



THE THIRD WAY

Open Ocean Aquaculture



Possibilities for France to develop salmon/trout production in own waters and combine with offshore wind for improved maritime spatial use

DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

THE TEAM



Karl Strømsem · 1st

Founder & CoB: PhD Hydrodynamics, 25 years + in O&G, energy and aquaculture industries (incl Lerøy, since 2012). Serial entrepreneur, including with exit to PE fund. Main career in Europe and UK, managed several EU funded R&D and Innovation projects. Short period in the Norwegian Government with Innovation and export on cleantech and energy



Paal Hylin

Founder & CEO: MSc, Industrial Economics, Norway, Master of Energy Economics, IFP Paris
25 years + in O&G industry holding CEO, COO positions in 250 mill USD turnover companies with 600+ employees, 5 years as entrepreneur and founder of start-up within maritime and aquaculture industries



Morten Jantzen Lyssand

Founder & CTO: MSc, Nautical Science, Norway.
20 years in O&G-, risk management and aquaculture industries. Head of Global Maritime, Oslo, developing company's aquaculture branch. Specialist within marine operations, project and risk management



Brit Hjeltnes · 1st
Fish Health Expert

Scientific Advisor: Dr. Scient Fish Vaccinology and Bacteriology, Former Deputy Director of Fish and Shellfish at the Norwegian Veterinary Institute (NVI) and Research Director in Fish Health at Institute of Marine Research (IMR). Professor in fish health at University of Tromsø and having taught fish health at University of Bergen, University of Dacca, Bangladesh and University of Nha Trang, Vietnam.



Freddy Knutsen · 2nd
Owner, RTS



Odd Kåre Øygarden · 2nd
Owner, RTS



Freddy and Odd Kåre are founders and owners of RTS, a subsea technology service company, providing advanced electronic equipment and engineering solutions to the world's major offshore companies involved in subsea construction projects.



Gunnar CARLSON, Marine Engineer and serial entrepreneur. Key player in building up the shipyard-, marine technology- and IT technology industries at Måløy (Norway). Established Easyform, Stadt Towing Tank and Måløy Verft under the Sea Technology umbrella to become an integrated provider of design and construction of advanced marine structures.

DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de L'INGÉNIERIE MARITIME

CAEN

THE PARTNERS

The technology company SUBFARM AS is established at Måløy, a technology and service hub for the maritime and aquaculture industries in Norway.

The company will be a fully independent commercial entity, servicing the aquaculture industry worldwide

Technology development and service agreements are in place with core partners:

Sea Technology group (Gunnar Carlson, shareholder in OOH)

- Design, model testing and analysis (www.stadttowingtank.no)
- Cage and feed buoy fabrication (www.maloy-verft.no and www.easyform.no)

Selstad (www.selstad.no)

- Design and provision of advanced net systems
- Cage- and mooring outfitting
- Worldwide sales & marketing network

RTS (www.rts.as)

- Control systems
- Sensors
- AI/Precision Farming

Core Partners

SEA
TECHNOLOGY

SELSTAD




rts


Advisors, aquaculture


 **SINTEF**
OCEAN

 **AquaGen**

Preferred industry vendors

 **SEVAN** Offshore harsh environment floating feed buoy

 **Nexans** Umbilicals and subsea tie-in solutions
ELECTRIFY THE FUTURE

 **FiReCo** Design and engineering specialist, composite structures

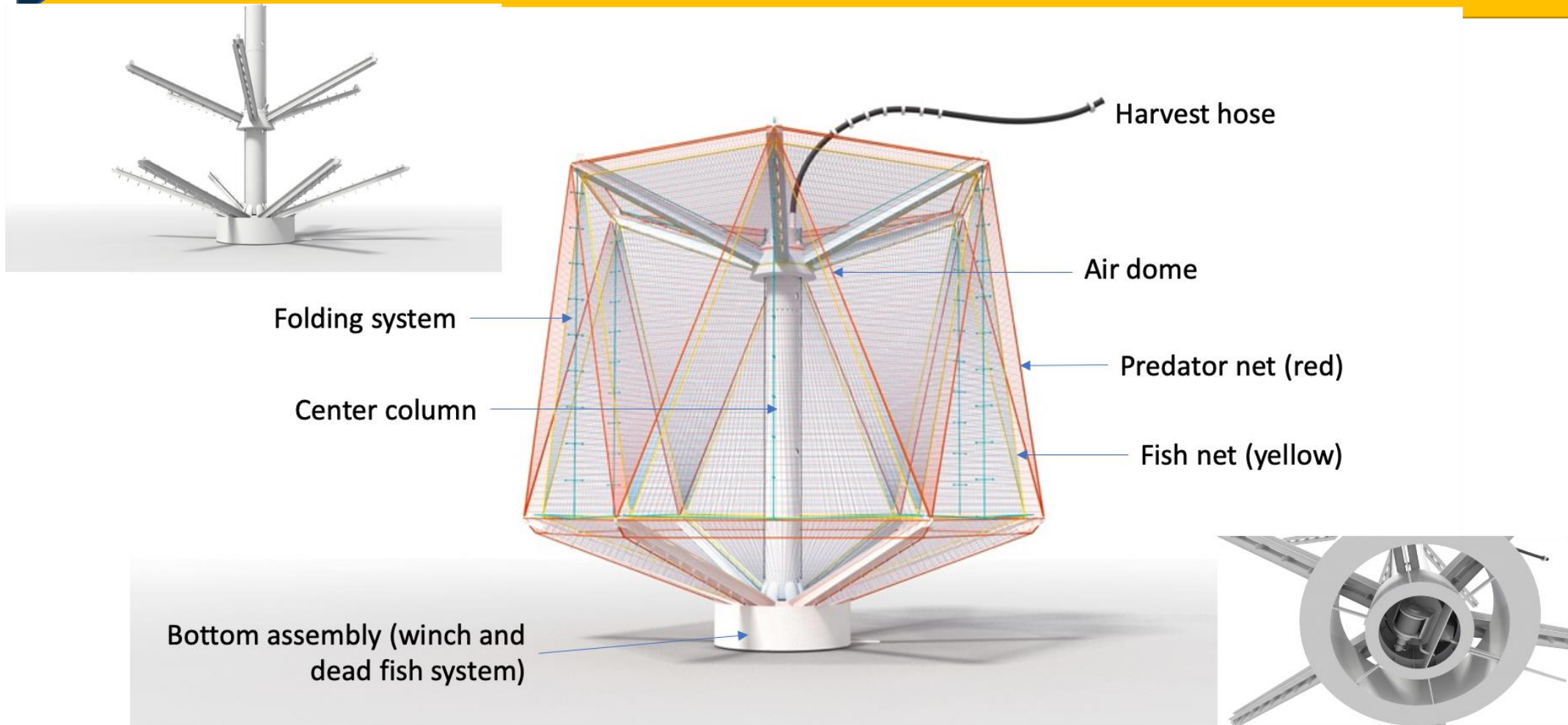
DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

