MONITORING PROGRAM 2017

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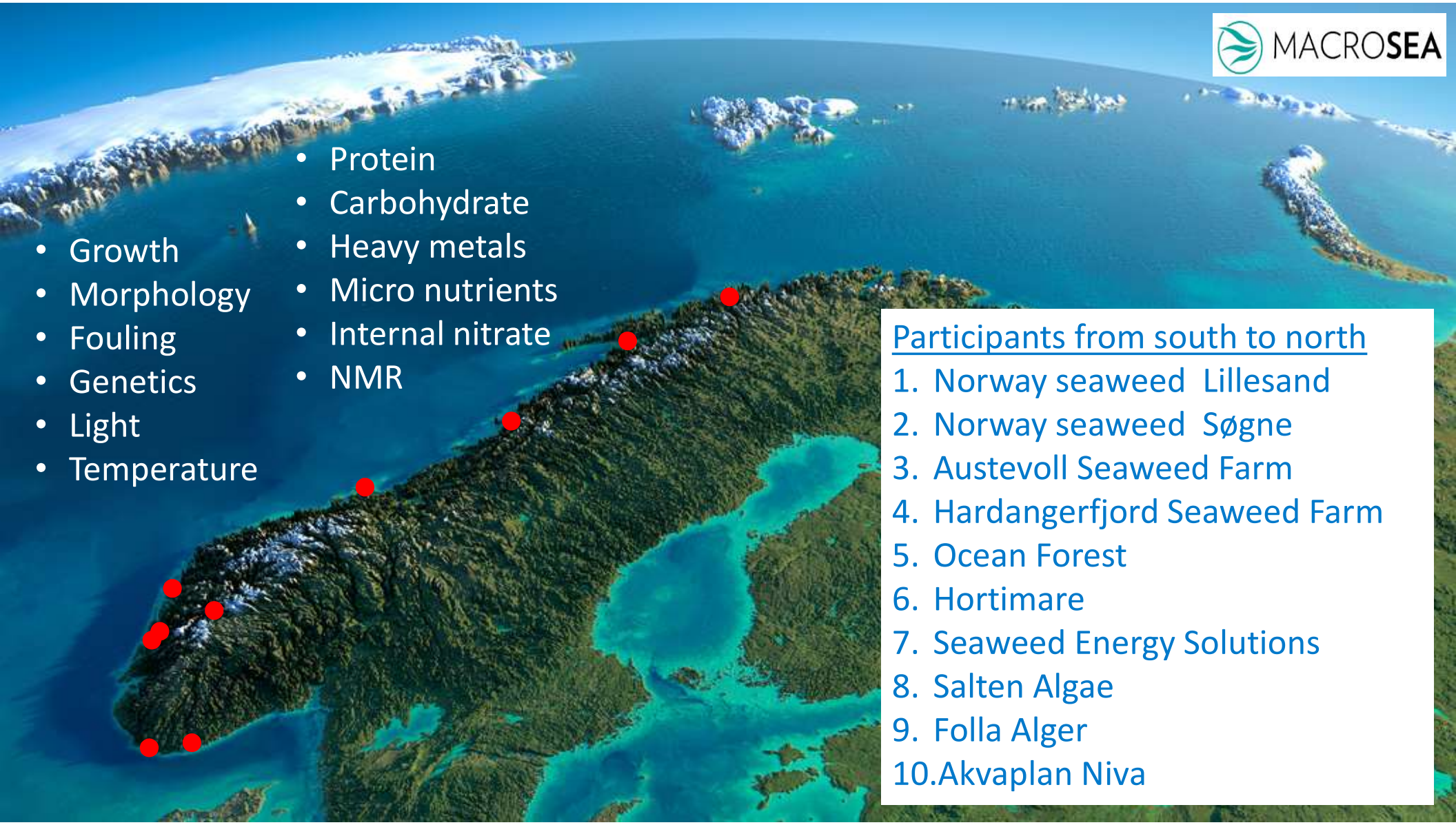
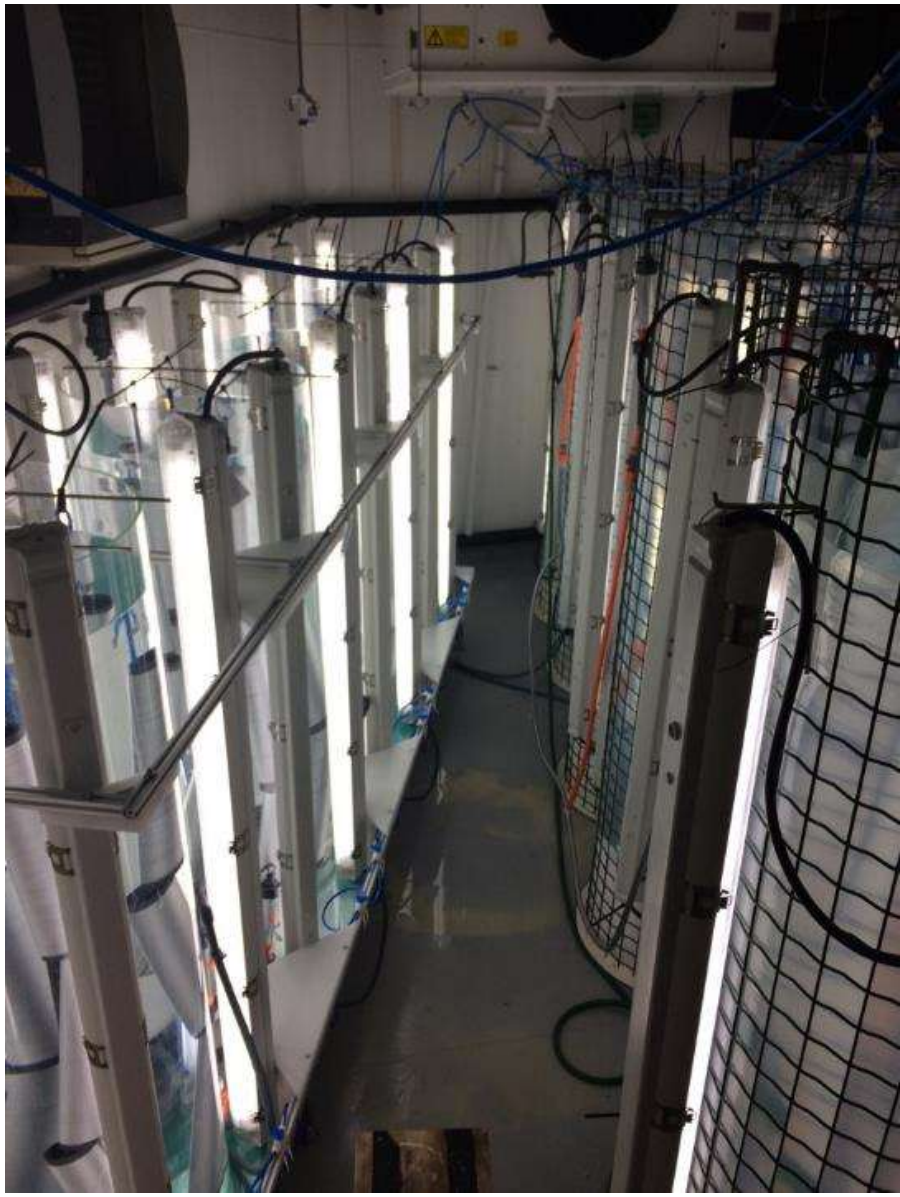

