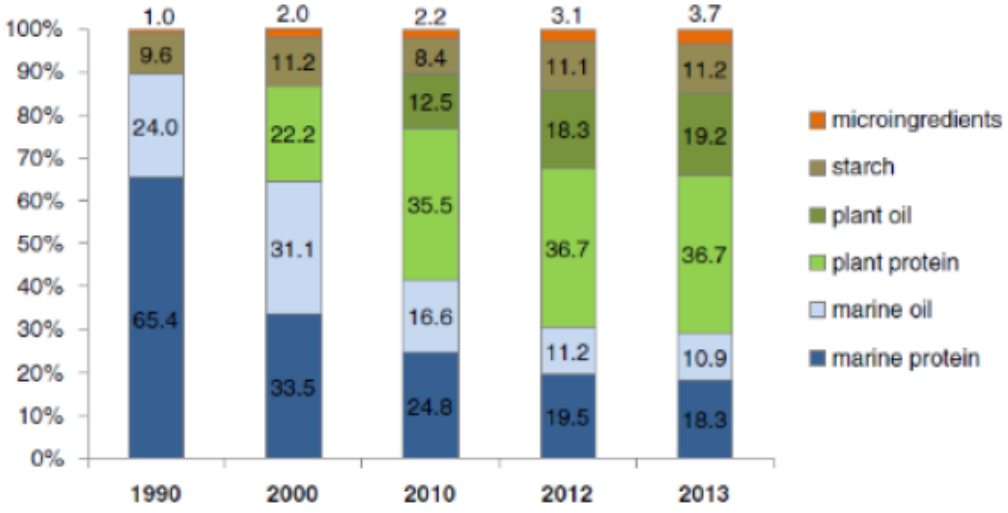
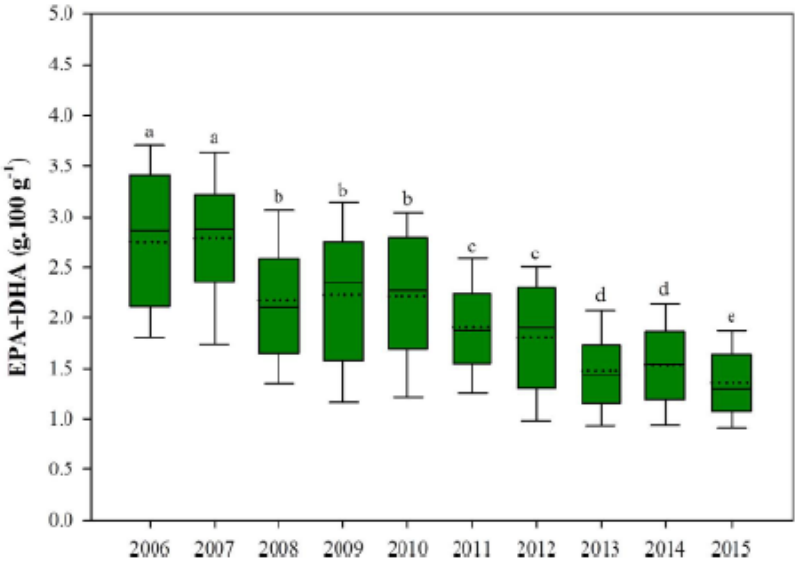
Resource use efficiency - fish feed

Evolution of salmon feeds over the past 25 years



Ytrestøyl et al. 2015. Aquaculture 448: 365-374.

LC-PUFA levels in the flesh



Sprague et al. 2016. Scientific Reports | 6:21892 | DOI: 10.1038/srep21892

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