

THE VALUE PROPOSITION FOR LAND-BASED RAS AQUACULTURE

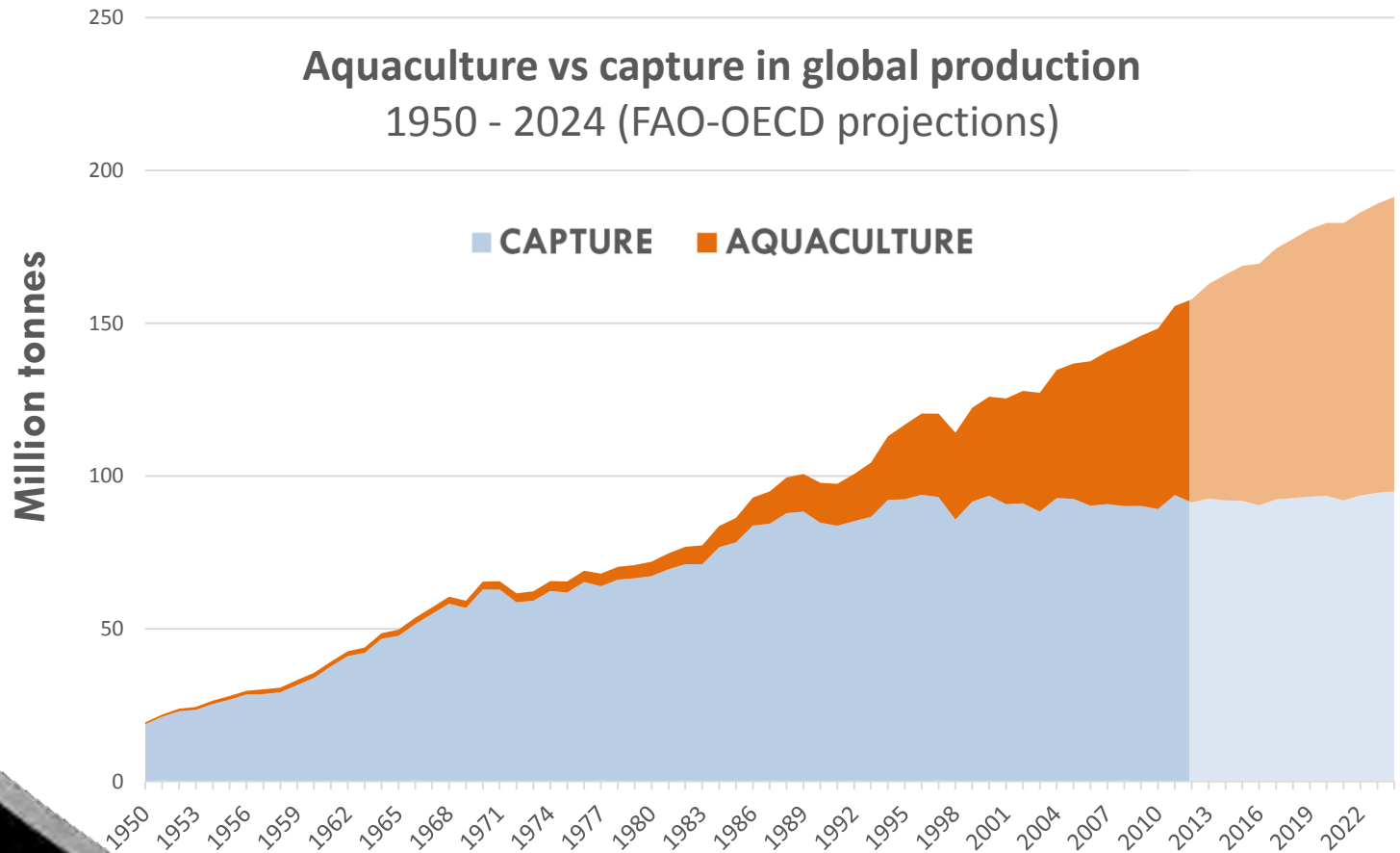
Photo: Interaqua



Eric Hobson, Kuterra LP
Guy Dean, Albion Fisheries Ltd
Gary Robinson, GRV Ltd

The opportunity

How to meet growing global seafood demand sustainably?