THE CONCEPT

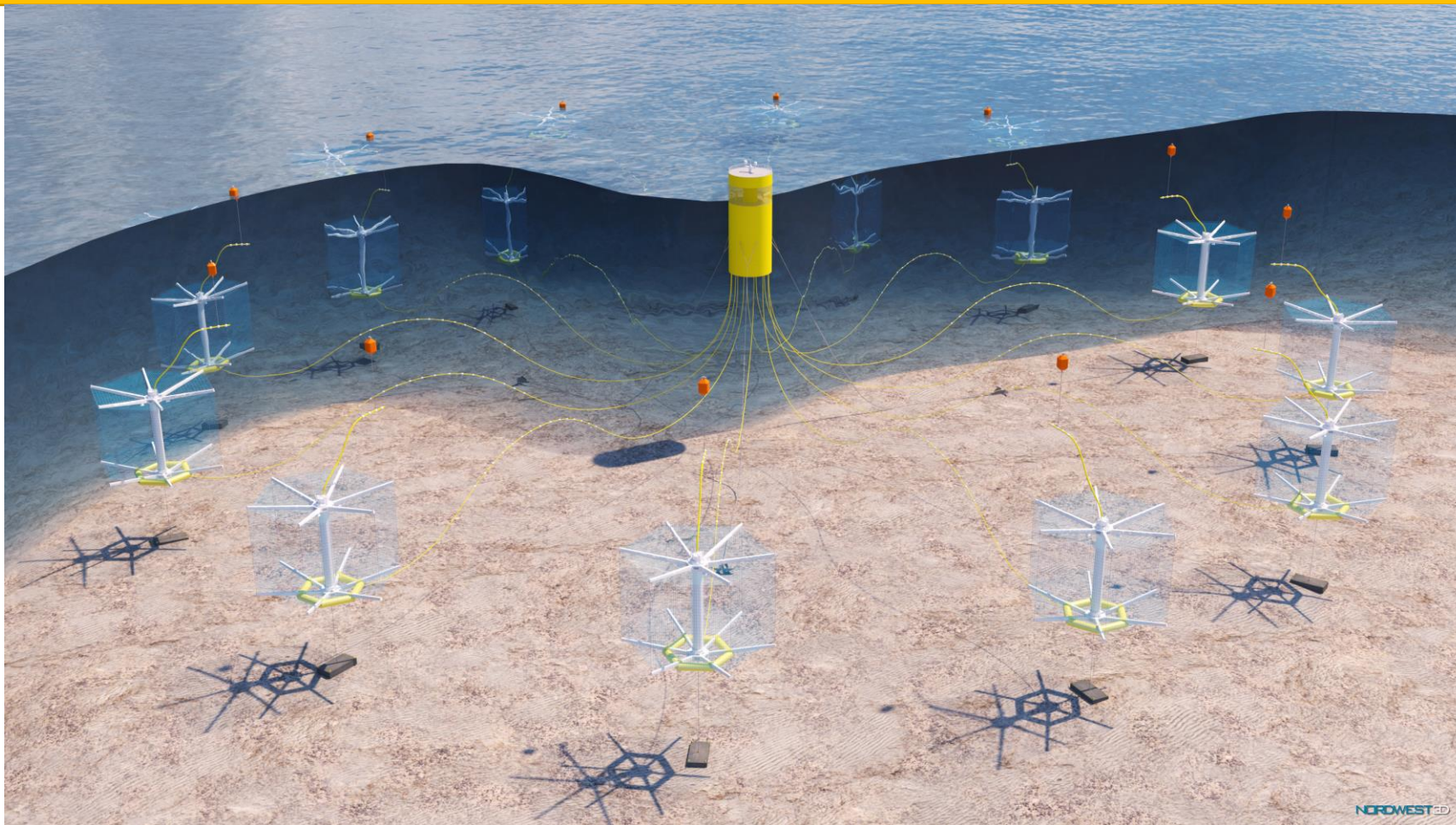


DU 22 AU 24
JUN 2022

1^{ères} Rencontres de L'INGENIERIE MARITIME

CAEN

THE SOLUTION



DU 22 AU 24
JUN 2022

1^{ères} Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

PRESENT STATE OF THE UNION AND TRENDS IN THE MARKET

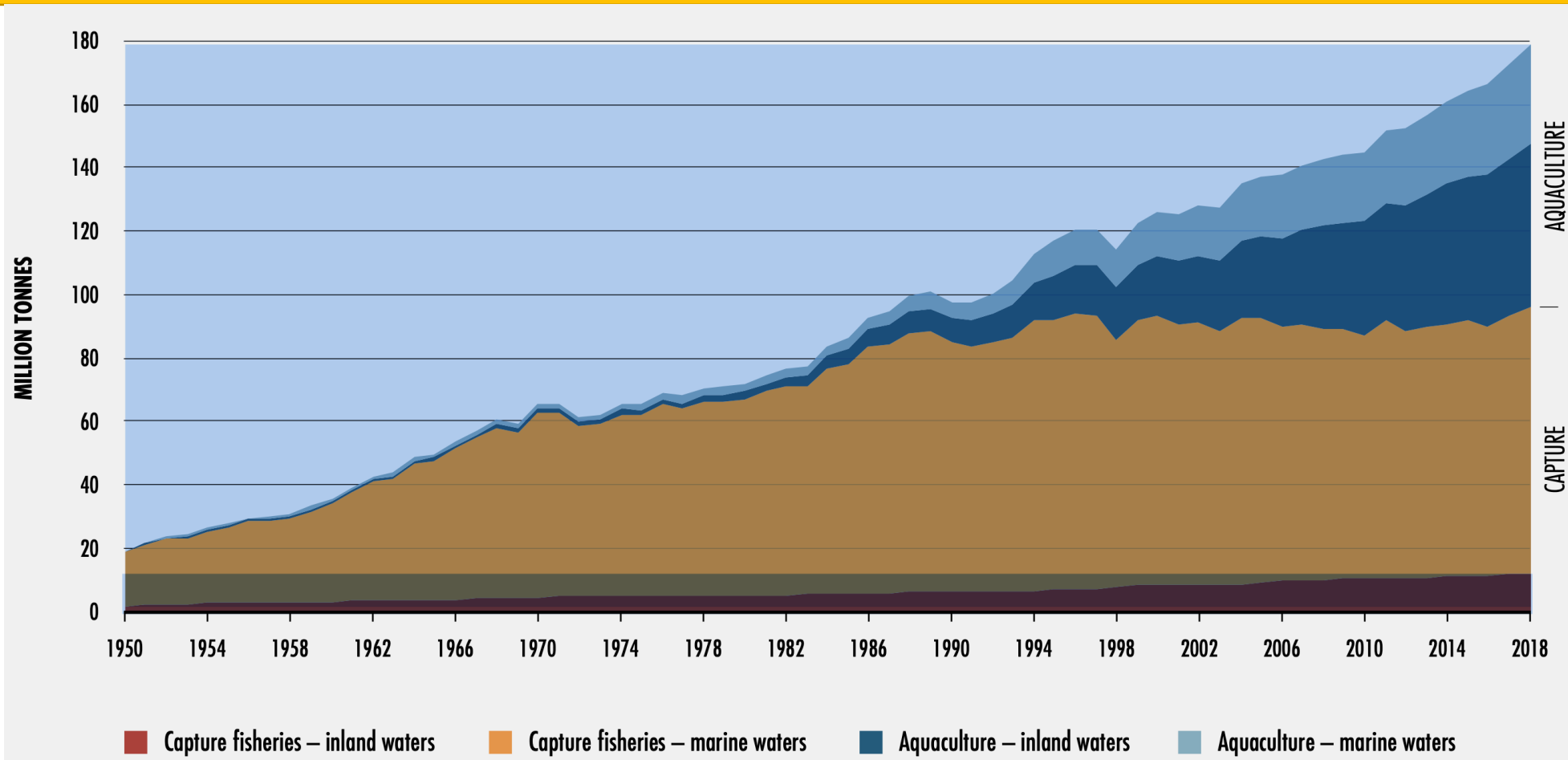
Salmon farming, rationale, technical solutions today, going more exposed offshore

DU 22 AU 24
JUN 2022

1^{ères} Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

WHY AQUACULTURE

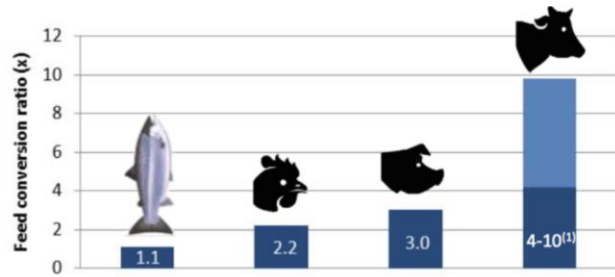


DU 22 AU 24
JUN 2022

1^{ères} Rencontres de L'INGÉNIERIE MARITIME

CAEN

SDG, SALMON AQUACULTURE, IMPACTS