MACROSEA
• Growth
• Morphology
• Fouling
• Genetics
• Light
• Temperature
• Protein
• Carbohydrate
• Heavy metals
• Micro nutrients
• Internal nitrate
• NMR
Participants from south to north
1. Norway seaweed Lillesand
2. Norway seaweed Søgne
3. Austevoll Seaweed Farm
4. Hardangerfjord Seaweed Farm
5. Ocean Forest
6. Hortimare
7. Seaweed Energy Solutions
8. Salten Algae
9. Folla Alger
10. Akvaplan Niva

Spore release and seeding

- Fertile *Saccharina latissma* were sent to Trondheim from the different location during week 50 in December 2016. A common protocol was used for collecting and sending the “mother plants”
- Spore release was done according to the Sintef protocol and a spore density of ~250.000 spores/ml was obtained from all location
- The spores were sprayed on thin string and incubated in the seaweed hatchery for 7 weeks



Seedling density- Image examples

13. January 2017 (0%)

16. January 2017 (12%)

20. January 2017 (16%)

23. January 2017 (61%)

26. January 2017 (73%)

30. January 2017 (83%)

2. February 2017 (84%)

6. February 2017 (89%)

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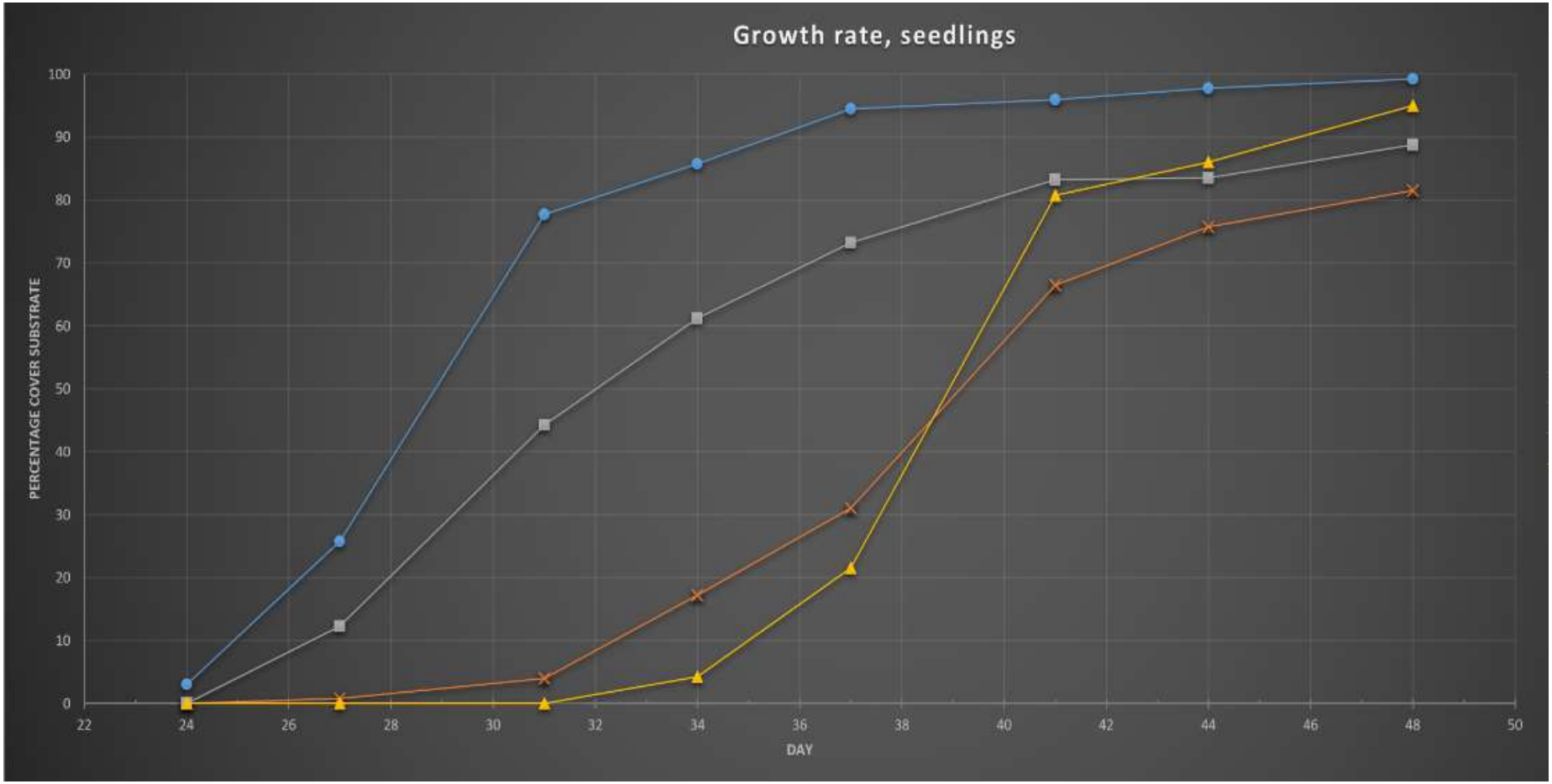
Growth rate, seedlings
PERCENTAGE COVER SUBSTRATE
DAY
0
10
20
30
40
50
60
70
80
90
100
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50