The Trends

Supply

Demand

Consumer expectations

Traceability requirements

Willingness to pay premium

RAS technology advances

RAS production knowledge

RAS production risk

Feed costs

Local food production

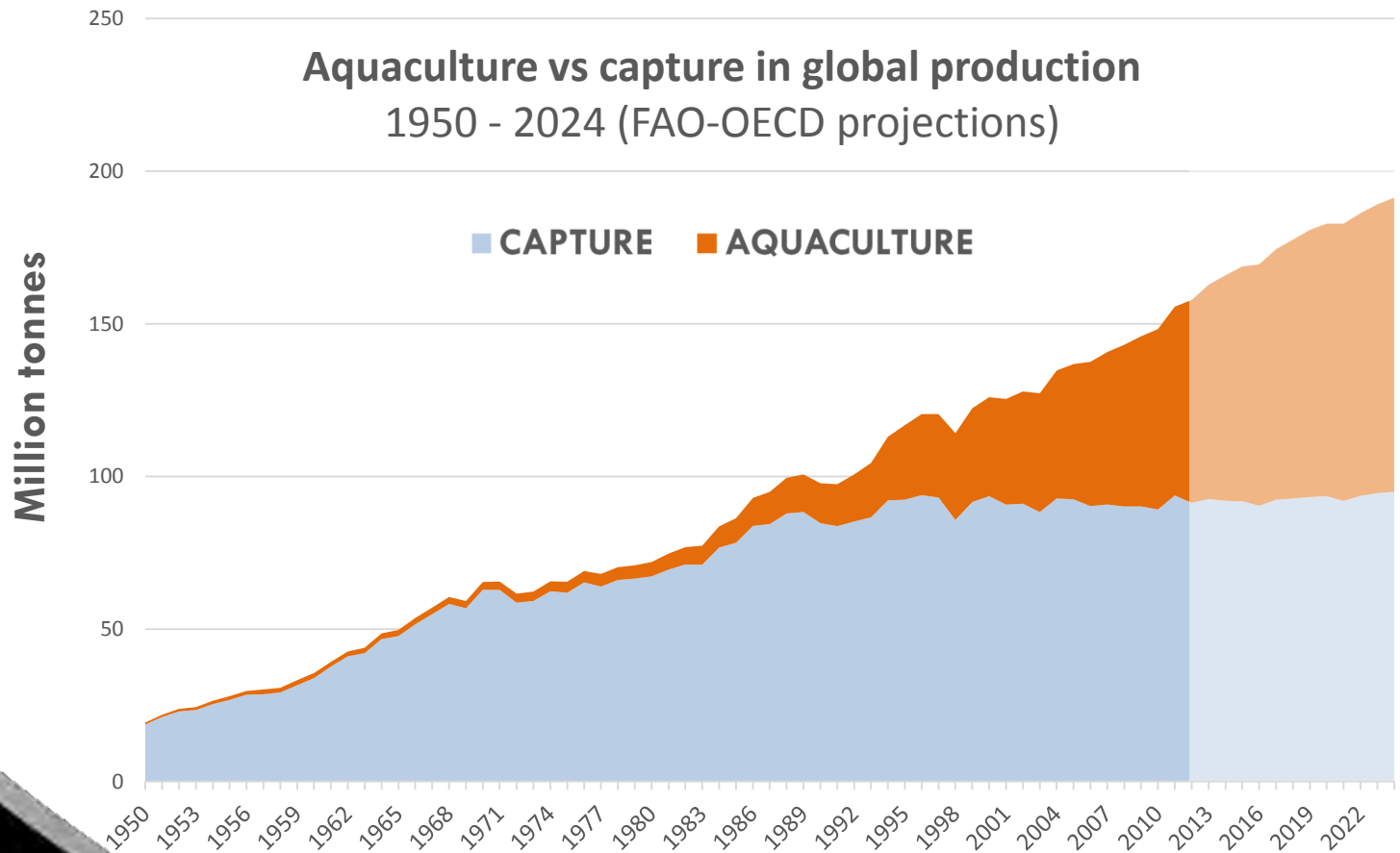
Environmental compliance costs

TREND

1

Growing seafood demand

Seafood consumption is growing.



TREND Growing seafood demand

1

Fishing is
near its limits



TREND Growing seafood demand

1

Ocean-based
aquaculture faces
challenges.



Photo: NASA ISS

TREND Rising consumer expectations

2

Factors people care about in choosing food

38% Chemicals, toxins, pesticides

31% Non-GMO

23% All natural, not artificial

18% Organic

15% Additives, fillers

11% Preservatives

Source: Nutrition Business Journal



Photo: Albion Fisheries

TREND Rising consumer expectations

2

The increasing appetite for sustainable seafood

The Marine Stewardship Council is the world's leading certification and ecolabelling program for sustainable seafood. Look for the blue MSC ecolabel when buying wild-caught fish and seafood.



agreed it's important for supermarkets to sell sustainably caught fish



believe restaurants should show sustainable seafood options on their menus



agreed buying sustainably caught seafood is helping restore fish stocks



agreed they trust brands using ecolabels more than those that don't

Sustainability and traceability high on the agenda when making purchasing decisions



sustainability

and 39% expressed an increased willingness to pay a little more for a product with an ecolabel



traceability



of seafood buyers actively look for fish from a sustainable source

Independent ecolabels are more trusted than a brand's own promise



of those who recognise the MSC ecolabel were more likely to think that the commercial fishing industry is improving its level of sustainability



9,019 regular seafood buyers were questioned across 15 countries;

Australia, Canada, Denmark, France, Finland, Germany, Japan, the Netherlands, Poland, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the USA. Surveys took place between 19 March to 25 July 2014.

TREND

Rising consumer expectations

2

MBA Seafood Watch assessment for
Recirculating Aquaculture Systems
for any species, grown anywhere

Criterion	Score (0-10)	Rank
C1 Data	7.00	GREEN
C2 Effluent	9.00	GREEN
C3 Habitat	6.83	GREEN
C4 Chemicals	6.00	YELLOW
C5 Feed	4.00	YELLOW
C6 Escapes	7.00	GREEN
C7 Disease	8.00	GREEN
C8 Source	10.00	GREEN
C9X Wildlife mortalities	-2.00	GREEN
C10X Introduced species escape	-2.00	GREEN
Total	53.83	
Final score	6.73	

Source: Seafood Watch



TREND

3

Increasing traceability

THIS
FISH

TRACE YOUR FISH

Enter the code from your fish or try a [sample code](#).

THISFISH CODE

L261145

TRACE



Source: ThisFish.info



TREND 4 Willingness to pay more for seafood that meets expectations

Wegmans Fresh Farm-Raised Boneless Atlantic Salmon Fillets - 1 Fillet



[Read all 2 reviews](#) [Write a review](#)

\$9.99 / lb.



Wegmans Food You Feel Good About Fresh Wild Alaska Sockeye Salmon Fillet



[Read all 2 reviews](#) [Write a review](#)

\$14.99 / lb.



Wegmans Food You Feel Good About EU Organic Salmon - 1 Fillet



[Read all 2 reviews](#) [Write a review](#)

\$16.99 / lb.



