CULTIVATION POTENTIALS FOR BROWN AND RED ALGAE IN NORWAY

SIG Seaweed 5, Trondheim, November 27, 2019

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SINTEF Ocean

Salmon aquaculture in Norway

1000 locations

1,3 million t
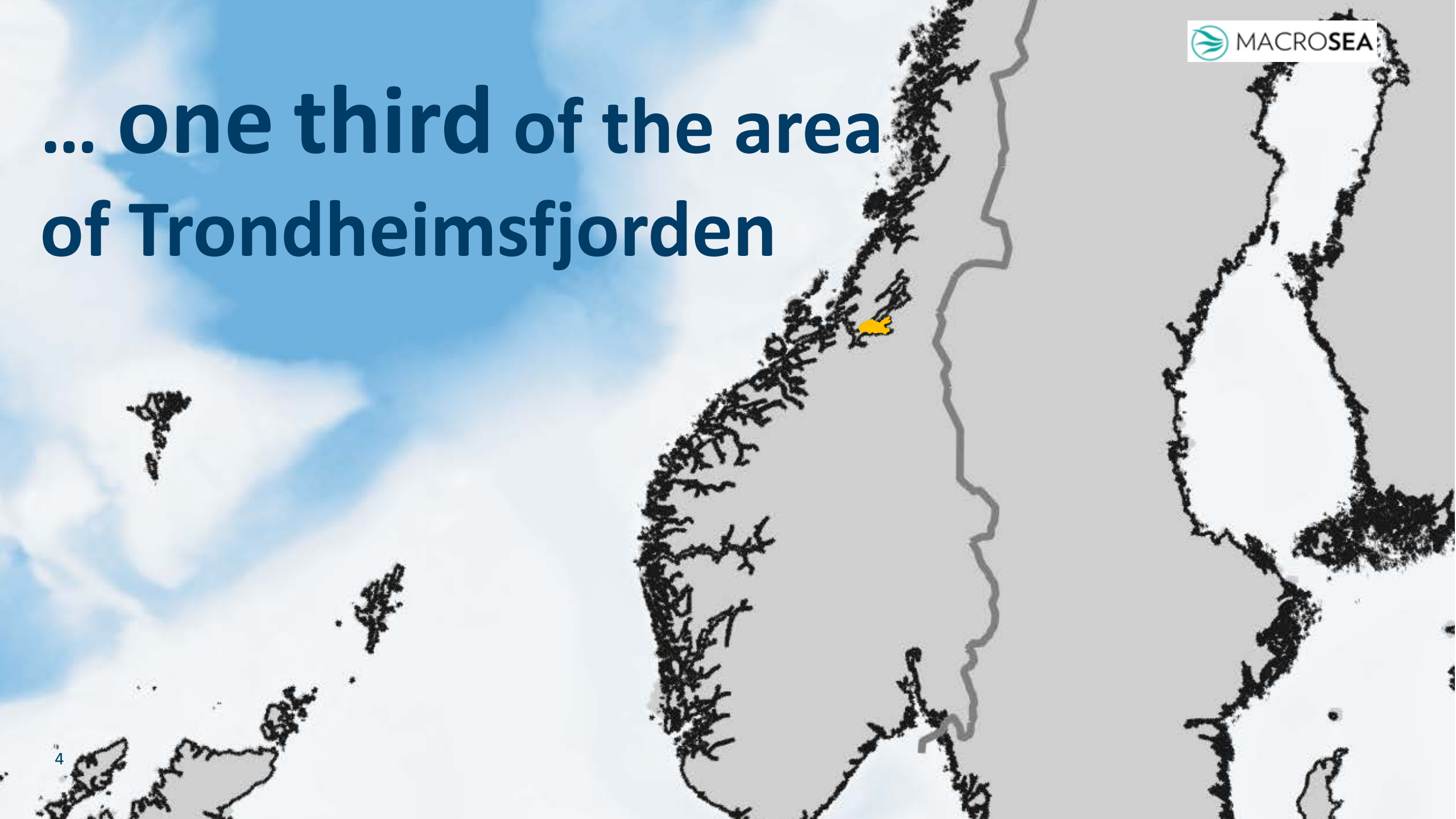
420 km^2

Kelp aquaculture in China

6,5 million t

400 km²

Pyropia Farms

Fishing Ponds

0   .5   1   2 Km

MACROSEA

Bilde: Xiao et al. Sci Rep 7, 46613; doi:10.1038 /srep46613 (2017)

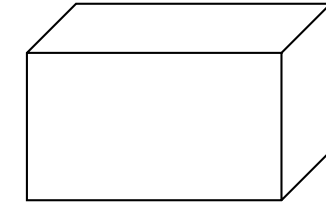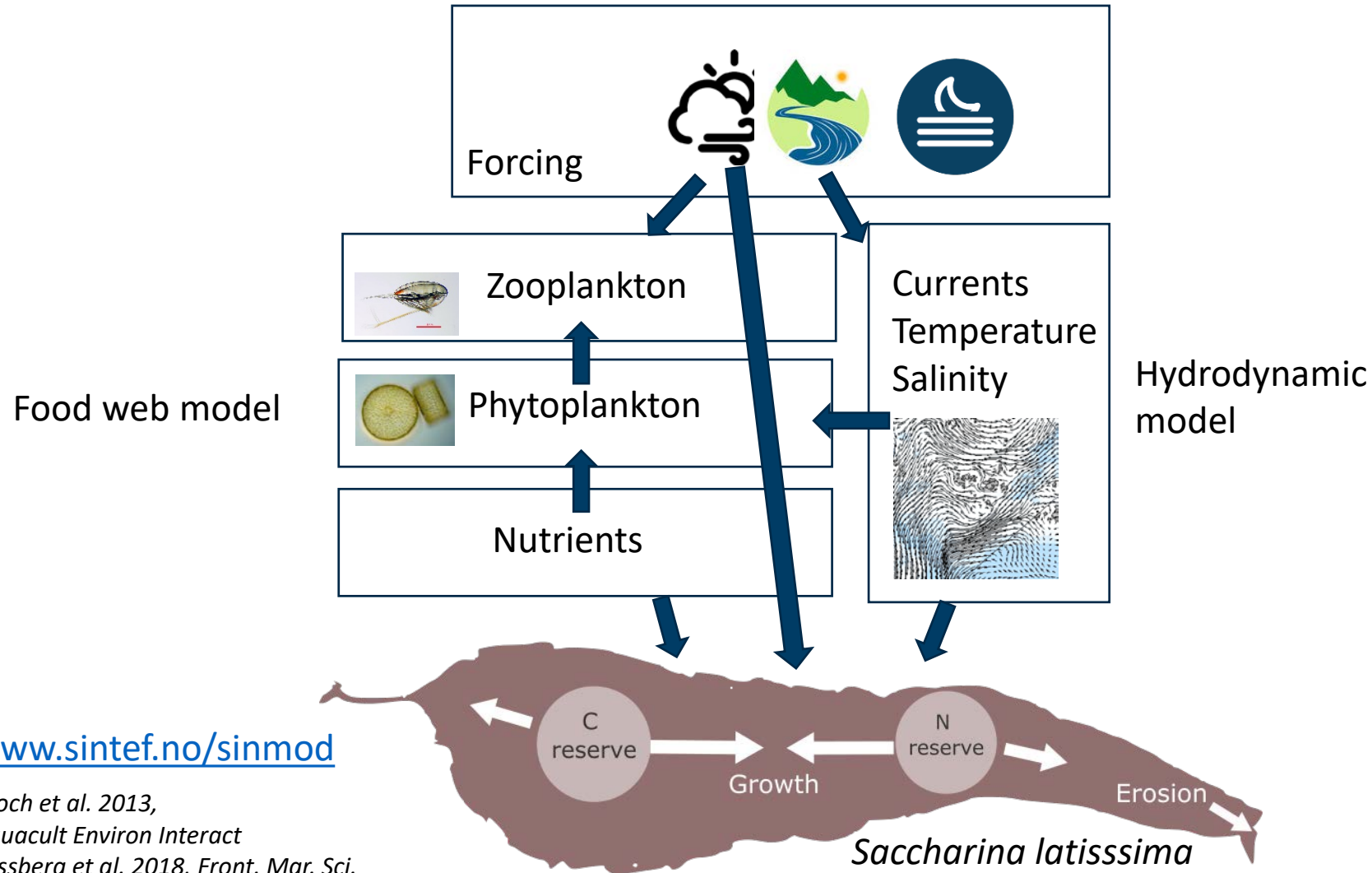# … **one third** of the area of **Trondheimsfjorden**

What is the potential for seaweed aquaculture in Norway?