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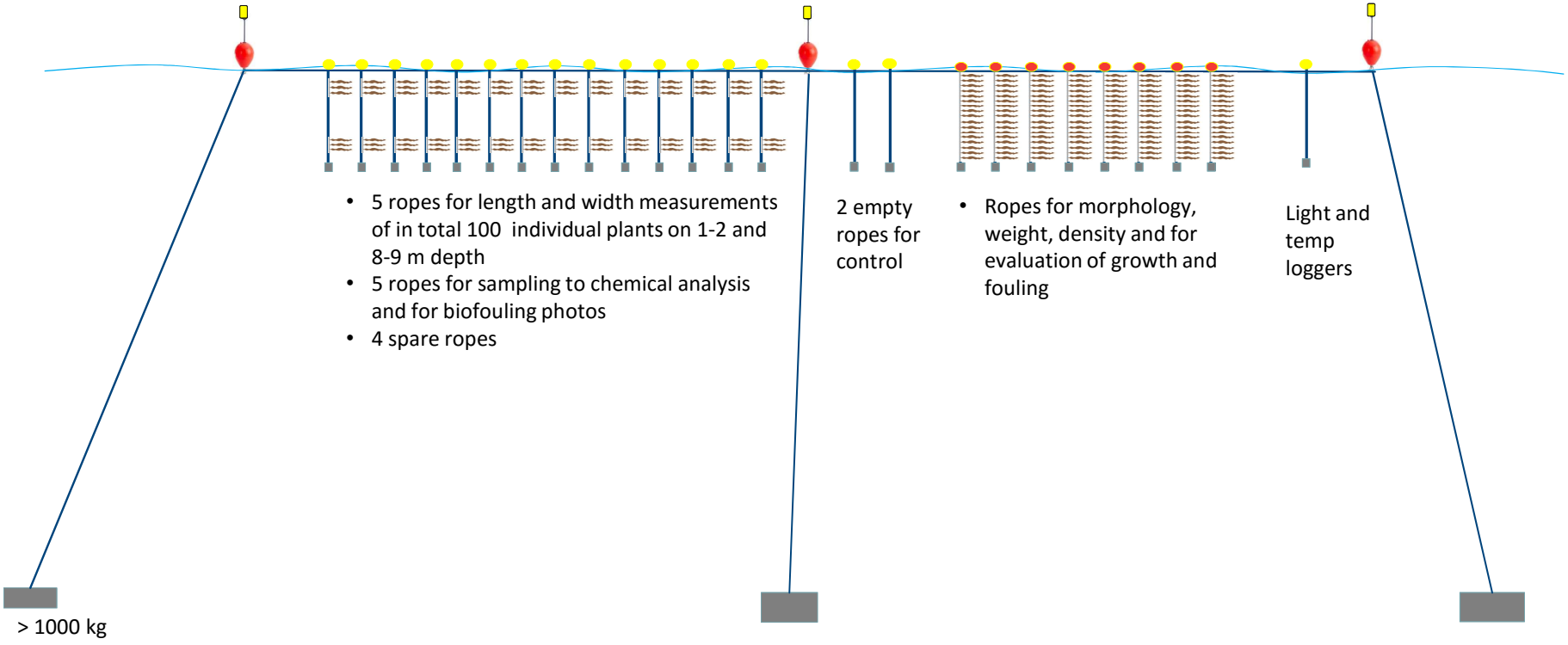
Packing and shipment

- The thin, seeded string was spinned onto thicker rope and wrapped in plastic to keep the ropes moist during transportation
- The ropes were packed in Styrofoam boxes and shipped with express delivery to all the ten location
- As far as possible, the ropes were deployed the same day at the sea farms, or stored in tanks with seawater on land until deployment (1-14 days)

Deployment and set-up at the farms



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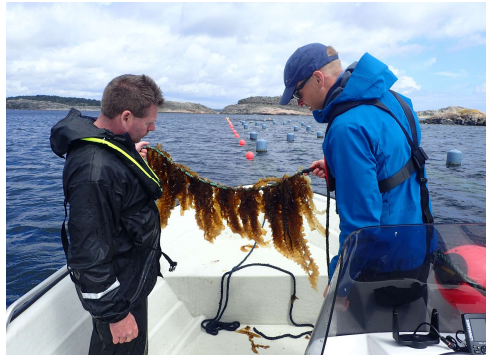
Registration and sampling

- The participants in the Monitoring program received a protocol for registration/sampling and the equipment needed
- 8 sampling in total were planned from April to September:
  - Length/width on 100 plants (50 from each of the two depths)
  - Weight (starting at sampling number 3)
  - Density (starting at sampling number 3)
  - Pictures for fouling registration (Sanna)
  - Sampling of biomass for chemical analysis (50 plants from each depth)
  - Pictures from the two depths
- Due to bad weather, early fouling/loss of biomass and other circumstances, not all participants have done all the registrations