TREND RAS technology advances

5

Technology advances through

- Optimization
- Standardization
- Scale

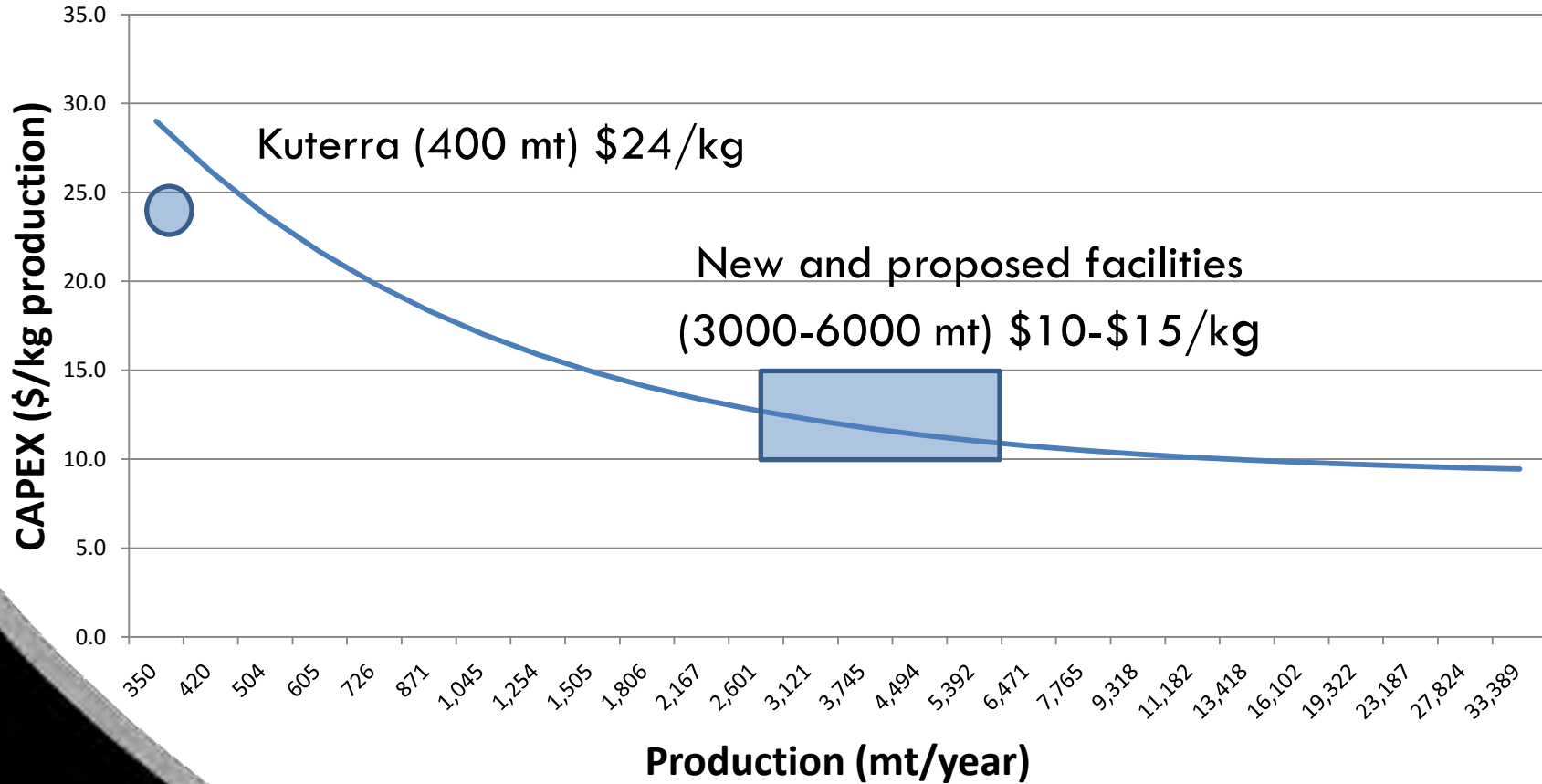


Image: Akva Group

TREND RAS technology advances

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Scale vs CAPEX



TREND RAS technology advances

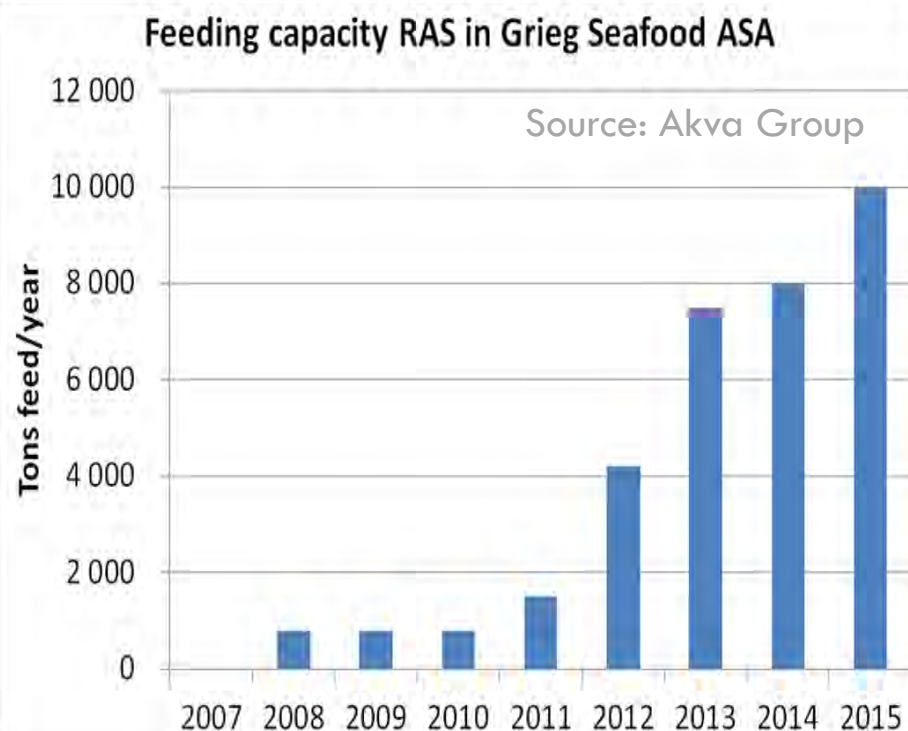
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Key technology drivers

- Increasing use of RAS by primary production industries
- Changing economics of RAS production
- Incubation centres: Regions with active and connected industry, producer, supplier and research communities (eg. Denmark, Norway)
- Centres of aquaculture excellence (eg. Freshwater Institute)



Photo: Nofima



TREND RAS technology advances

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Where we
came from



TREND RAS technology advances

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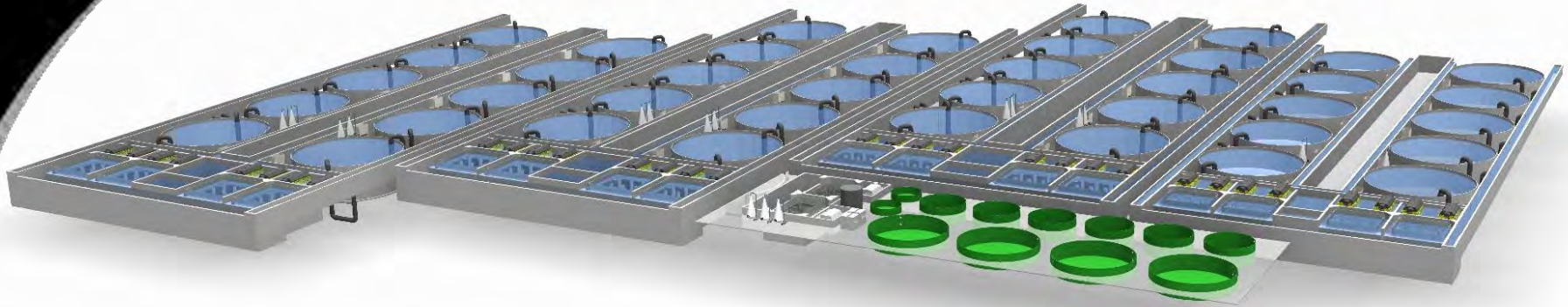
Today