Photo from www.SalMar.no

SINMOD – dynamical coupled physical-biological model system

Forcing

Zooplankton

Phytoplankton

Nutrients

Food web model

**Currents
Temperature
Salinity**

Hydrodynamic model

C reserve

Growth

N reserve

Erosion

Saccharina latisssima

- Photosynthetic rates

- Uptake

- Respiration

- Growth

www.sintef.no/sinmod

*Broch et al. 2013,
Aquacult Environ Interact
Fossberg et al. 2018, Front. Mar. Sci.
Broch et al. submitted*

SINMOD

- Hydrodynamic model (regular grid, z-layer, hydrostatic)

- Nesting; scale from 20 km horizontal resolution down to 32 m

- Vertical resolution decreasing with depth

- Hindcast or forecast

- Sea ice

- Ecosystem model adapted to Norwegian Sea and Barents Sea

- www.sinmod.com

SINTEF
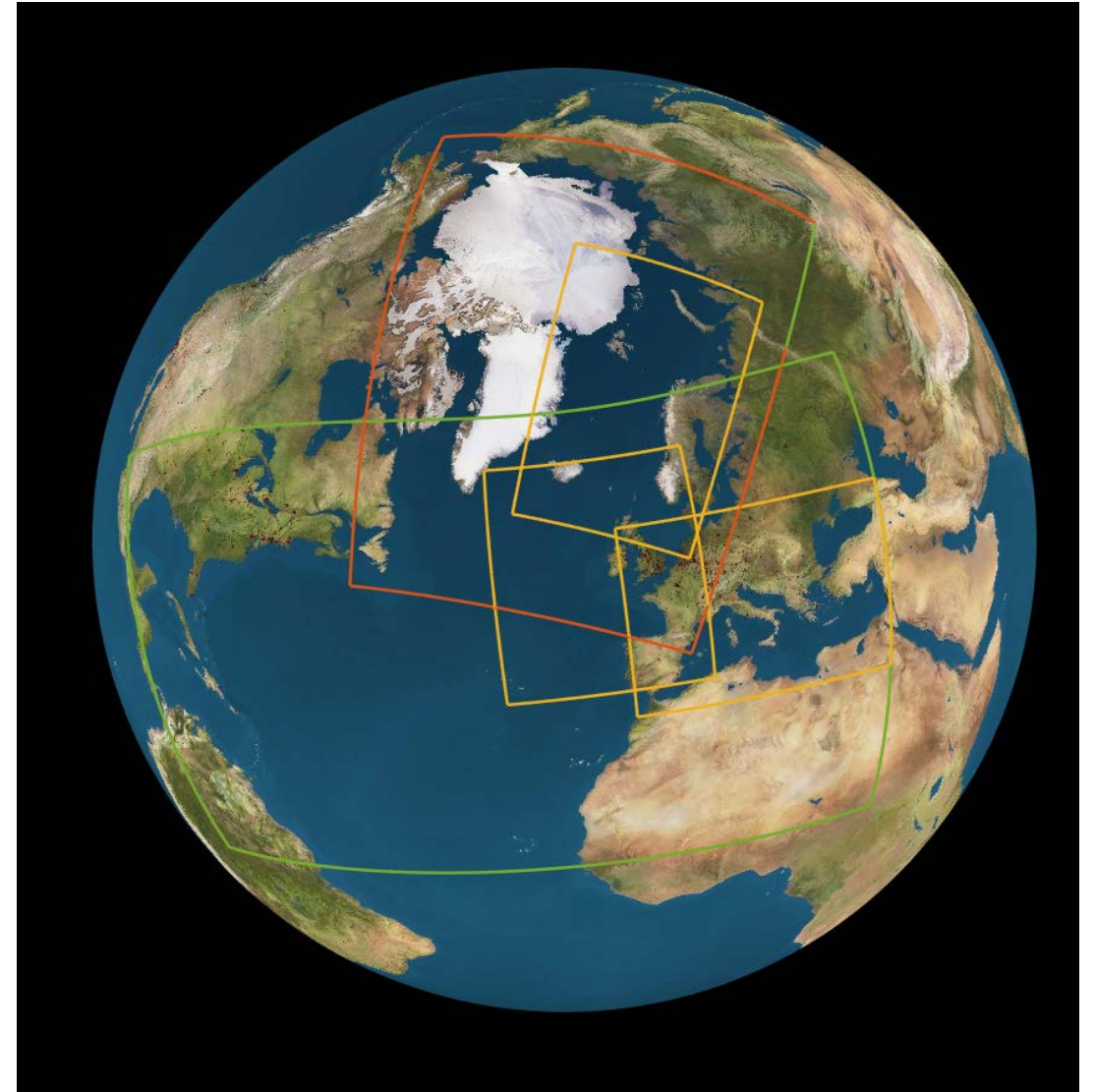
Palmaria palmata

- No advanced model

- Integrating and scoring environmental conditons (from model)
  - NO_3, S, T (Data on bounds from Werner & Dring (2011), Cultivating *Palmaria palmata*, Irish Sea Fisheries Boars)
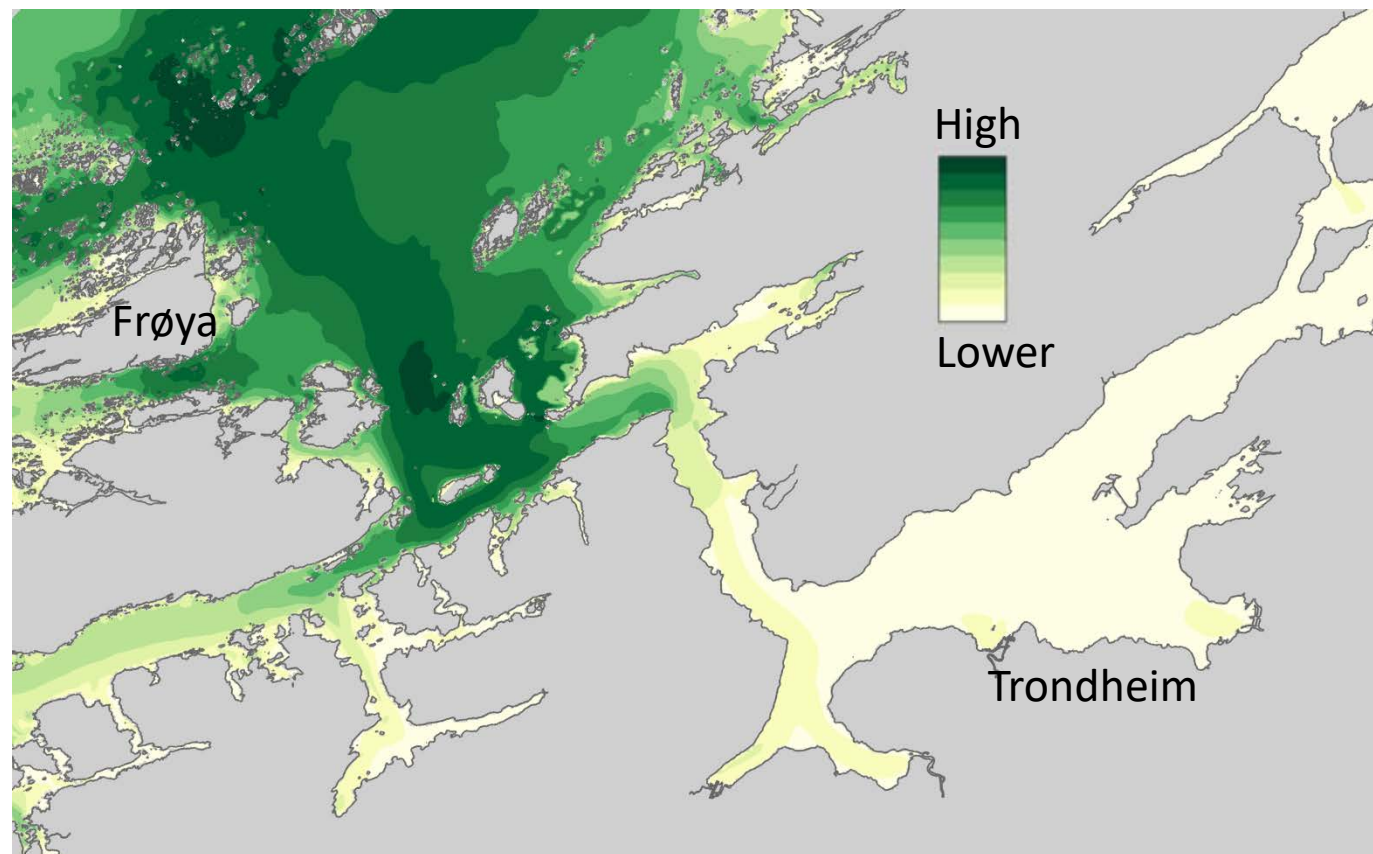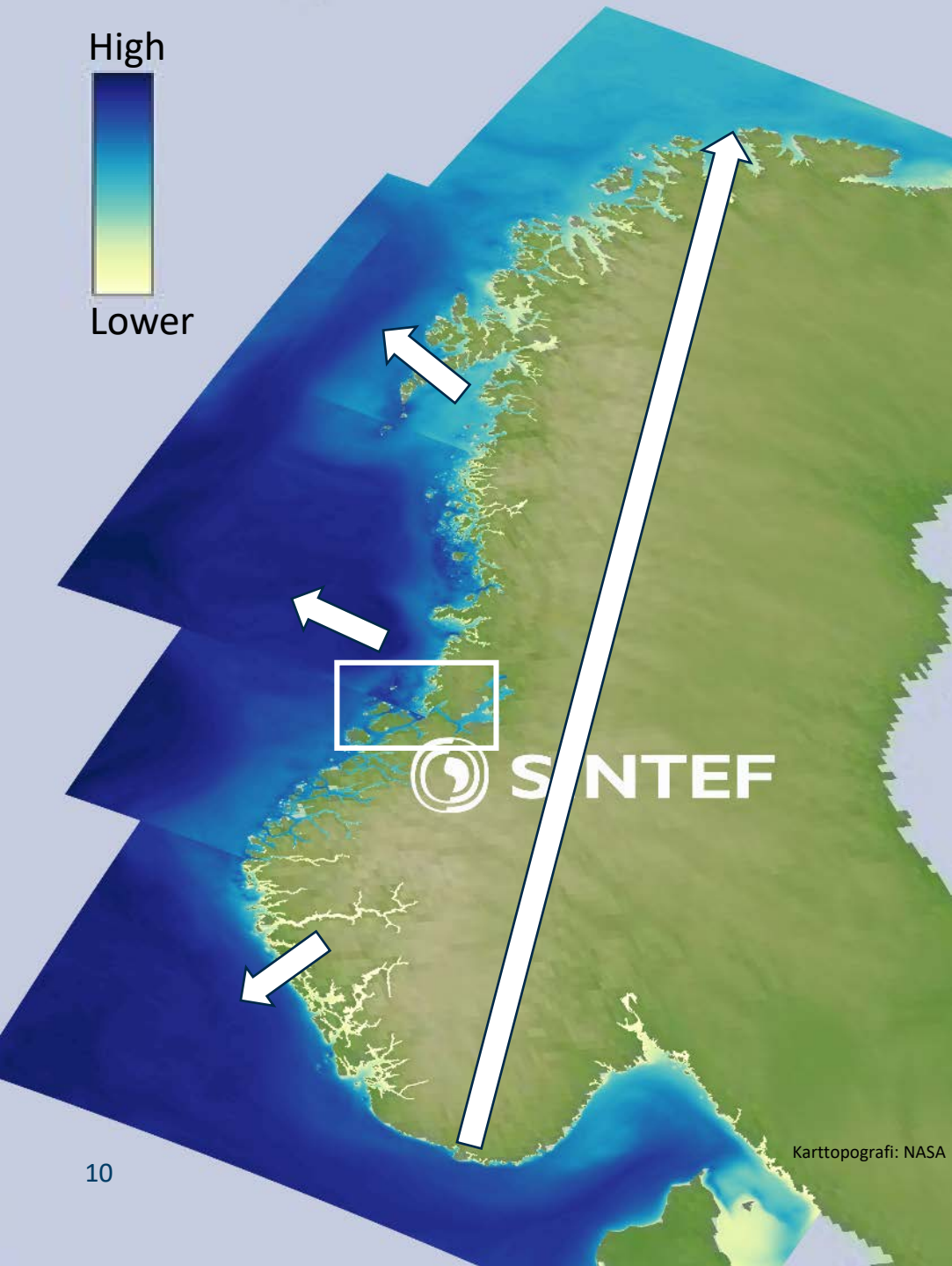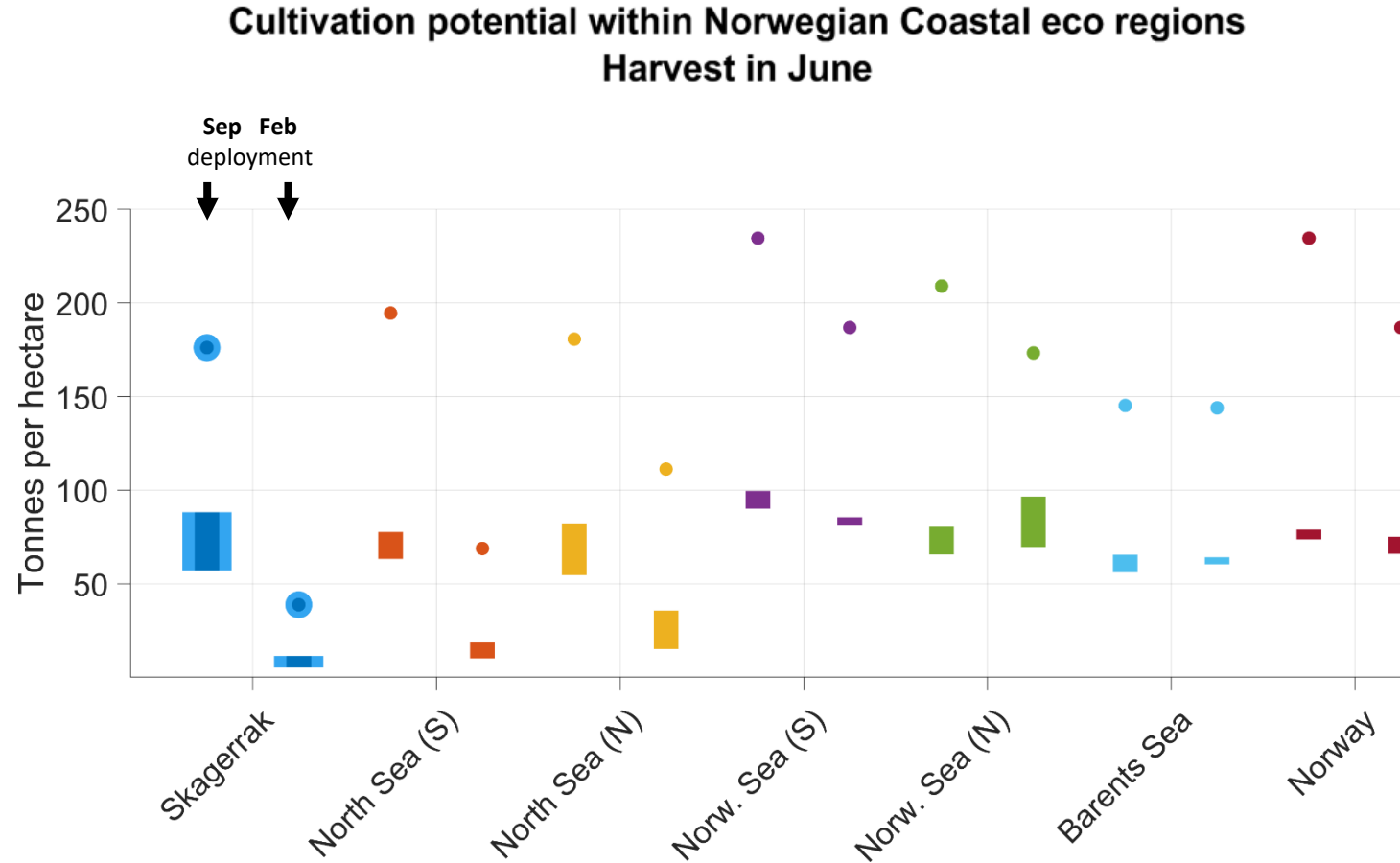
- Only one season (Jan-June)