Note (1): FCR of cattle varies between 4.2 and 9.8 depending on feed (finished on cereal or grass)

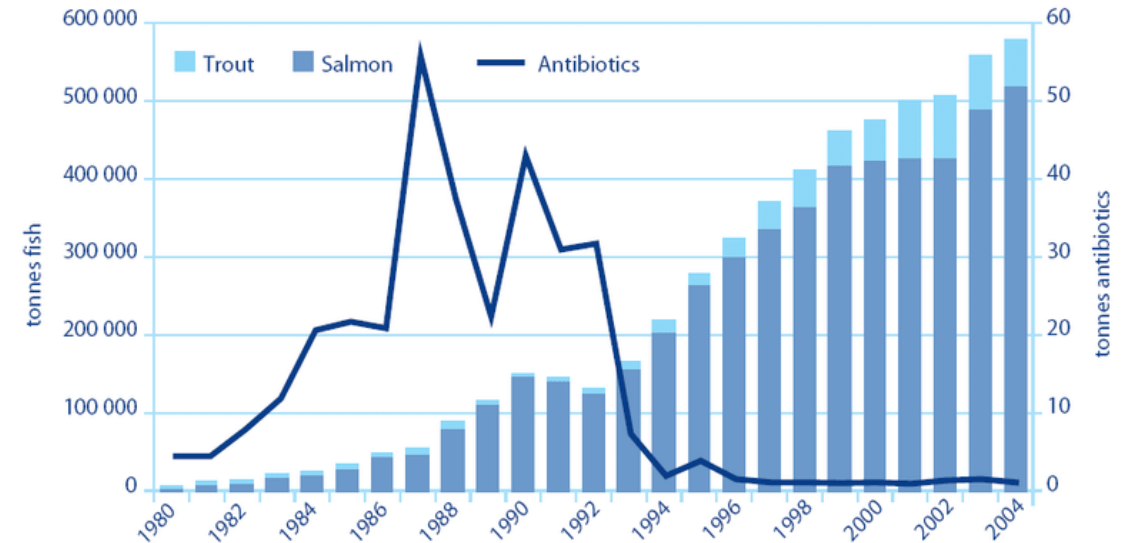
Energy retention	27%	10%	14%	27%
Protein retention	24%	21%	18%	15%
Edible yield	68%	46%	52%	41%
Edible meat pr 100 kg fed	61 kg	21 kg	17 kg	4-10 kg



Carbon footprint kg CO2/kg edible meat	2.9 kg	3.4 kg	5.9 kg	30 kg
Water consumption litre/kg edible meat	1,400 litre ⁽¹⁾	4,300 litre	6,000 litre	15,400 litre

Note: 1) The figure reflects traditional smolt production in plants with water flow through. Recirculation plants, which are being implemented to an increasing extent, requires significantly less fresh water (up to 99% of the fresh water is recycled).