Photo: Akva Group

TREND RAS technology advances

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Where we
are going

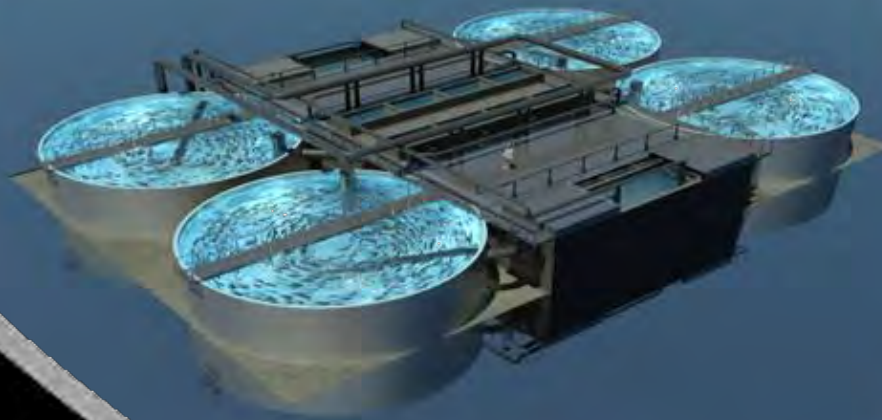


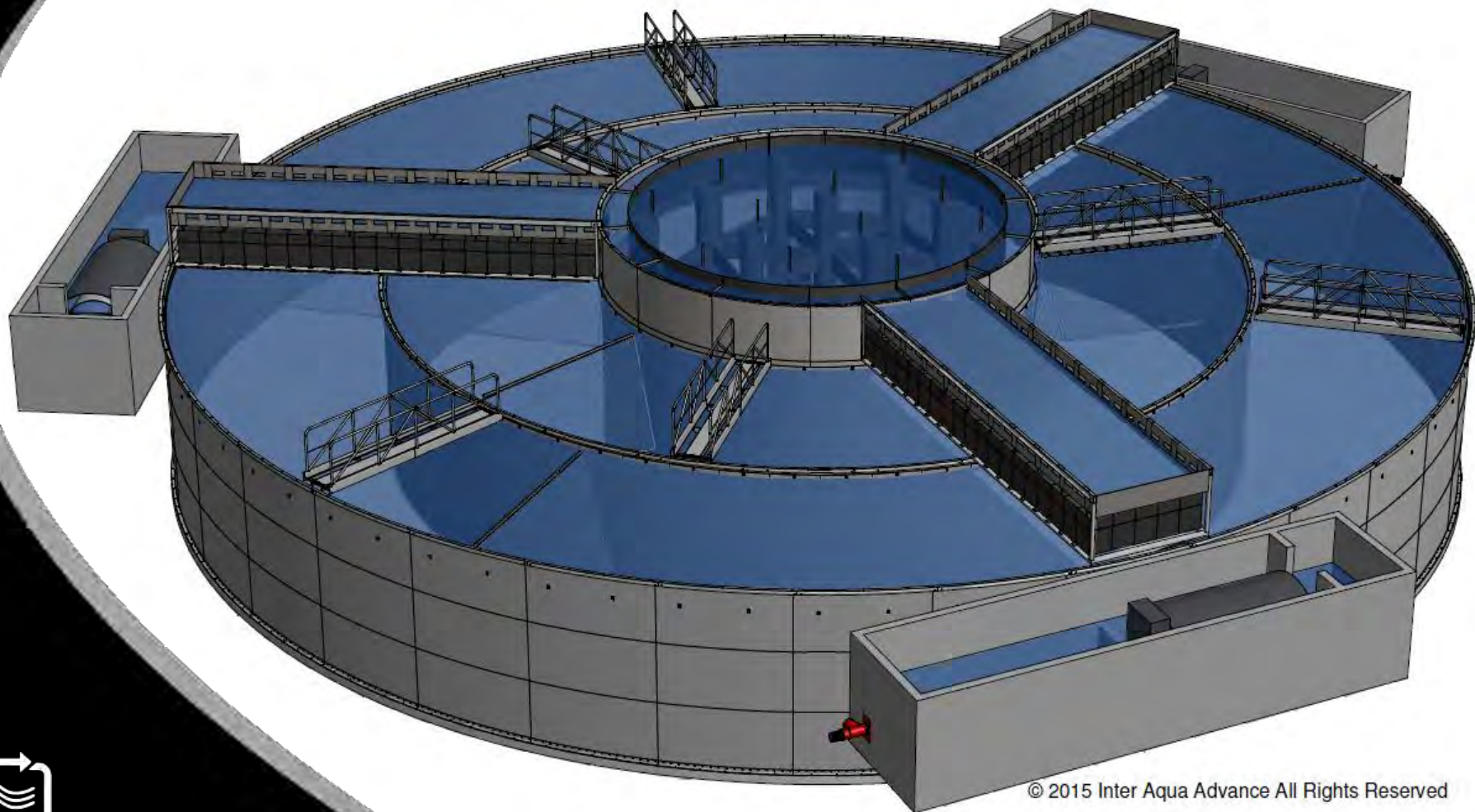
Photo: Akva Group



TREND RAS technology advances

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New directions