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Norway Seaweed Lillesand (NSL)

Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Norway Seaweed Søgne (NSS)

Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36 | Week 39

Austevoll Seaweed Farm (ASF)






Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Hardangerfjord Seaweed Farm (HSF)







Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Ocean Forest (OFL)








Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Hortimare (HOM)

Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Seaweed Energy Solution (SES)








Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Salten Algae (SAL)





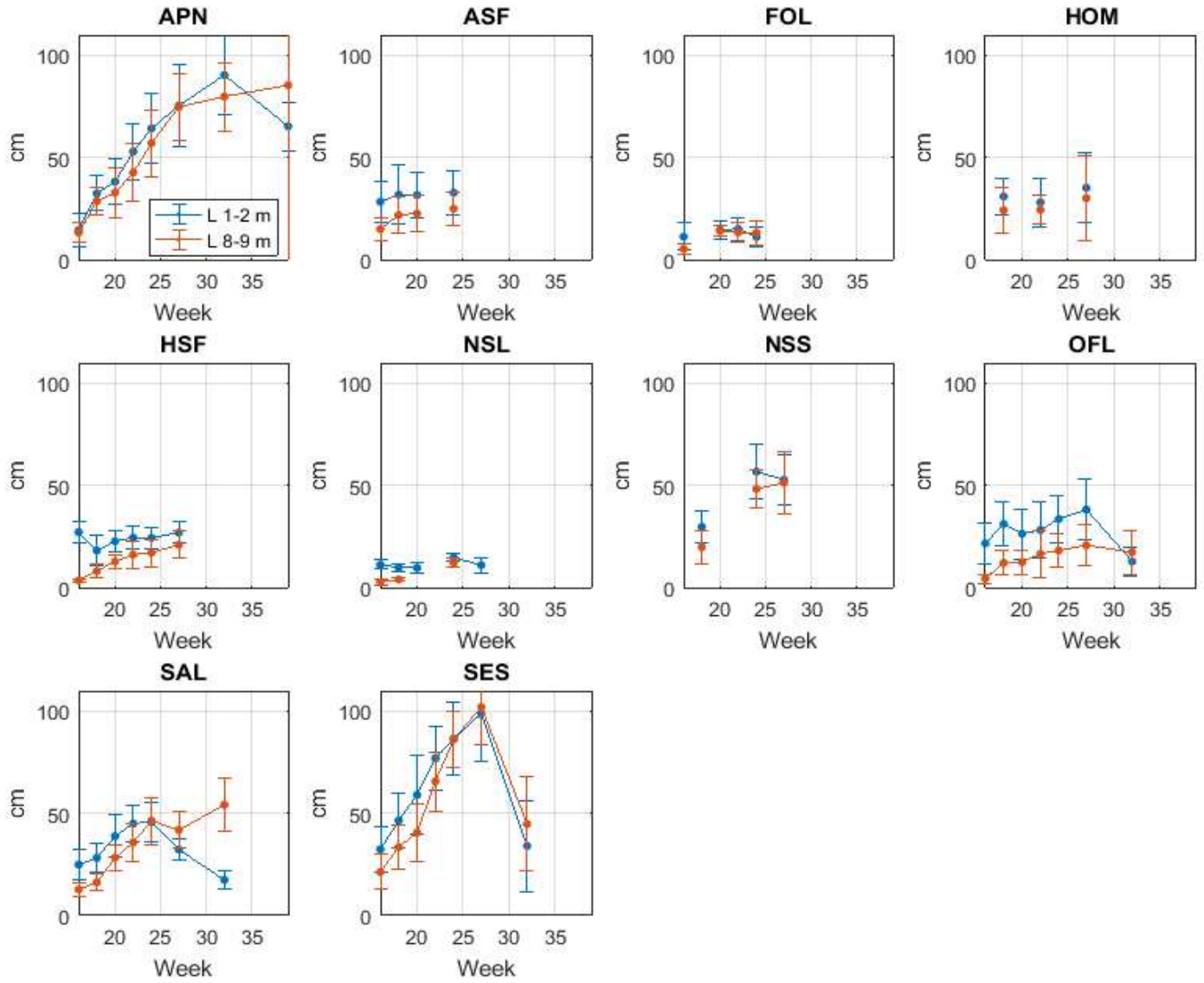


Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

Folla Alger (FOL)