Antibiotics used in Norwegian farming of trout and salmon 1980-2004



Source: The Norwegian Medicinal Depot, The Directorate of Fisheries

DU 22 AU 24
JUN 2022

1^{ères} Rencontres de L'INGÉNIERIE MARITIME

CAEN

TRENDS

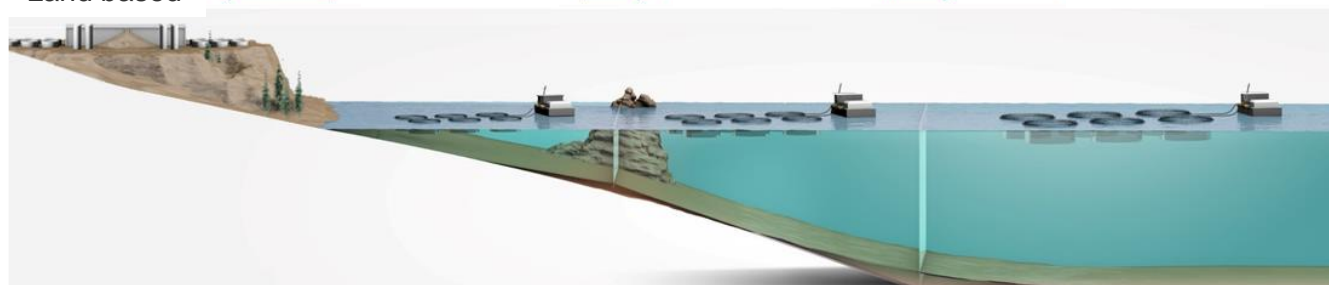
Sustainability pushes farming onshore and offshore

- New areas create a need for new technology and new services
- Innovation will be key, the supplier industry can be in the front seat in terms of creating new opportunities
- Existing aquaculture will remain relevant and the largest customer group in the foreseeable future



Anders Gjendemsjø,
Deloitte

Land based ← Traditional → Exposed → Offshore



DNB

Source: Deloitte

DNB Seafood

29

DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de

L'INGÉNIERIE MARITIME

CAEN

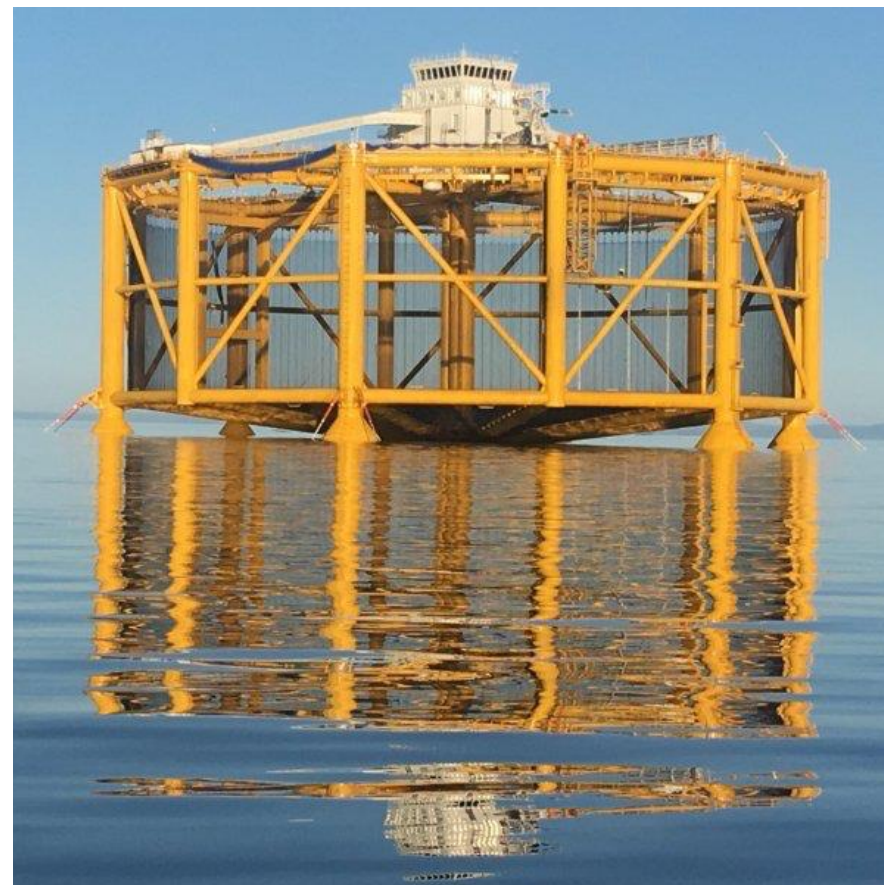
MOVING MORE EXPOSED

Traditional fish farms



>

Offshore fish farm



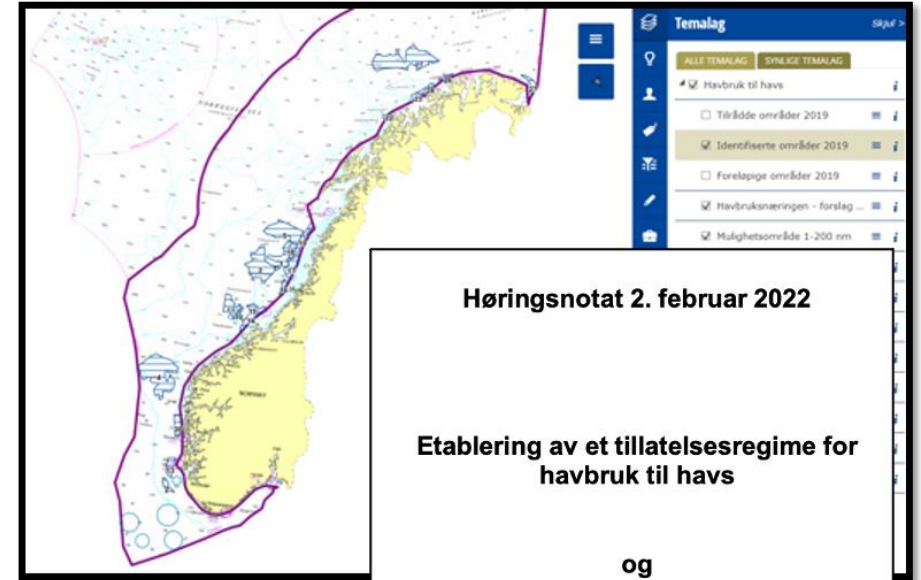
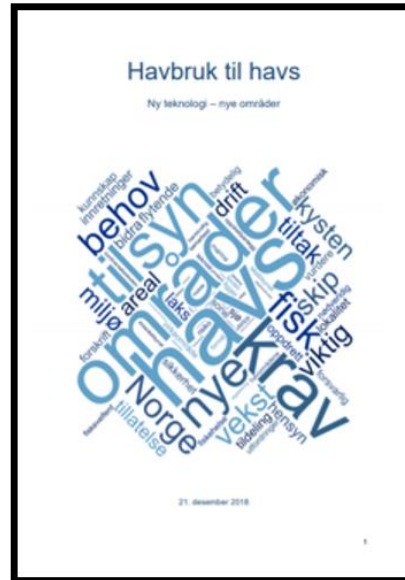
DU 22 AU 24
JUN 2022