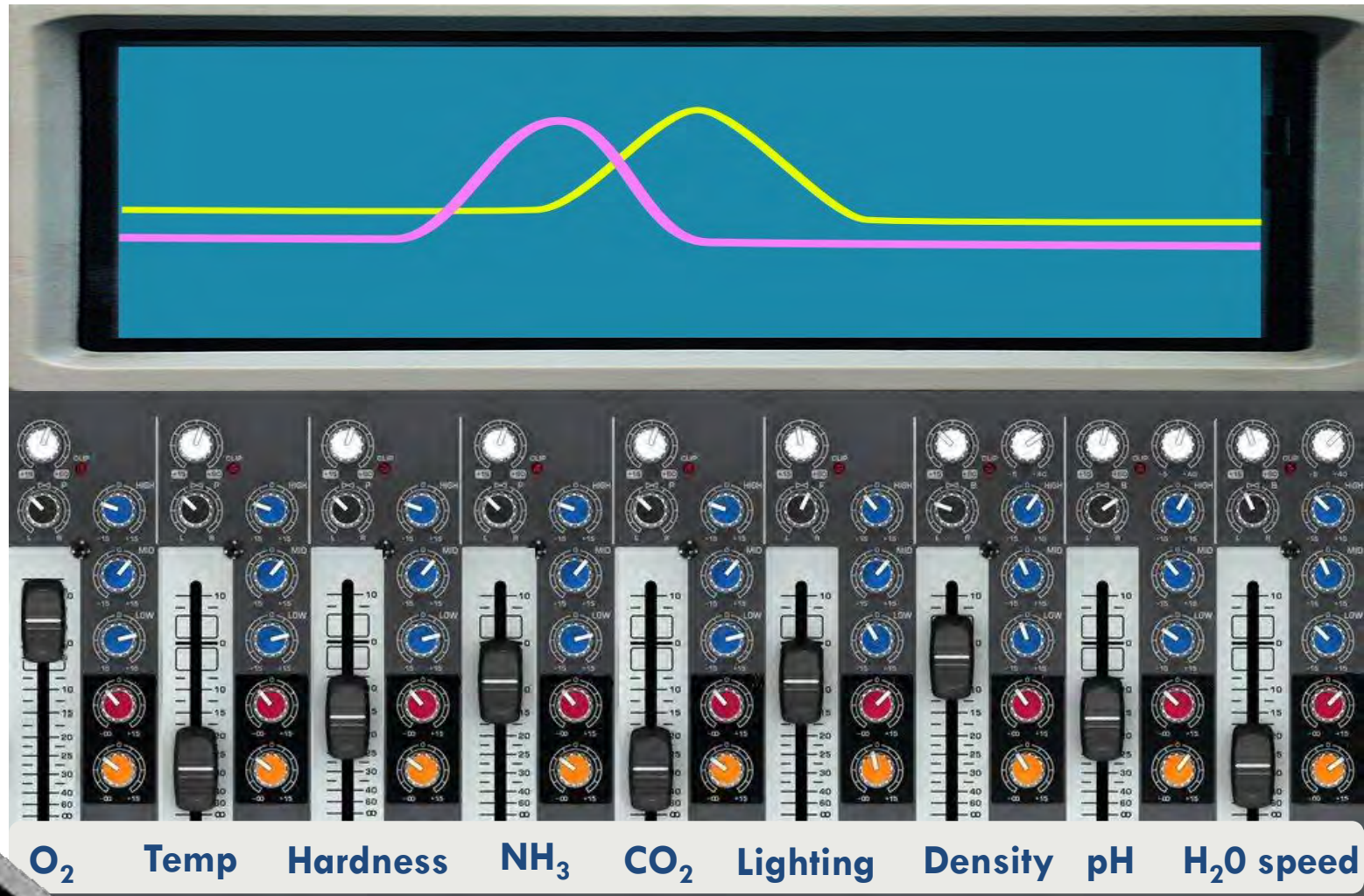


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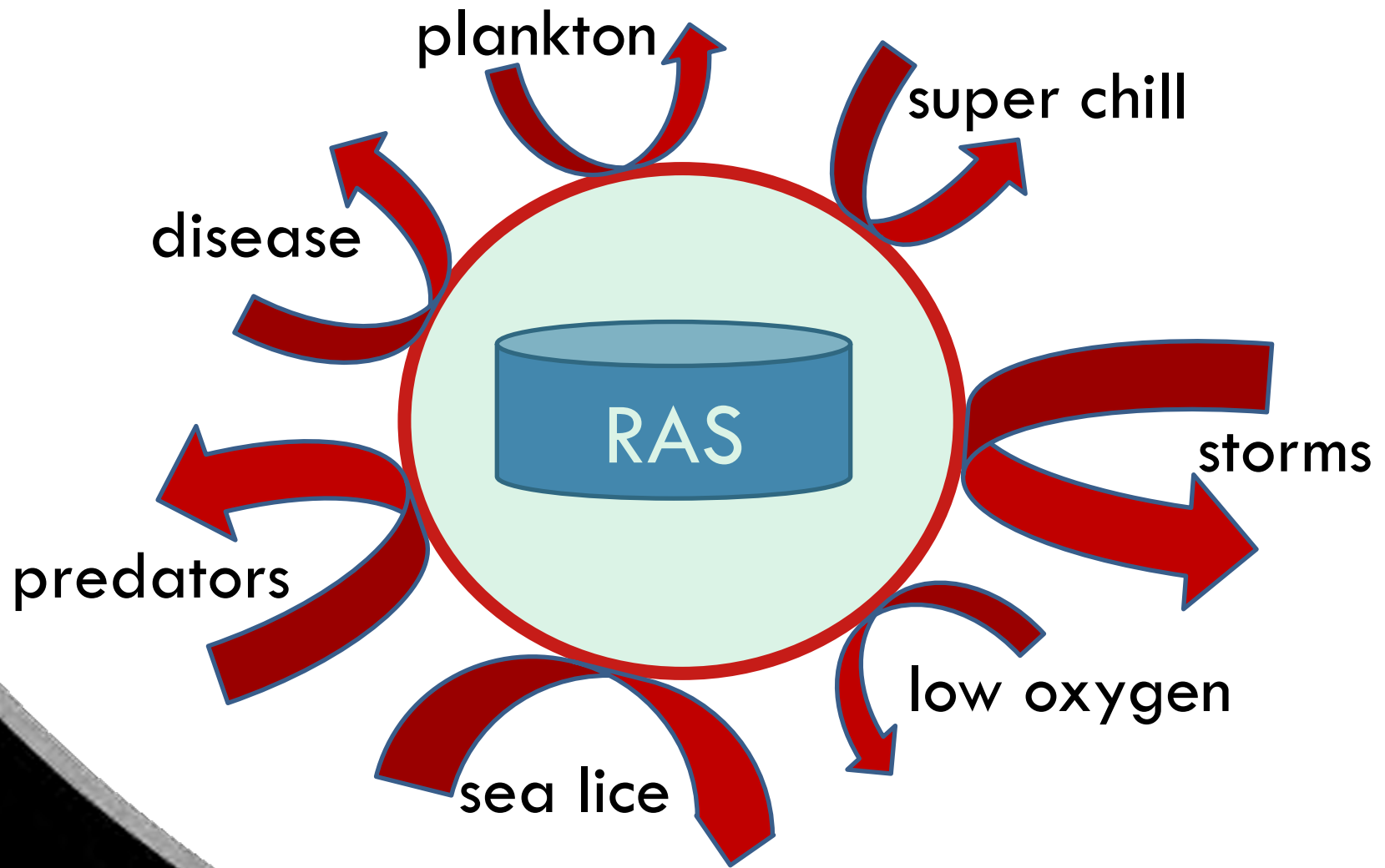
TREND Advancing production knowledge

6



TREND **Falling production risk**

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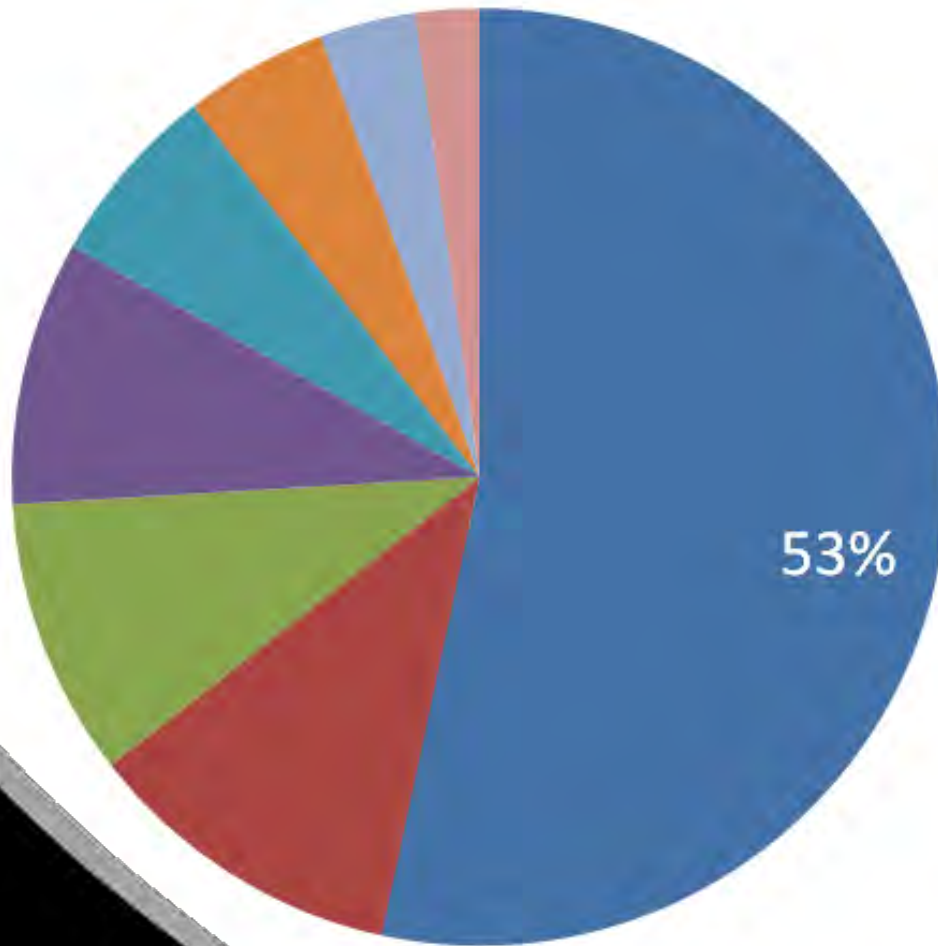