Week 16 | Week 18 | Week 20 | Week 22 | Week 24 | Week 27 | Week 32 | Week 36

AkvaplanNiva (APN)


APN
ASF
FOL
HOM
HSF
NSL
NSS
OFL
SAL
SES
cm
Week
0
50
100
20
25
30
35
L 1-2 m
L 8-9 m

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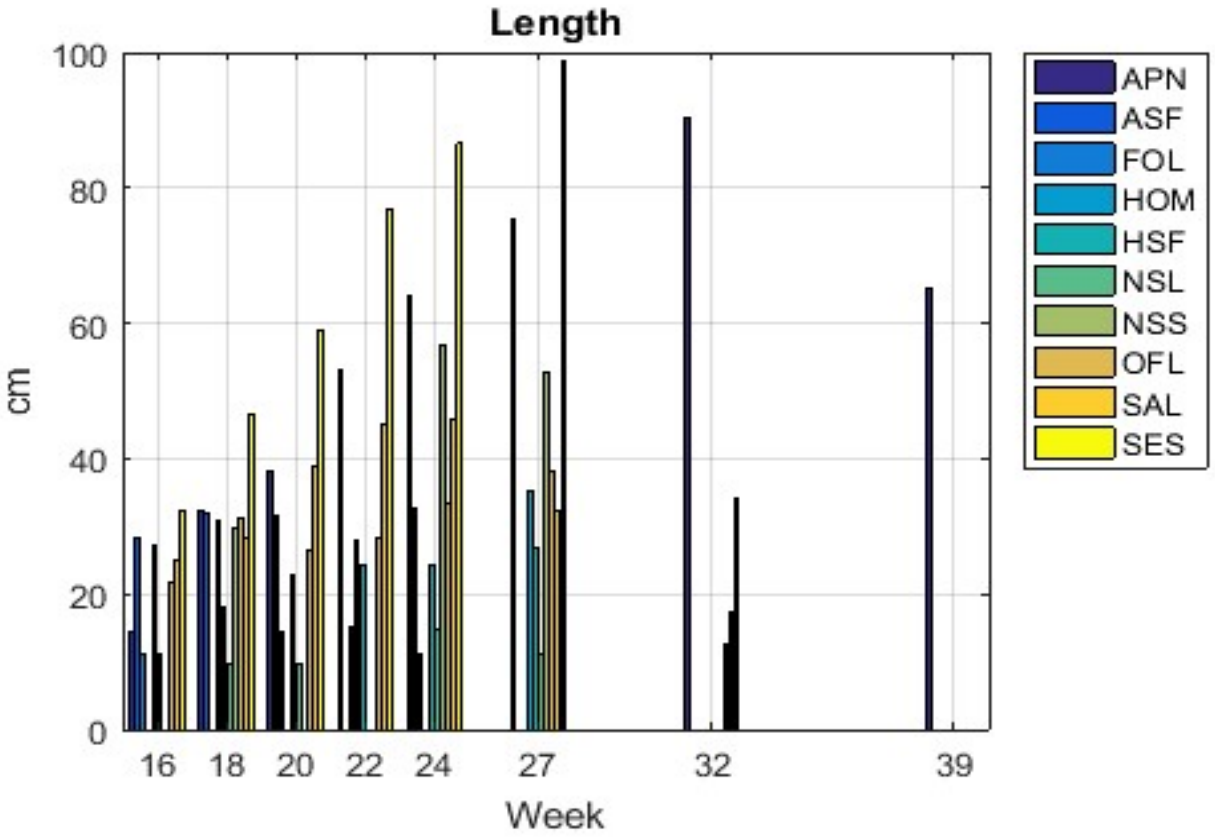
Comparison of growth between the locations



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Processing of samples in the lab

- The samples were transported frozen from all locations to Trondheim after the last registrations
- Samples are freeze dried prior to further analysis

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Freeze dried sample from week 16

Freeze dried sample from week 20

Freeze dried sample from week 32

- A few samples have too little biomass to run all the planned analysis (especially from the 1. and 2. registrations).
- Samples with biofouling will give a result that will differ from the other weeks