SINTEF

Saccharina latissima

Palmaria palmata

High

Lower

Karttopografi: NASA

The potential for kelp cultivation

Karttopografi: NASA

Index translated into biomass

Cultivation potential within Norwegian Coastal eco regions
Harvest in June
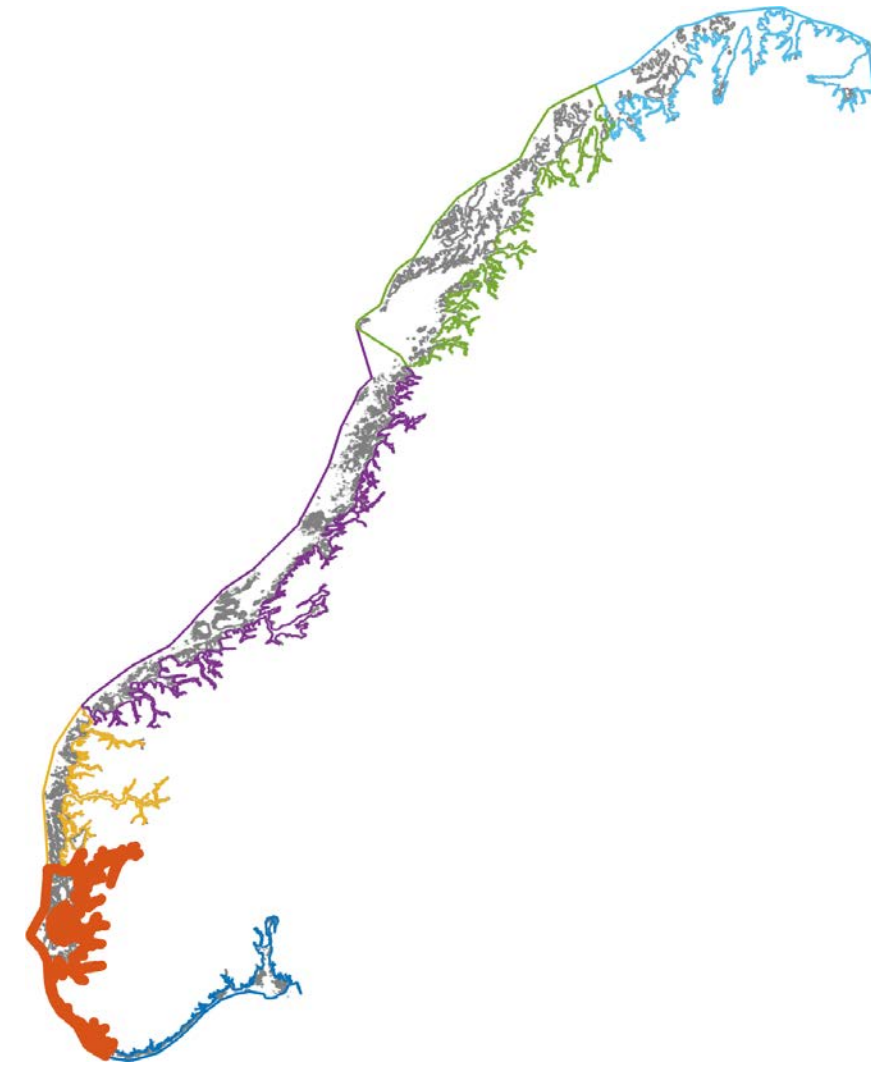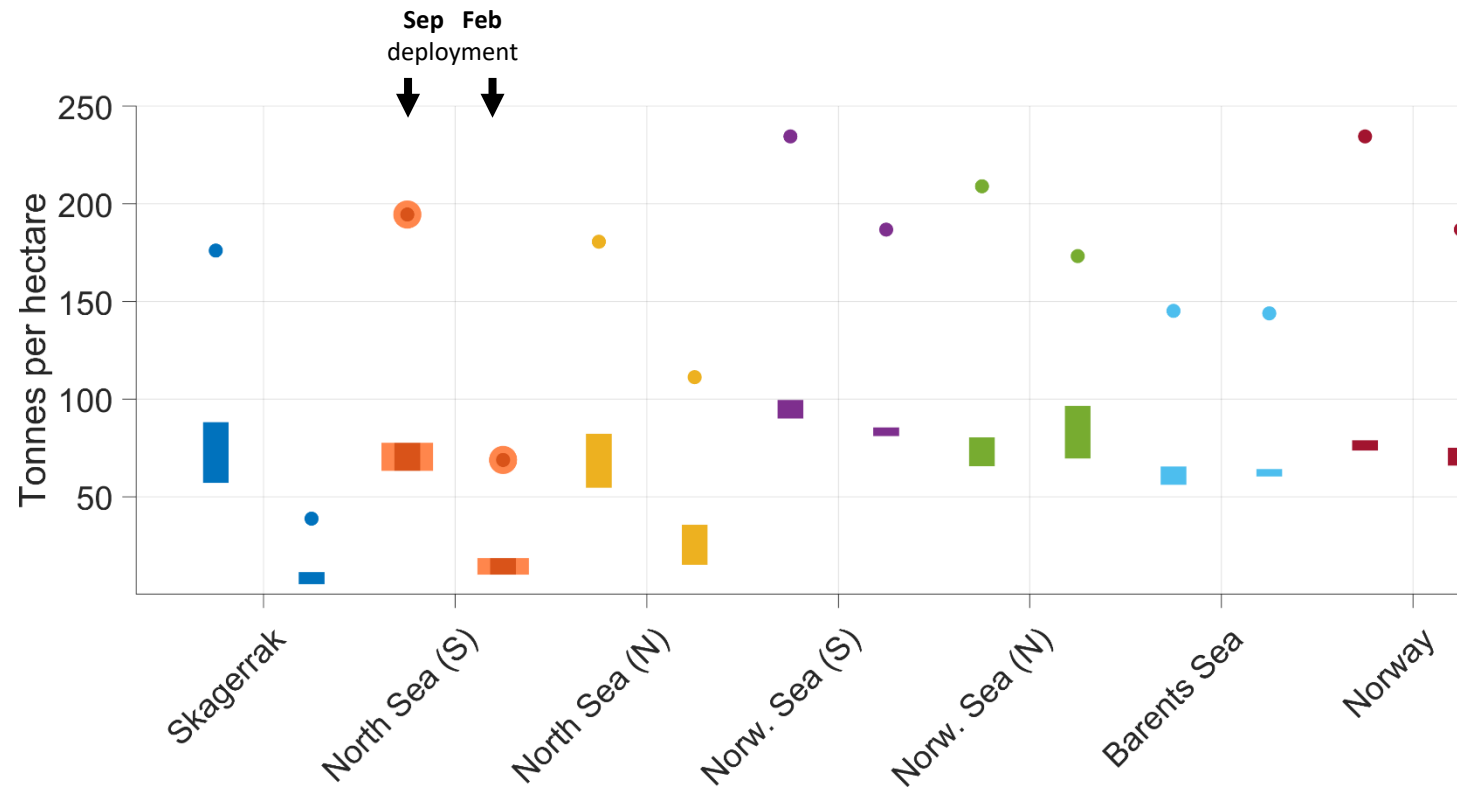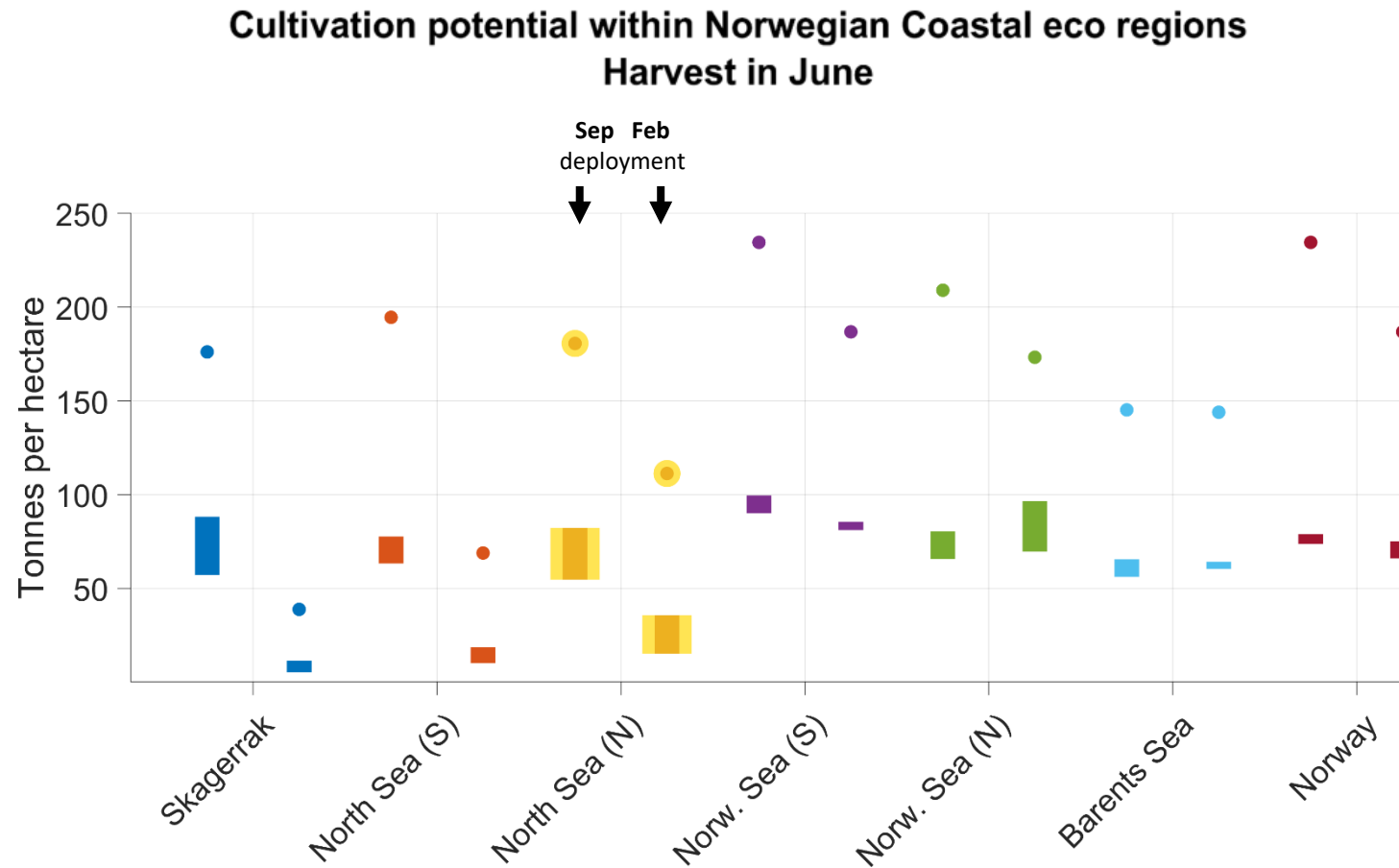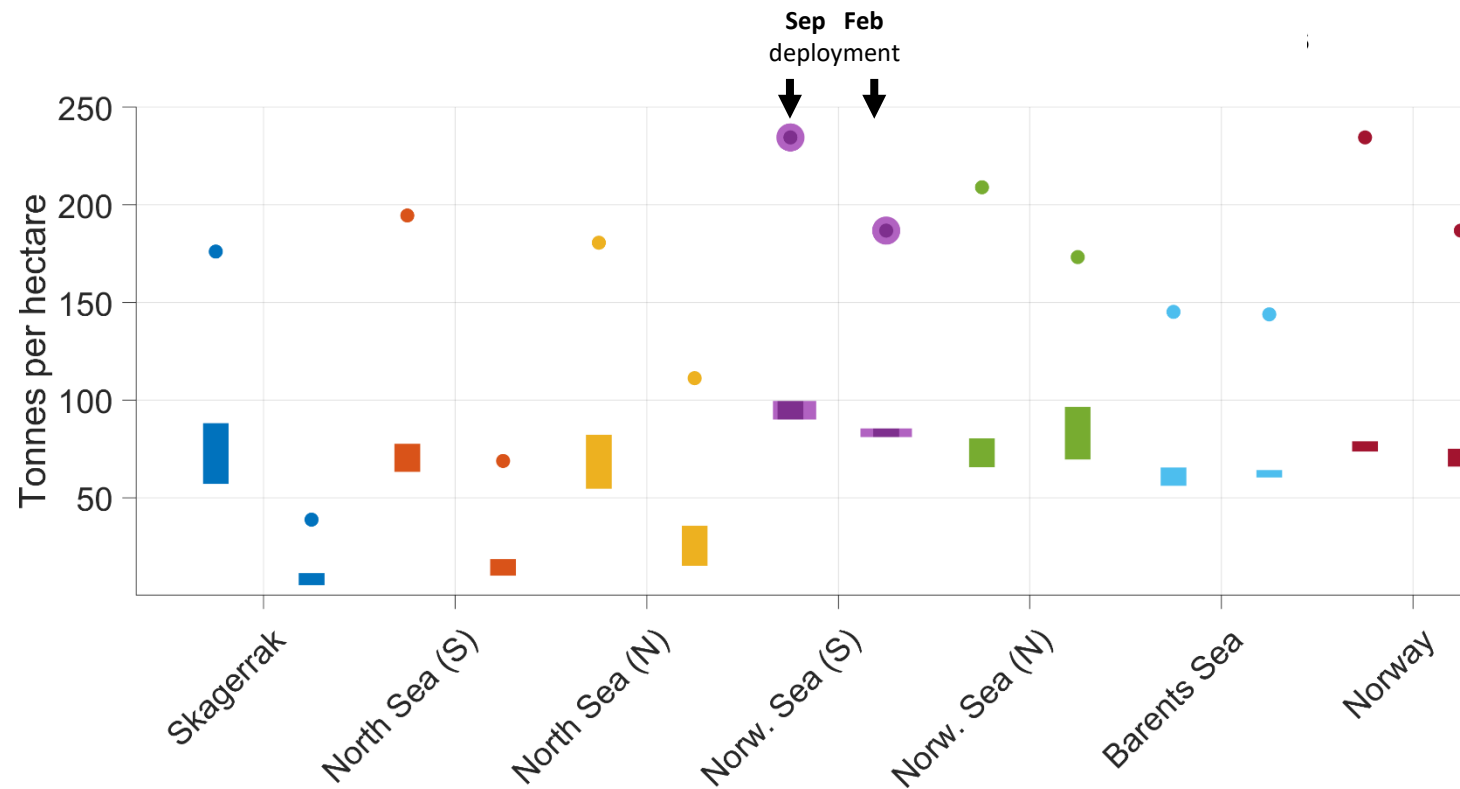
Index translated into biomass