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Rising feed costs

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3000 mt/y RAS model farm



Production costs

■ **Feed**

■ Smolts (hatchery)

■ Water treatments

■ Energy

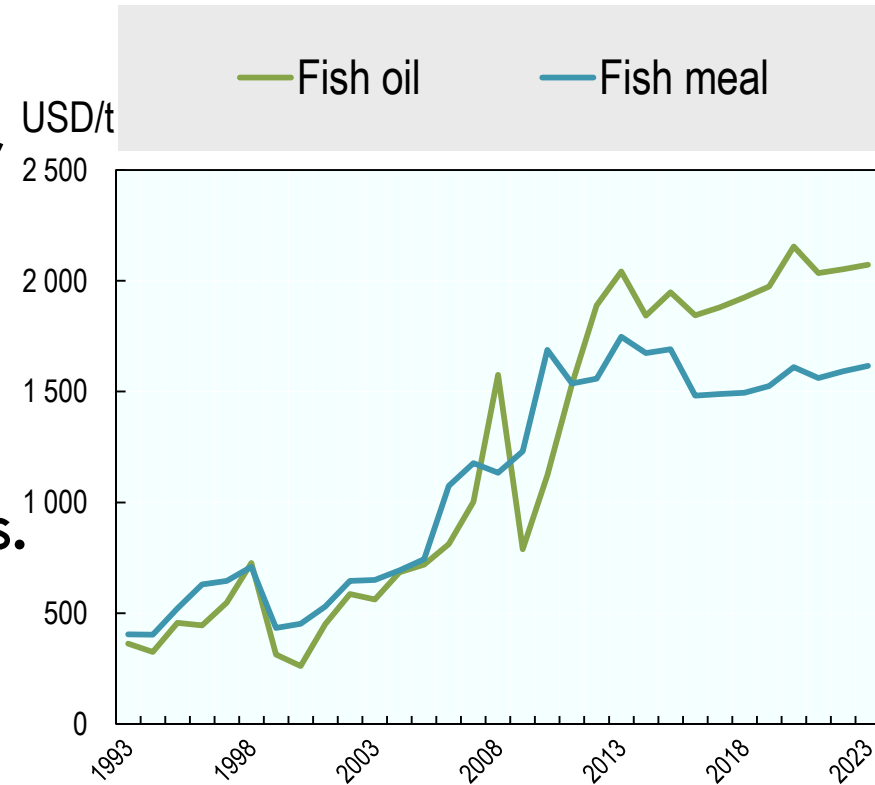
■ Labour

■ Insurance

■ Maintenance



- RAS offers the potential for optimized fish performance, which = maximized feed conversion.
- Other forms of aquaculture have less capacity to do this.
- As feed costs increase, RAS competitiveness improves.

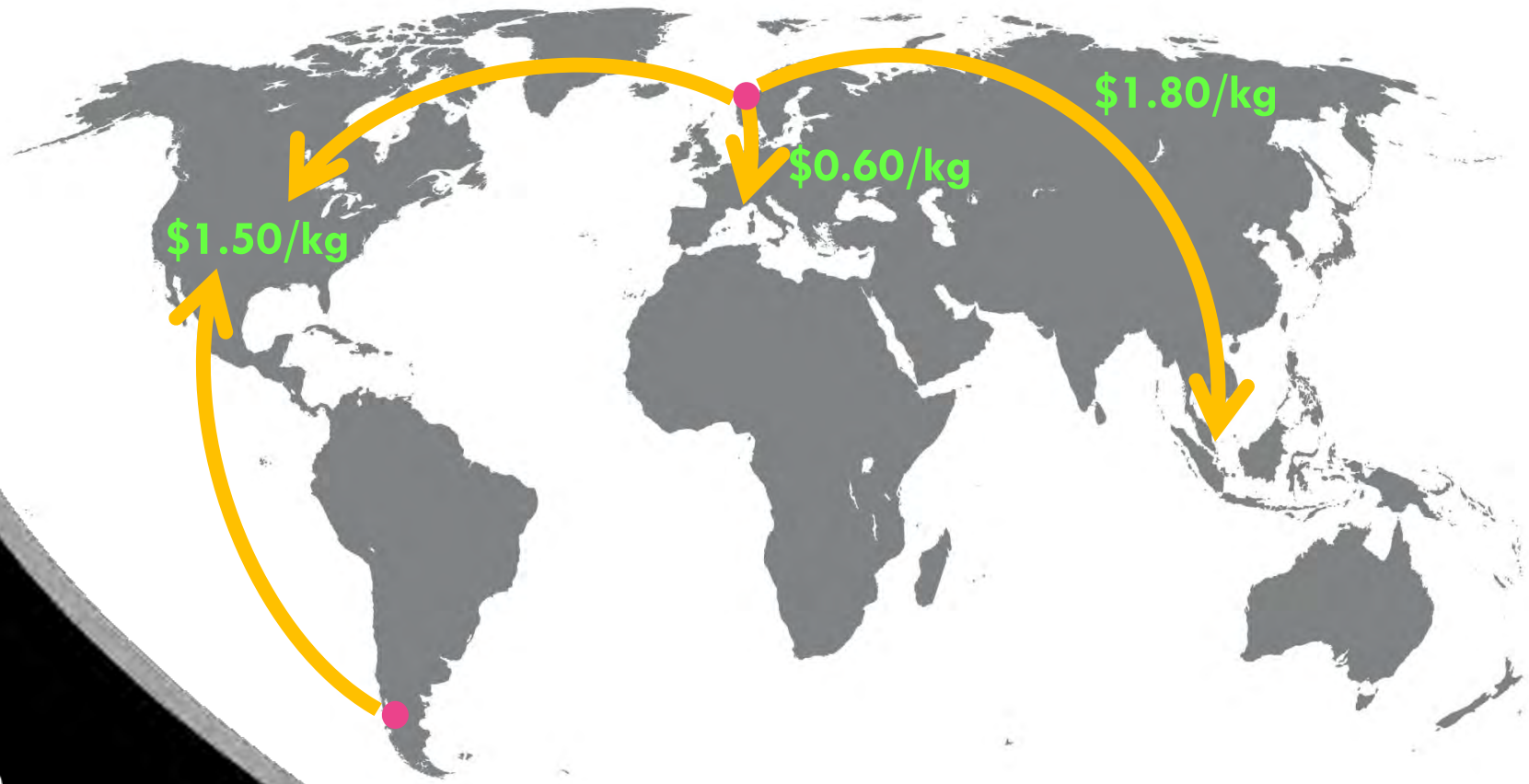


Source: OECD - FAO Agricultural Outlook 2014 - 2023

TREND Local food production

9

Sample freight savings from local production (USD)