1^{ères} Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

NORWAY IS MOVING OFFSHORE

- By expanding into the offshore, the Norwegian government ambition is to double the yearly production of salmonids by 2030, to 2.4 mill tons, and quintuple it by 2050,
- Interdepartmental work groups have been at work since 2018 and issued a series of documents preparing the grounds
- On February 2, 2022, the new government issued a draft of “Establishing a license regime for open ocean farming”, requesting stakeholder comments by 22 May.
- 3 of 11 initially proposed areas offshore have been selected to undergo environmental impact assessments prior to license rounds
- Present proposal is that producers with appropriate technology will be granted a conditional production license on provided that the technology and production capability is verified



Høringsnotat 2. februar 2022

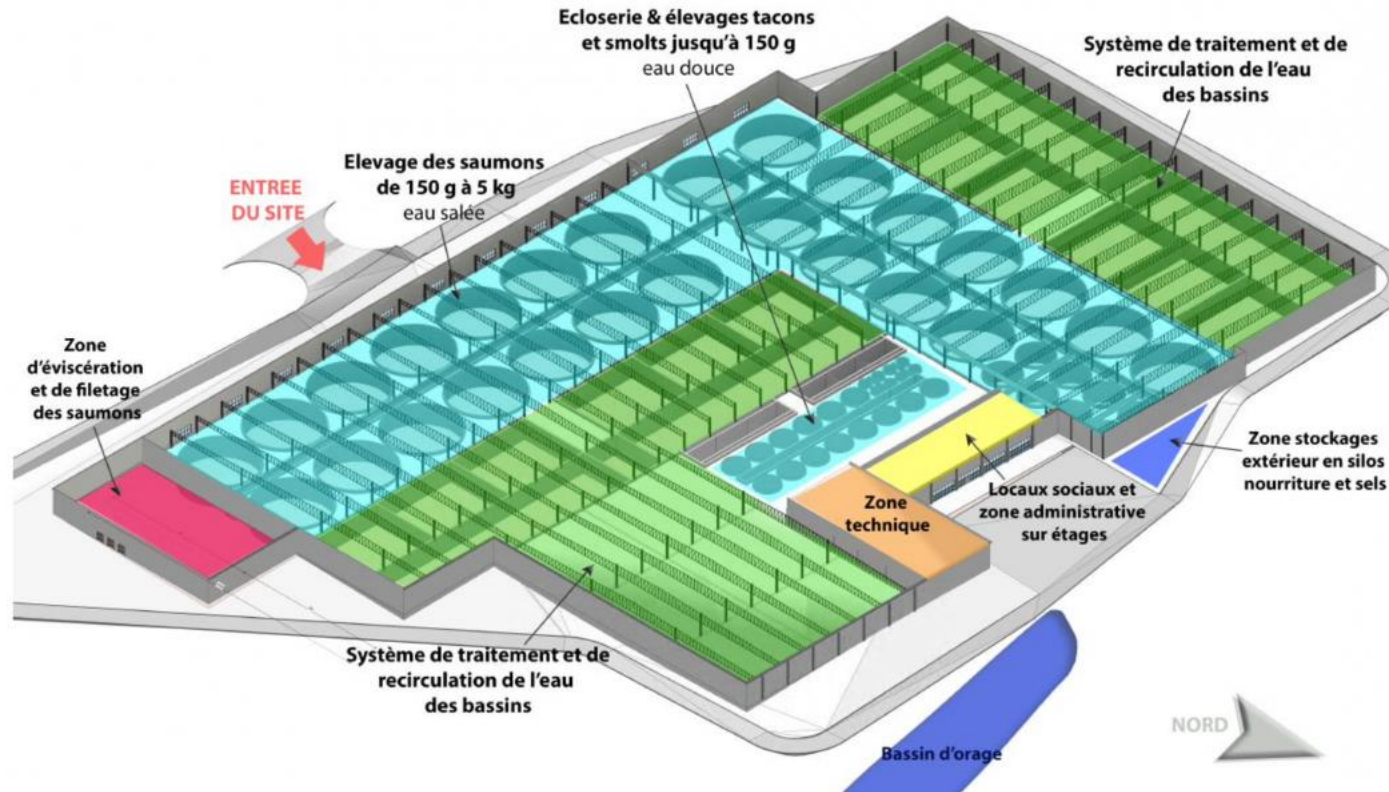
Etablering av et tillatelsesregime for havbruk til havs

og

endringer i yttergrensene i produksjonsområdeforskriften



LAND BASED PRODUCTION AND COST



Picture from the Smart Salmon Groups plan in France

Cost will be a driving factor

CAPEX traditional, 2 - 3 €/kg production capacity

CAPEX land based 20-25 €/kg production capacity

CAPEX exposed 10 – 15 €/kg production capacity

CAPEX Subsea Offshore 5 -7 €/kg production capacity

PLUS Licence Costs

DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de L'INGÉNIERIE MARITIME

CAEN

THE THIRD WAY

Offshore, Subsea Aquaculture

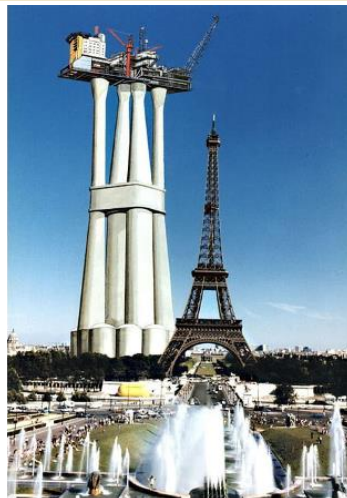
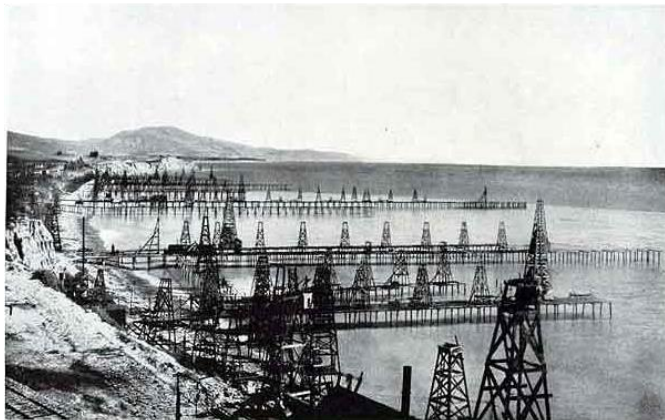
DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