Cultivation potential within Norwegian Coastal eco regions
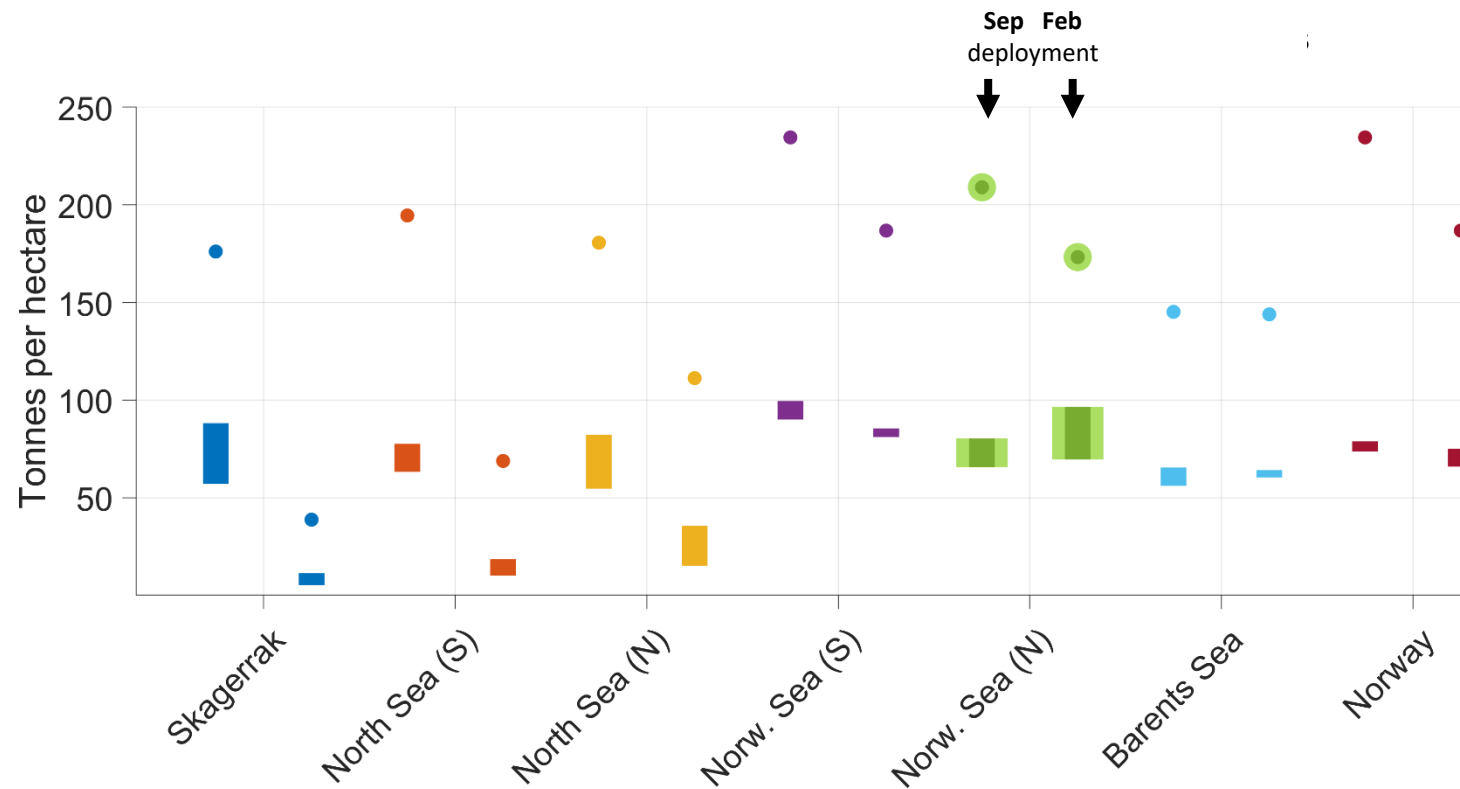Harvest in June