TREND

Local food production

9



or



Photo: Interaqua

TREND 10

Rising environmental compliance costs

- Site productivity limits
- Sea lice treatments
- Net strength limits
- Monitoring and reporting
- Licence and tenure fees



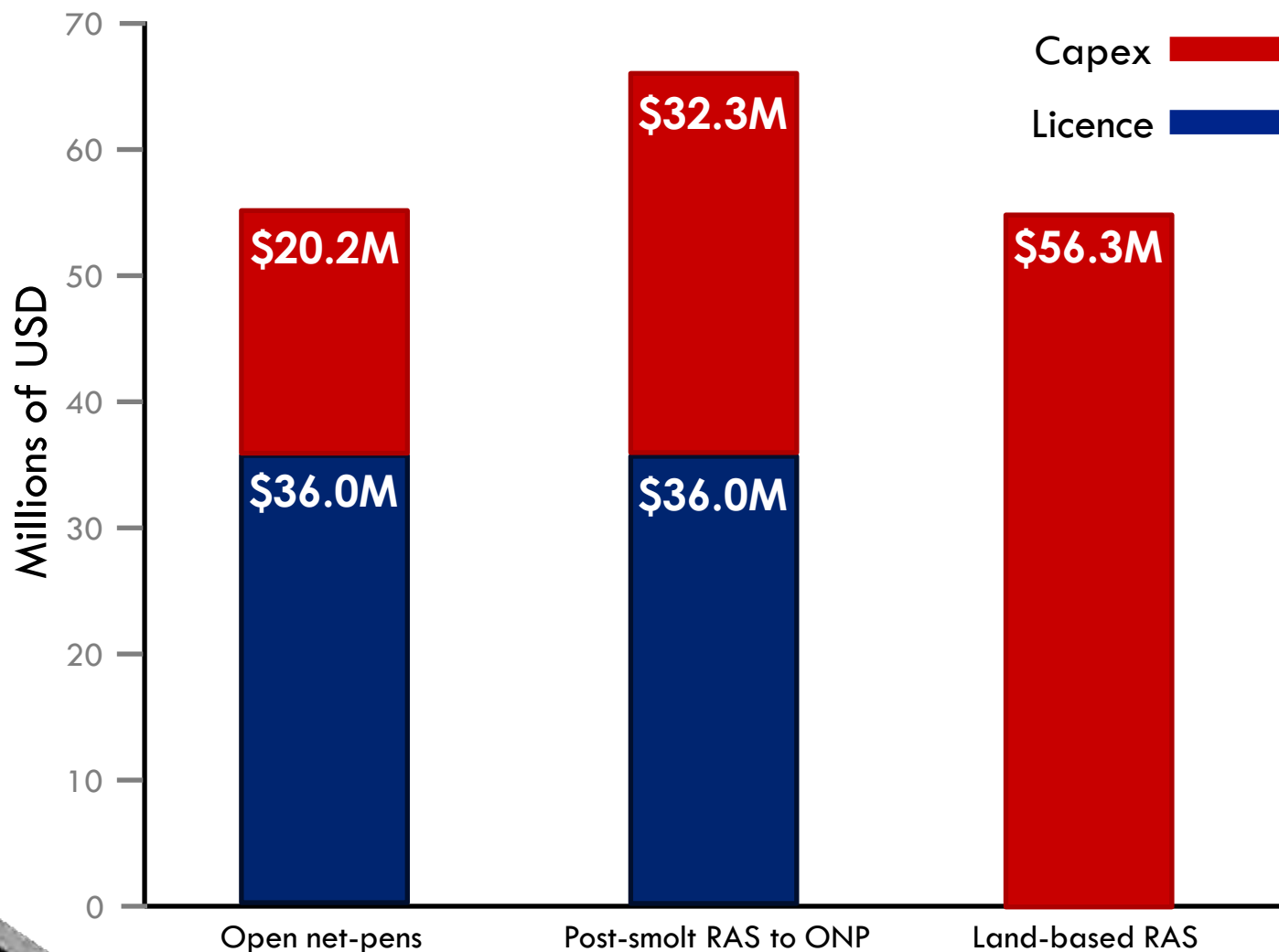
**What does all this mean for the
RAS industry?**