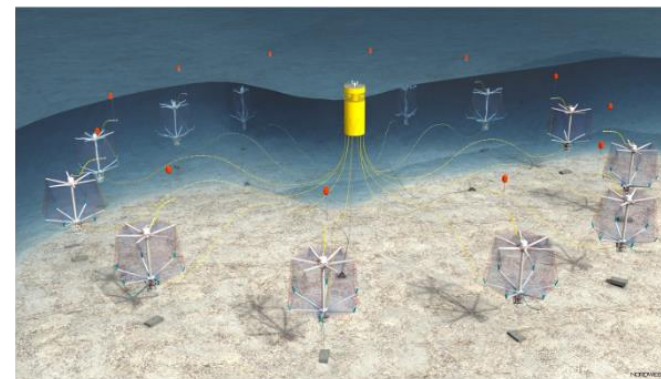
THE THIRD WAY



Starten på
oppdrettsnæringen i Norge



Osland, E. (1990) Bruke havet ... Pionertid i norsk fiskeoppdrett. Oslo: Det Norske Samlaget. Foto: Helge Sunde



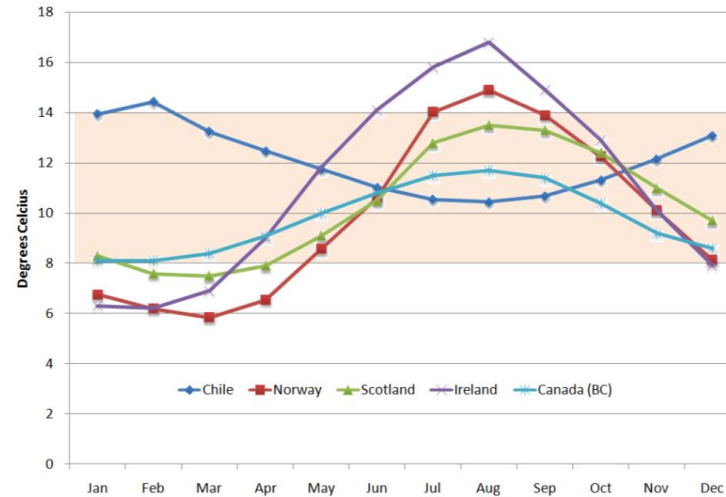
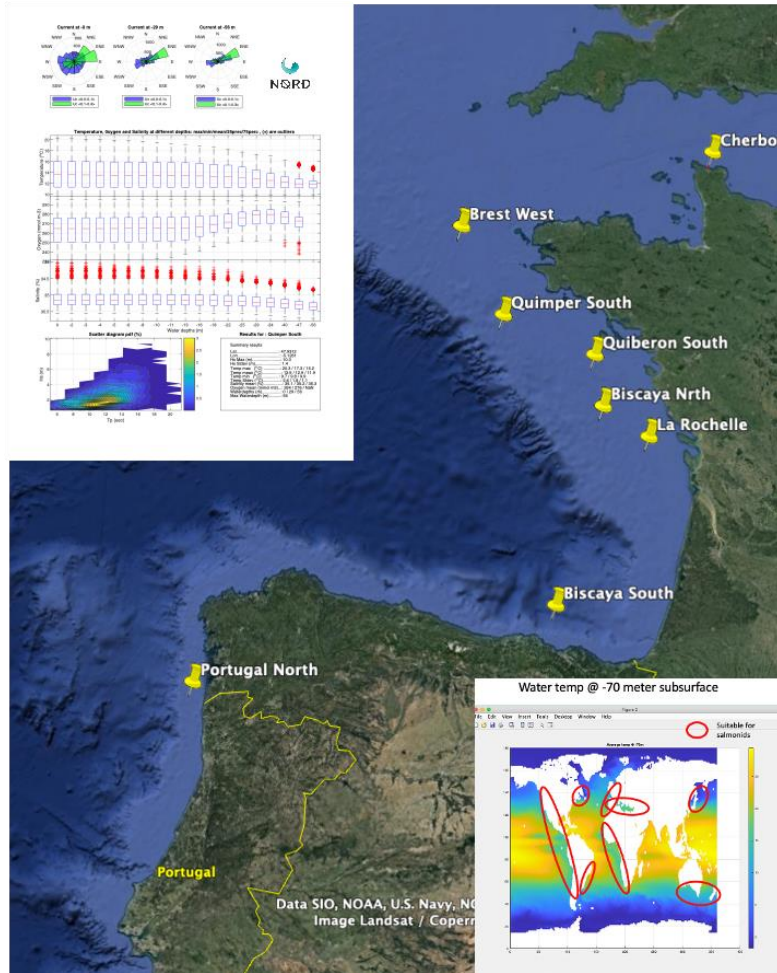
DU 22 AU 24
JUN 2022