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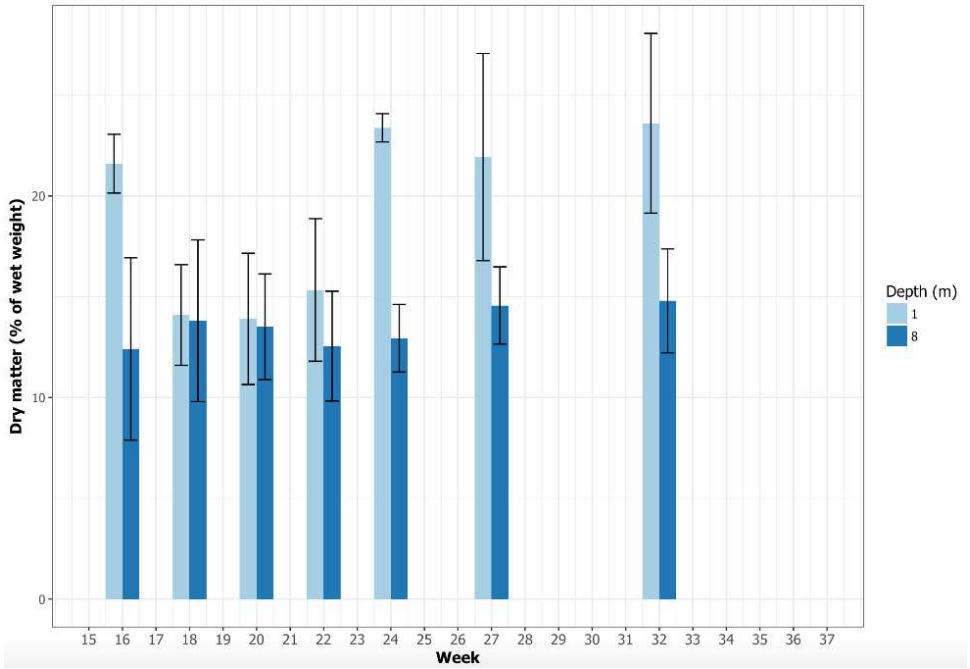
Analysis

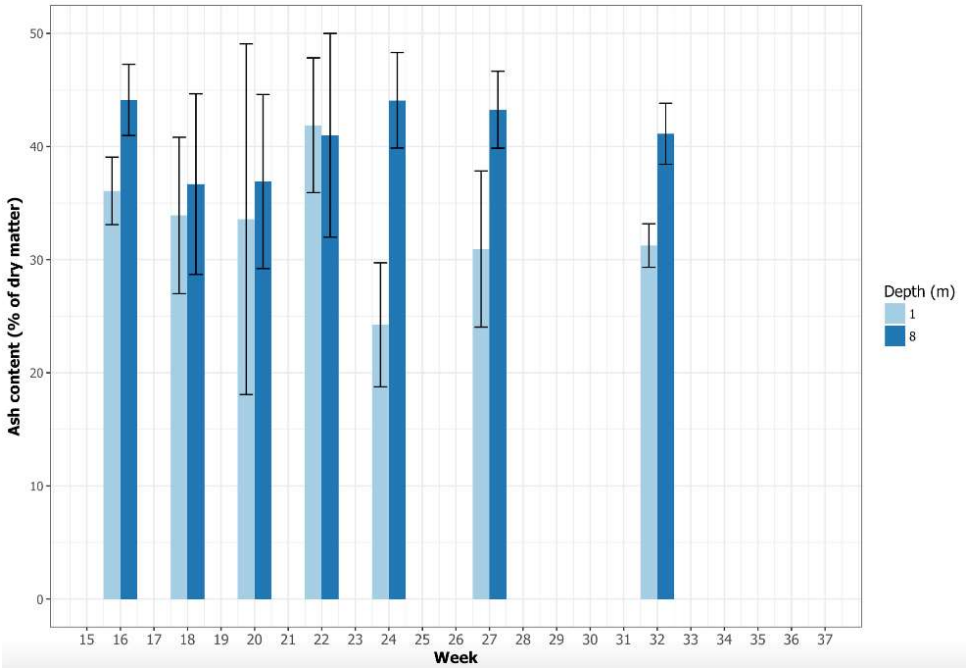
- Amino acids
- Internal nitrate
- CN
- Carbohydrates
- Heavy metals
- Inorganic arsenic (As)
- Iodine
- Polyphenols
- NMR
- Dry matter/ash