Index translated into biomass

Cultivation potential within Norwegian Coastal eco regions
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Cultivation potential within Norwegian Coastal eco regions
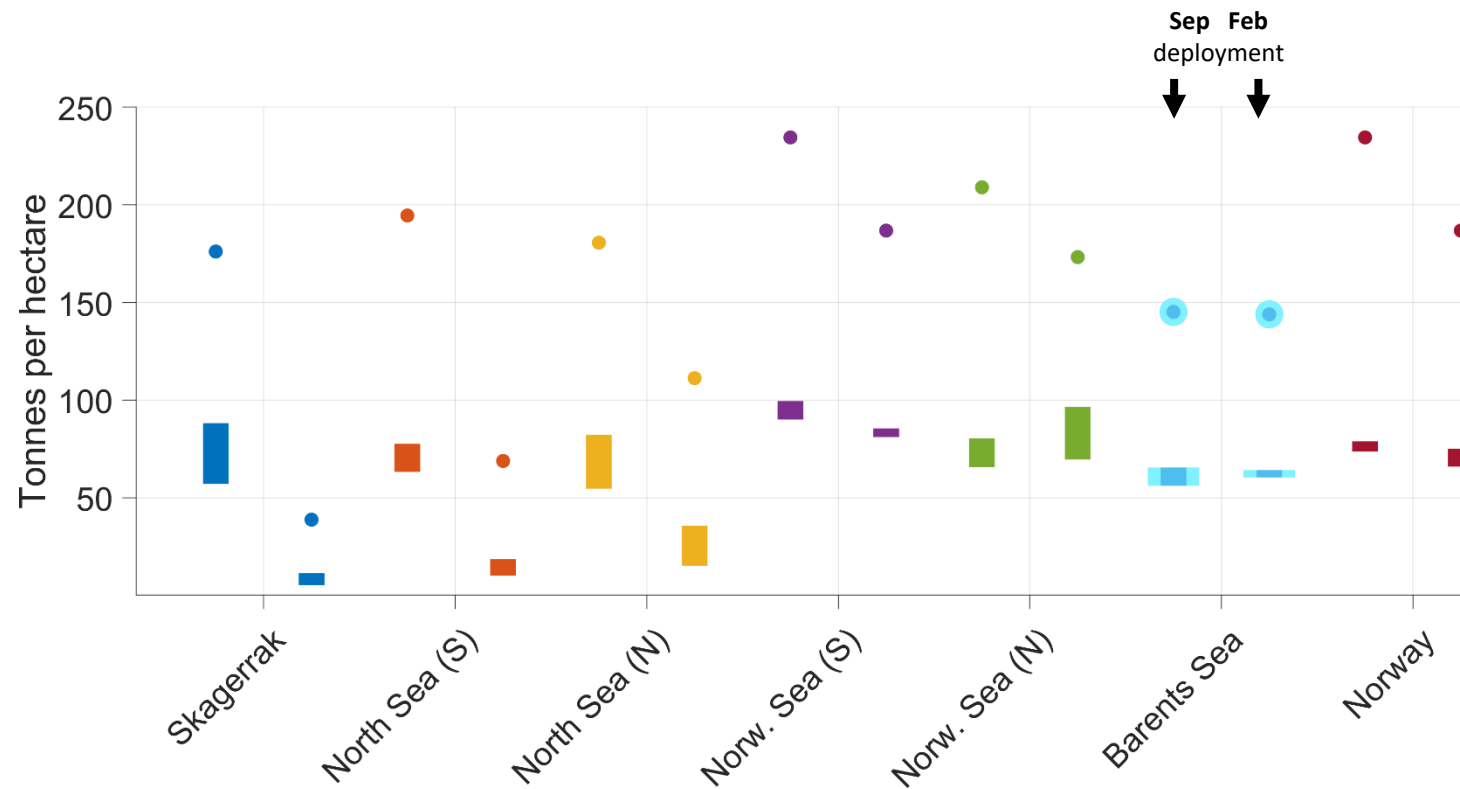Harvest in June