1^{ères} Rencontres de **L'INGÉNIERIE MARITIME**

CAEN

PREREQUISITES

TEMPERATURE, AIR, CURRENT, OXYGEN, WAVES

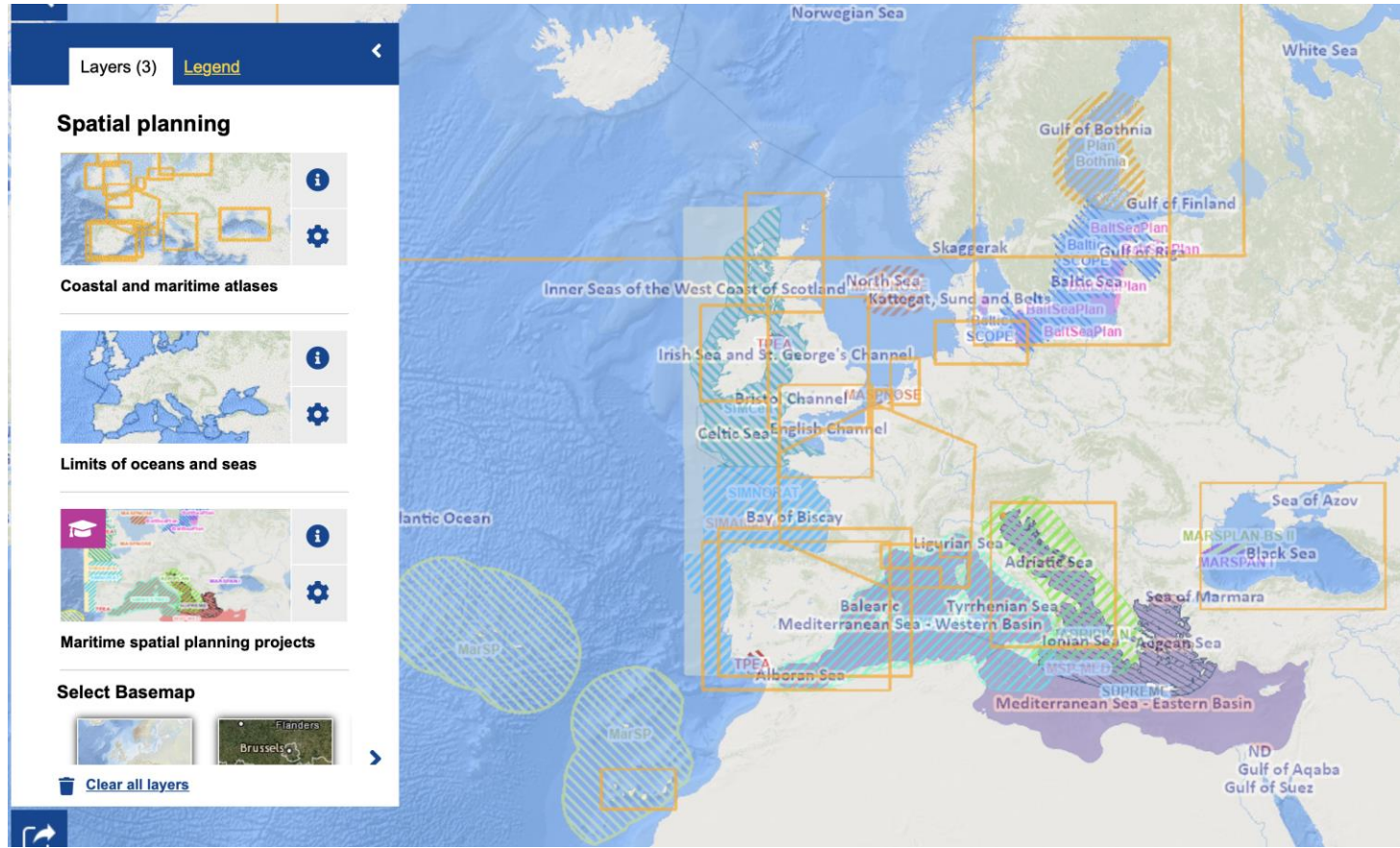


DU 22 AU 24
JUN 2022

1^{ères} Rencontres de L'INGÉNIERIE MARITIME

CAEN

MARITIME SPACE RESTRICTED



Multi purpose use of maritime space will be important

Subsea aquaculture is excellent to combine with offshore wind

Shared space

Shared logistics resources

Access to renewable energy

DU 22 AU 24
JUN 2022

1^{ères}

Rencontres de

L'INGÉNIERIE MARITIME

CAEN

CASE STUDY FRANCE

FRANCE IS A HUGE CONSUMER OF SALMON AND IS IMPORTING 170 000 TONNES EACH YEAR

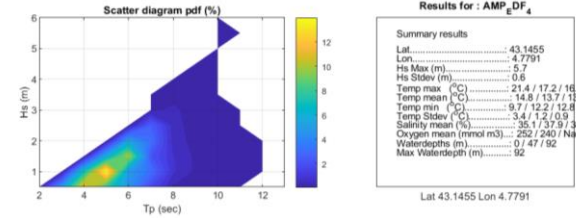
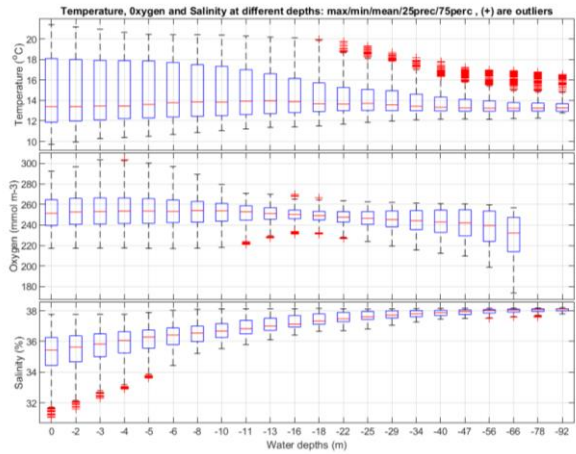
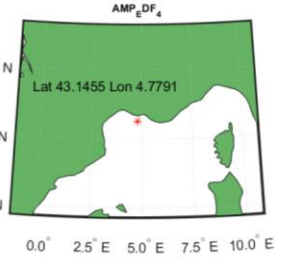
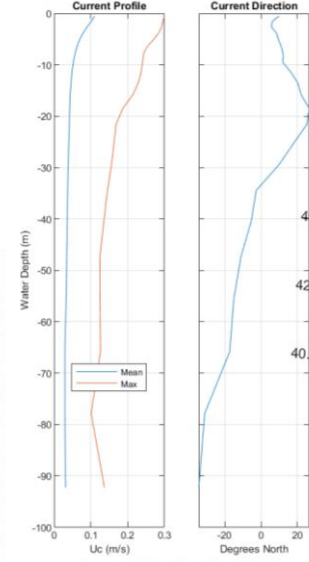
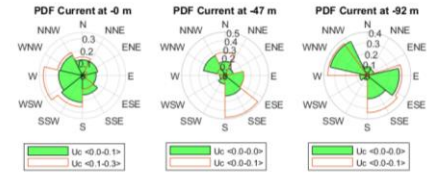
Illustration: Combined offshore floating wind and aquaculture offshore Marseilles

DU 22 AU 24
JUN 2022

1^{ères} Rencontres de **L'INGÉNIERIE MARITIME**

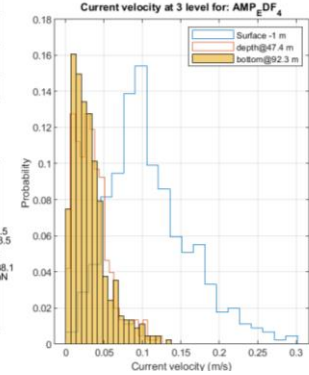
CAEN

CASE STUDY FRANCE, ENVIRONMENT



Results for : AMP_DF4

Summary results	
Lat.....	43.1455
Lon.....	4.7791
Hs Max (m).....	5.7
Hs Stdev (m).....	0.8
Temp max (°C).....	21.4 / 17.2 / 16.5
Temp mean (°C).....	14.8 / 13.7 / 13.5
Temp min (°C).....	9.7 / 12.2 / 12.8
Temp Stdev (°C).....	3.4 / 1.2 / 0.9
Salinity mean (‰).....	35.1 / 31.9 / 36.1
Oxygen mean (mmol m3).....	252 / 240 / NaN
Waterdepths (m).....	0 / 47 / 92
Max Waterdepth (m).....	92