Dry matter and ash content

Dry matter 1-2m and 8-9m depth



Ash content 1-2m and 8-9m depth



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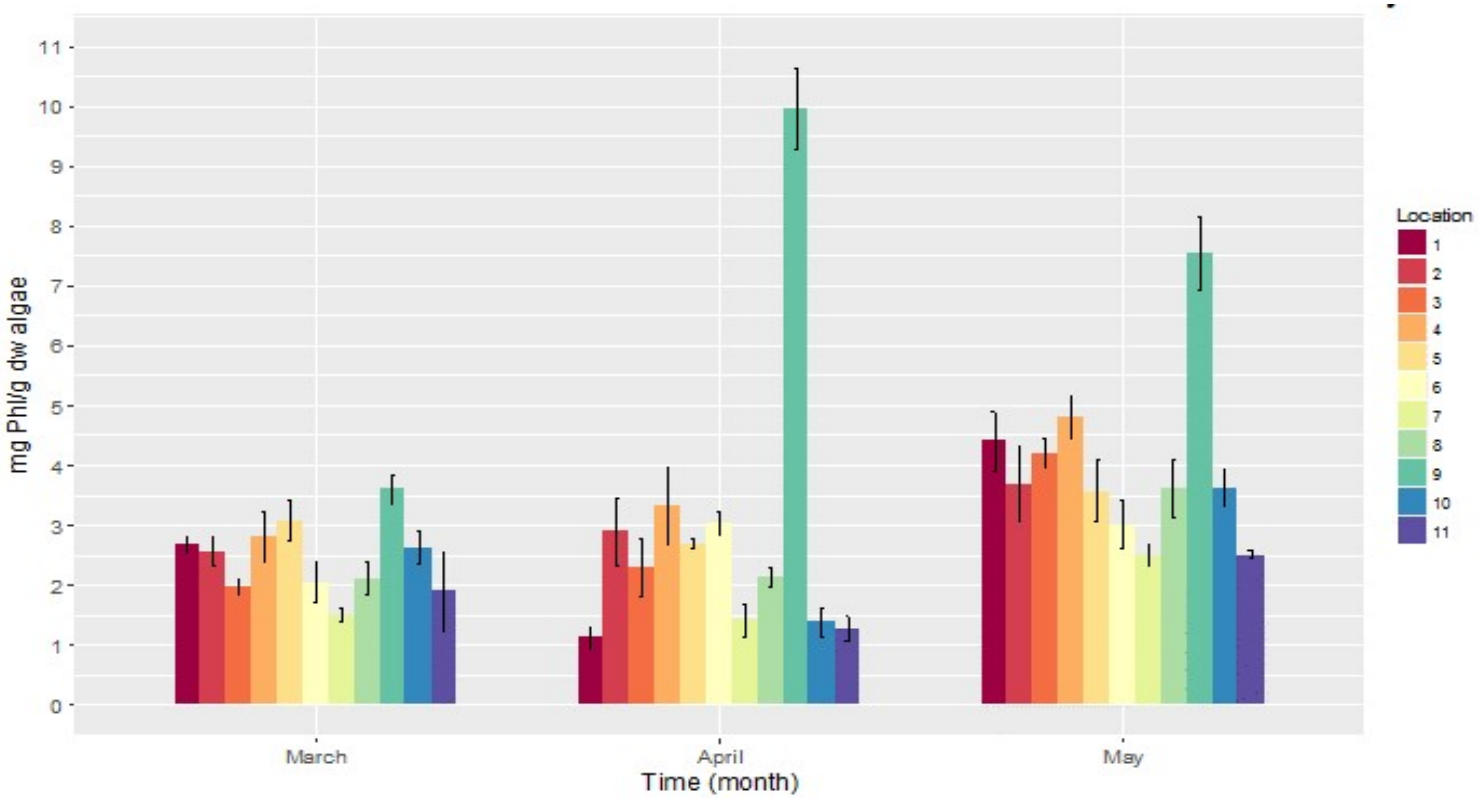
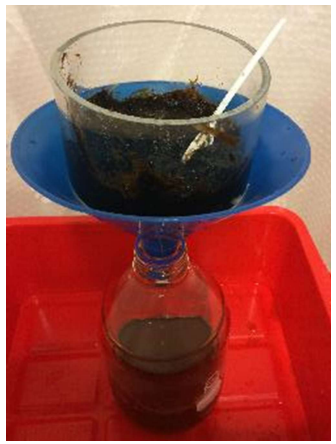
Phlorotannin content in seedlings from the different locations





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Monitoring Program 2018

- Decided not to run the whole program for another year
- Too time- and recourse demanding
- Seaweed will be deployed in Trondheim and Tromsø where the PhD's will have other experiments going on

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