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Cultivation potential within Norwegian Coastal eco regions
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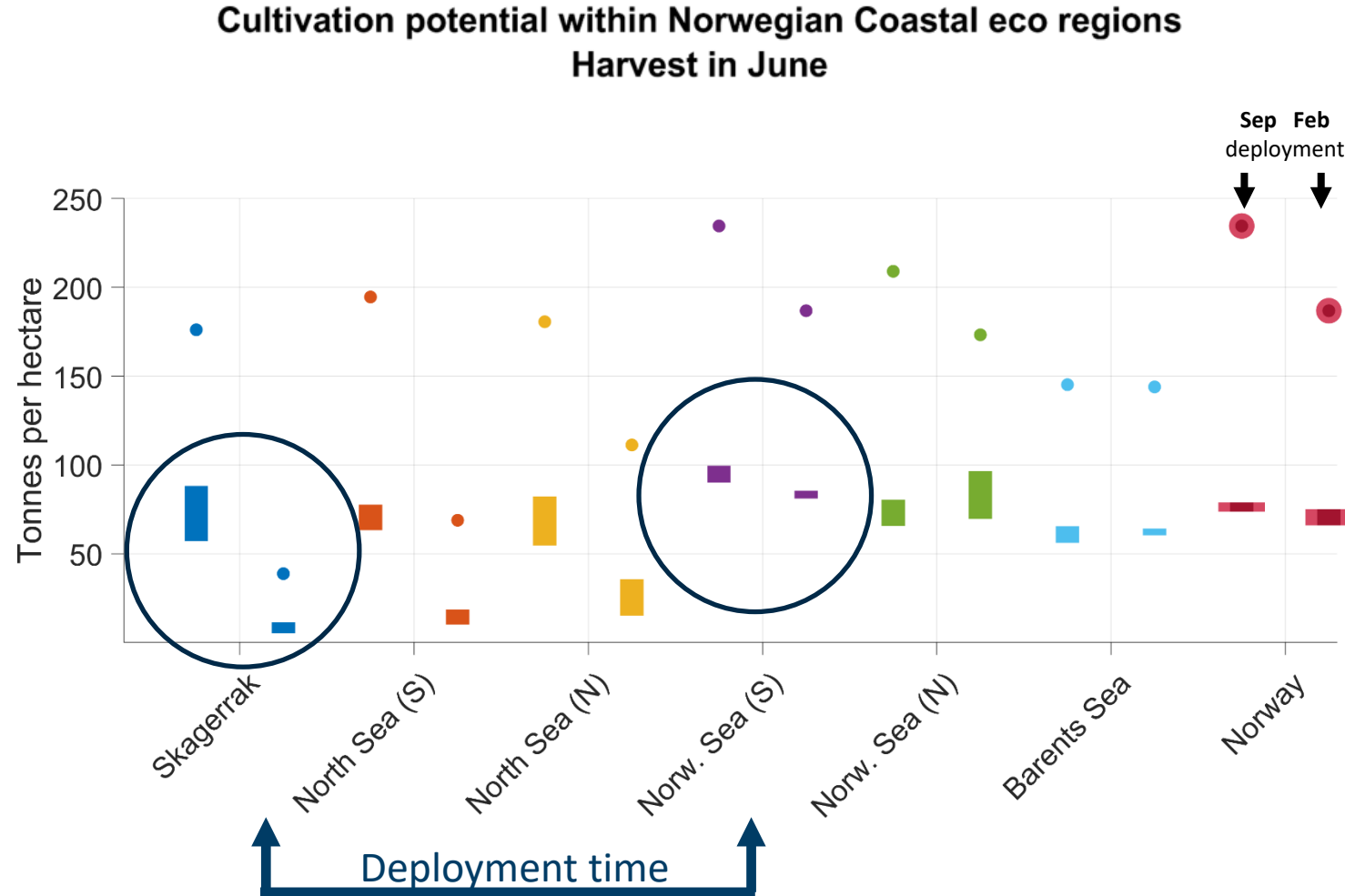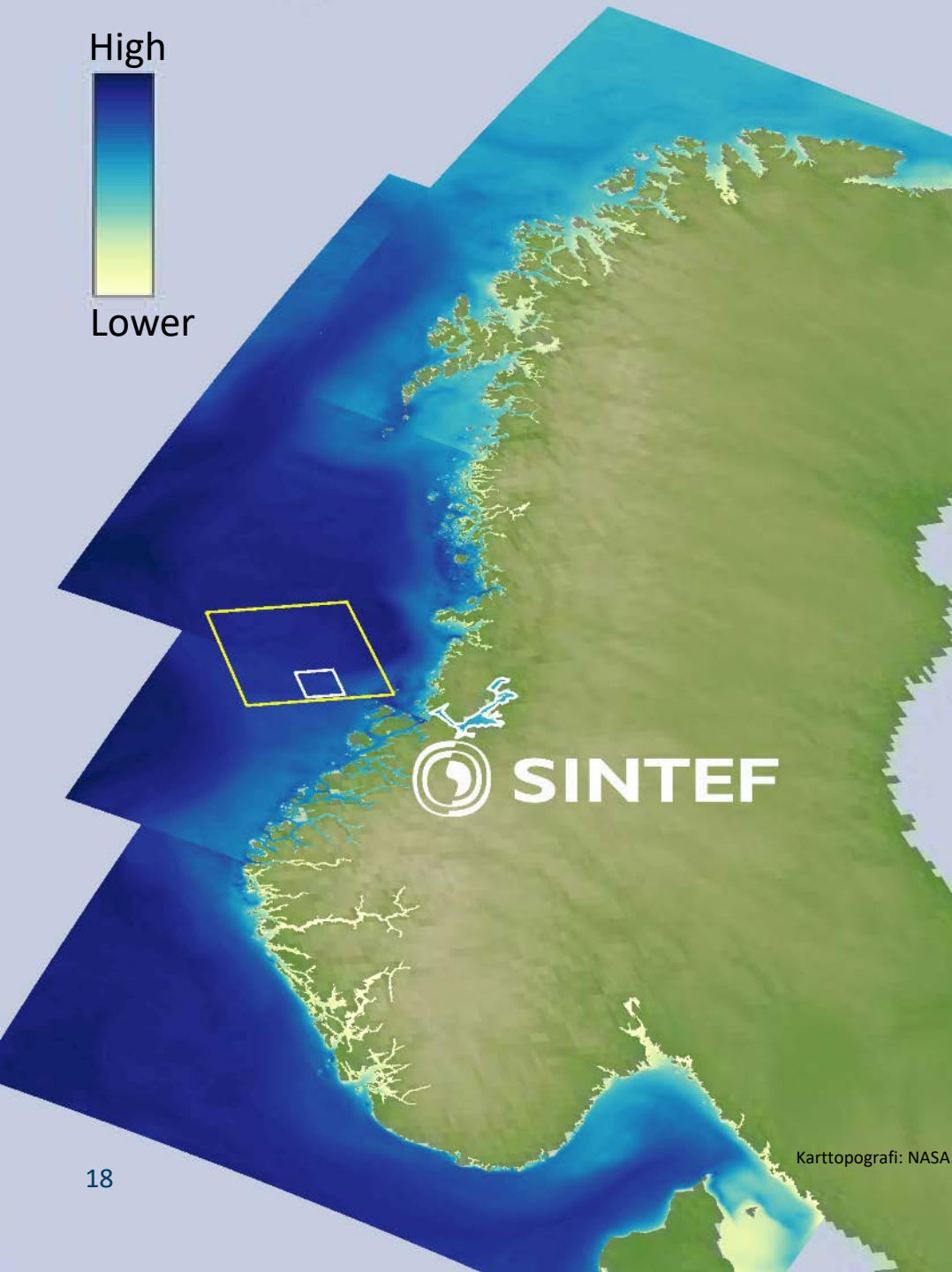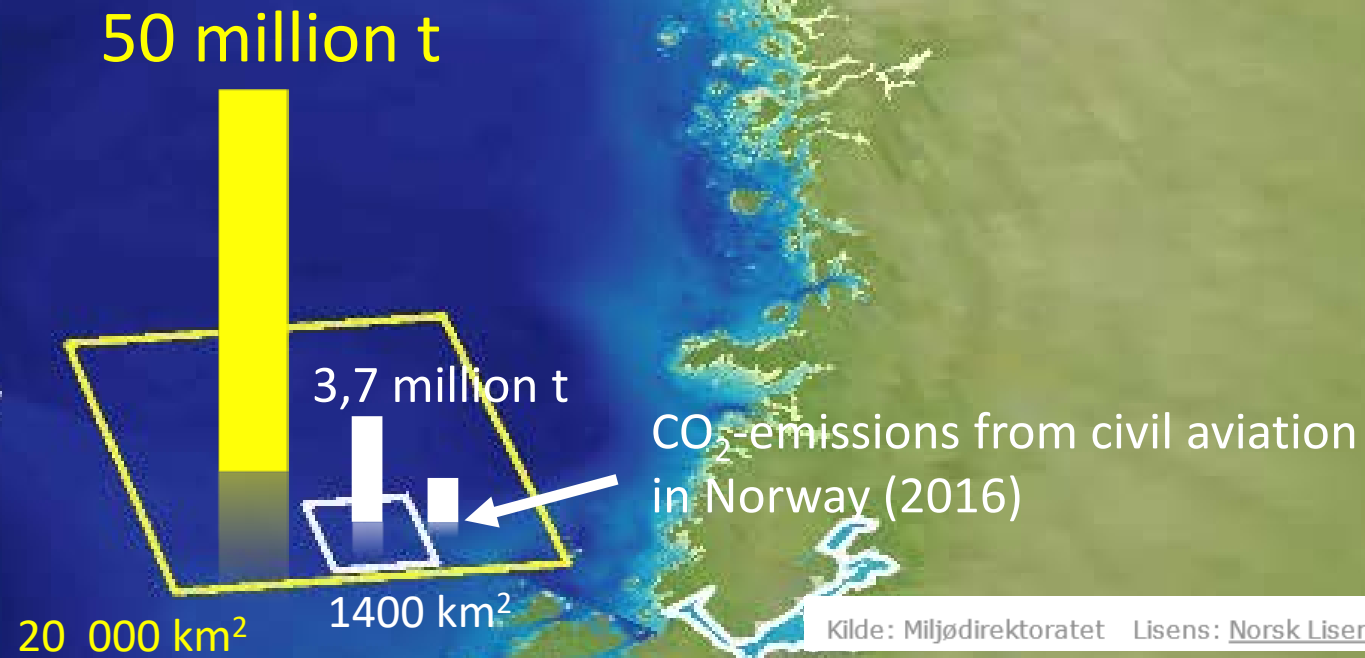Cultivation potential within Norwegian Coastal eco regions
Harvest in June