Summary results

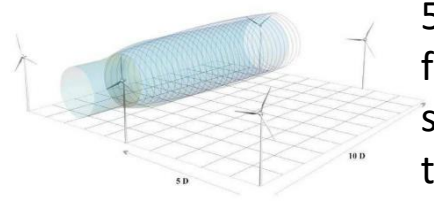
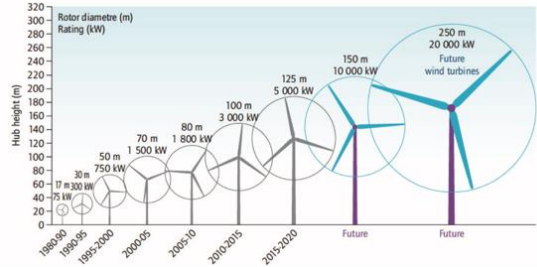
Lat.....: 43.1455
 Lon.....: 4.7791
 Current max (m/s).....: 0.3 / 0.1 / 0.1
 Current mean (m/s).....: 0.1 / 0.0 / 0.0
 Current Direction max (deg)....: 180.0 / 180.0 / 180.0
 Current Direction Mean (deg)....: 14.8 / 13.7 / 13.5
 Waterdepths used for data (m): 0 / 47 / 92

DU 22 AU 24
JUN 2022

1^{ères} Rencontres de L'INGÉNIERIE MARITIME

CAEN

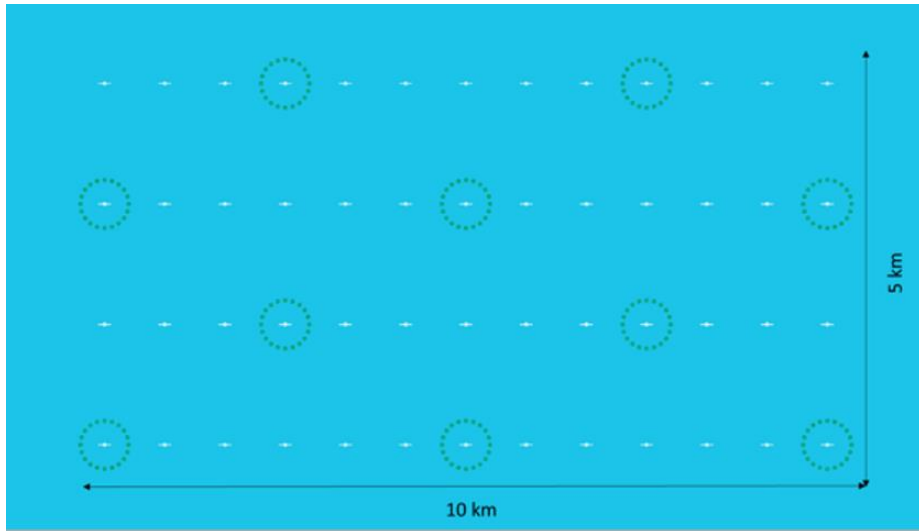
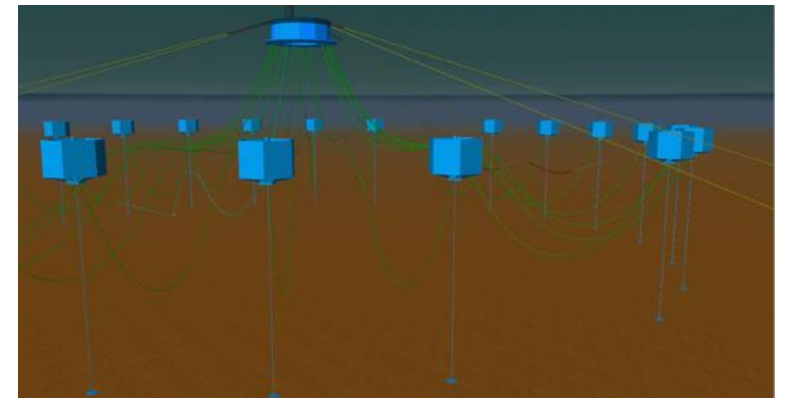
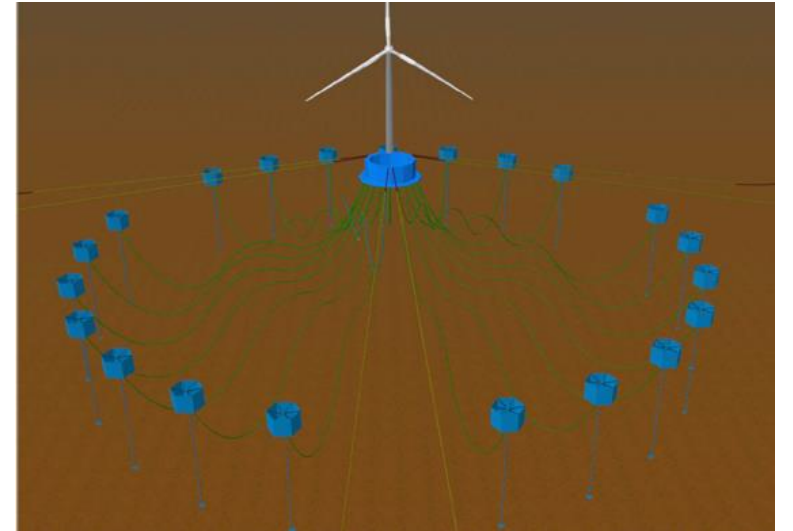
CASE STUDY FRANCE, POTENTIAL SOLUTION



52 windmills and 10 fish farms. The fish farms need some distance between them to minimise risk of diseases, parasites etc.

A wind park of this size can install 520 MW capacity and produce 100.000 tons of trout


In addition, it may employ 200 people to run the wind park and 3000 people to manage the fish production. All in an area of 50 km².



DU 22 AU 24
JUN 2022

1^{ères} Rencontres de L'INGÉNIERIE MARITIME

CAEN



Thank you
Questions ?



DU 22 AU 24
JUN 2022

1^{ères} Rencontres de **L'INGÉNIERIE MARITIME**

CAEN