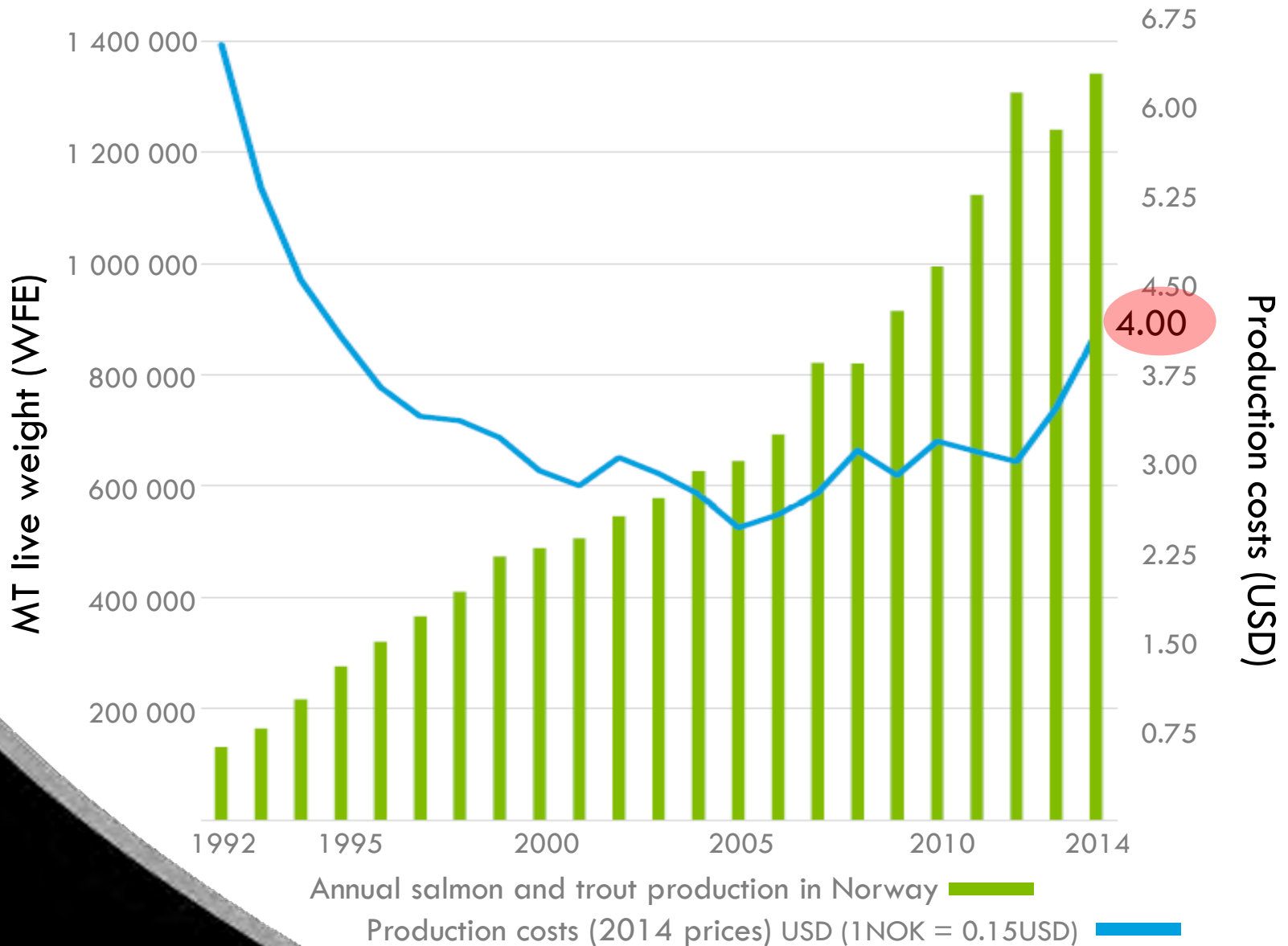
Capital costs

5000 MT in Norway

- Hatchery included in each scenario
- 1 NOK = 0.15 USD
- Licence cost = \$12m per 1250-1667 MT



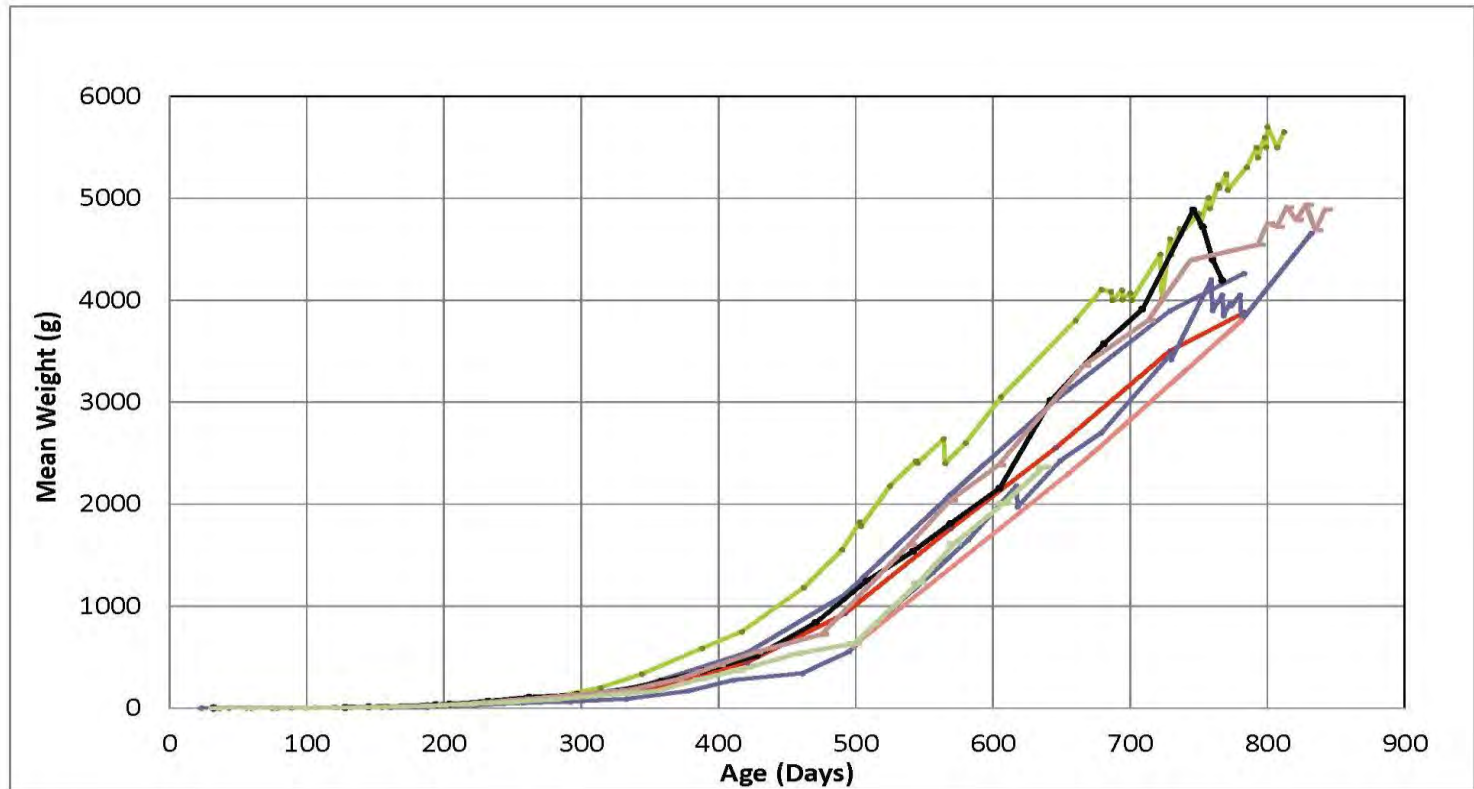
Production costs



Source: Norway Directorate of Fisheries via Anders Gjendemsjø, Deloitte AS, commissioned by Akva Group

Growth

Freshwater Institute growout trials 1-8



Leads to convergence

RAS

currently

Capital

Production
costs

RAS

over time

Capital

Production
costs

Netpens

over time

Capital

Production
costs

Traditional
netpens

currently

Capital

Production
costs



THE VALUE PROPOSITION FOR LAND-BASED RAS AQUACULTURE

RAS is the future of the Aquaculture Industry despite being more **capital intensive** than traditional approaches. RAS has major advantages such as **lower water** and **area requirements, year-round production, temperature control** and **mitigation of environmental effects**. RAS is **species adaptable**, allowing operators to **follow market trends** for seafood preference. RAS is also a “**point**” pollution source, enabling efficient solids waste treatment and nutrients removal, which allows **reducing the impact on the environment at a reasonable cost**.

- Youri Gendel, Ori Lahav, Technion - Israel



Thank you



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