The kelp cultivation potential

1400 km²

Thea area of Trondheimsfjorden

20 million t biomass

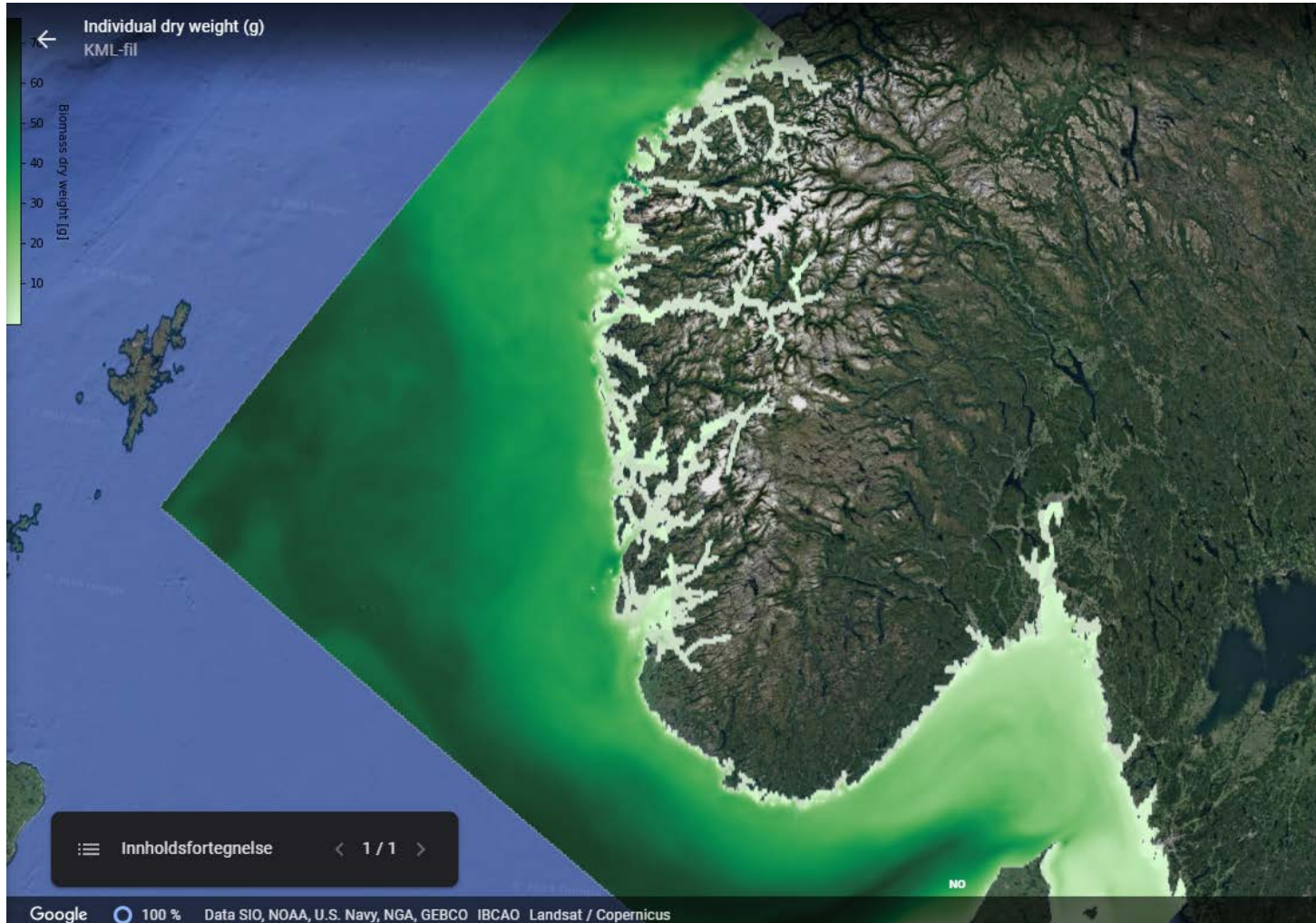**20 000 km²**

320 million t biomass

Potential for CO_2-capture

50 million t

3,7 million t

CO_2-emissions from civil aviation
in Norway (2016)

20 000 km^2
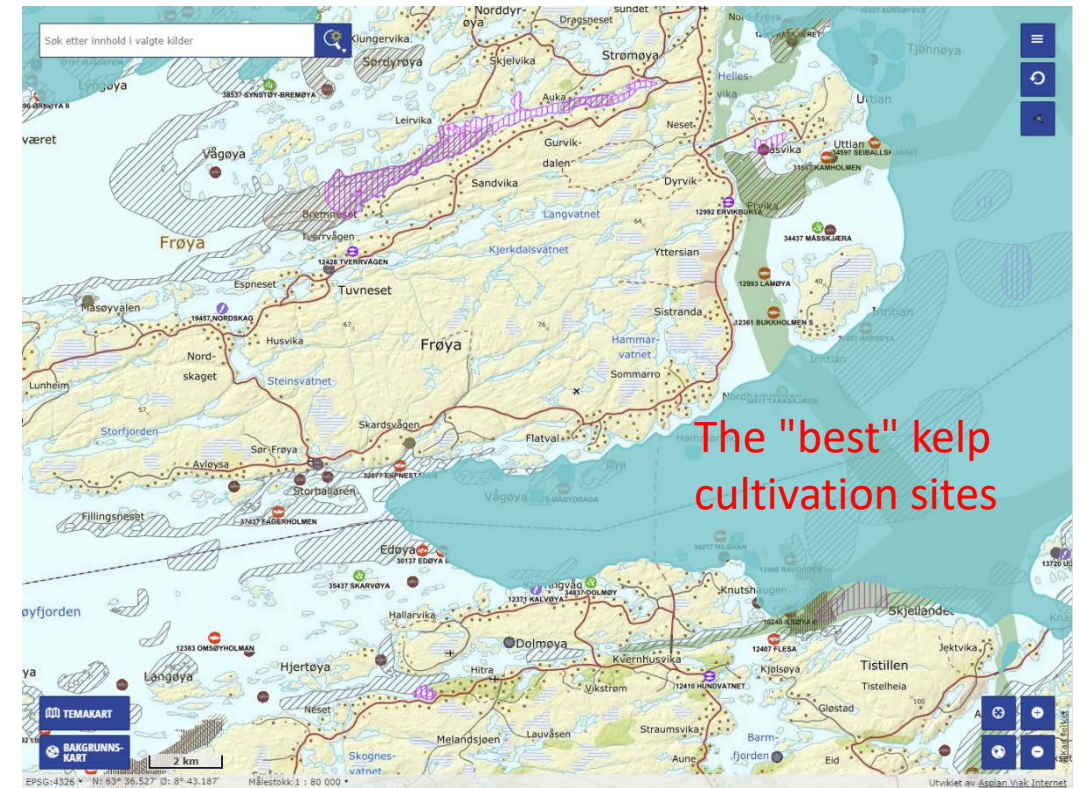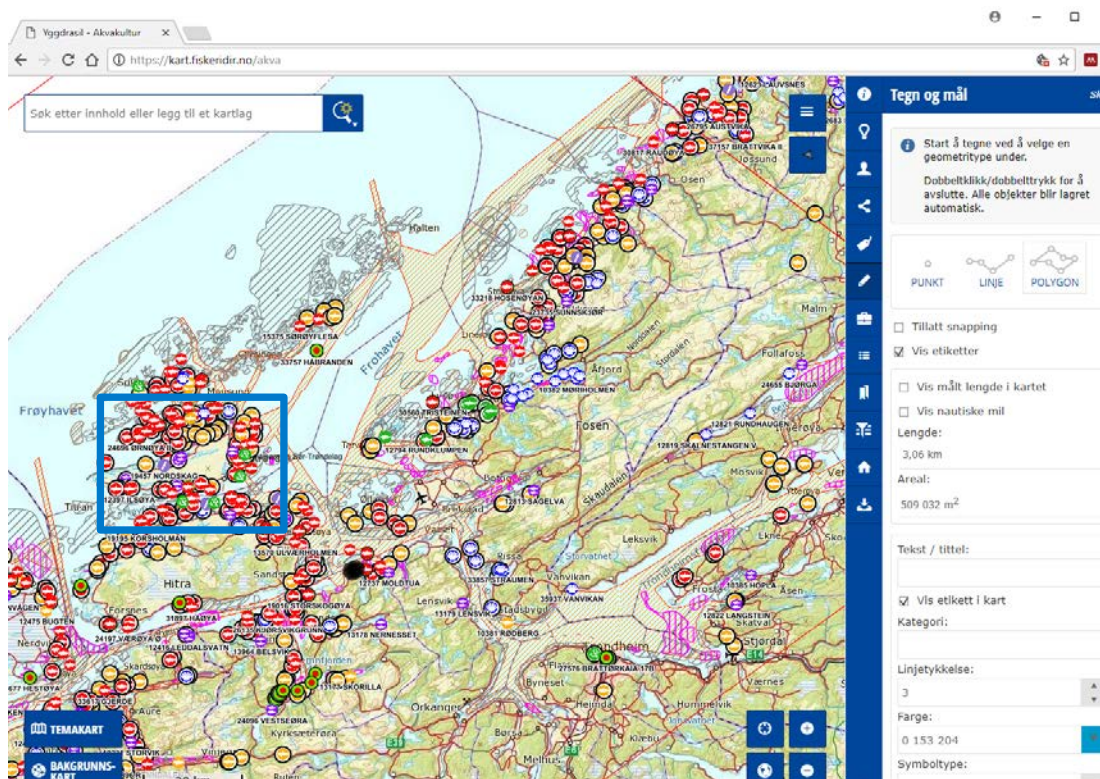
1400 km^2

MACROSEA

SINTEF

Karttopografi: NASA

How can we use these results?

- Screen shot from Google Earth w/kelp cultivation potential

- Soon available for entire Norway

- Decision support, or at least a place to start looking for sites

Available areas?

The "best" kelp cultivation sites

Funding

- The Research Council of Norway
  - MACROSEA - knowledge platform for industrial kelp cultivation (no. 254883, www.macrosea.no)
  - KELPPRO - interactions between kelp cultures and the environment (no. 267536 www.kelppro.net)
  - NOTUR grant no. NN2967k (HPC-resources at Stallo)
- Møre og Romsdal fylkeskommune
- Trøndelag fylkeskommune

Teknologi for et bedre samfunn