



GENIALG

e-Learning course

SUSTAINABLE SEAWEED FARMING PRACTICES

Module 1 - Seaweed Cultivation and Monitoring Protocols

LESSON 4

Monitoring Protocols for Seaweed Farming

©Atlantic Sea Farms



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GUIDING PRINCIPLES



- Evidence based: gather biotic and abiotic environmental data from test sites
- Informed by **BACI** design (Before, After, Control, Impact (or event))
- Detect spatial gradients from source of “impact”
- Separate anthropogenic and natural sources of variance
- Determine replicability across the geographical spectrum and environmental conditions
- Provide cost-effective monitoring guidance



ENVIRONMENT



1. Abiotic environment:

- Water chemistry (nutrients and pollutants)
- Water clarity
- Hydrodynamics and sedimentary regimes

2. Biotic environment: Fauna and flora

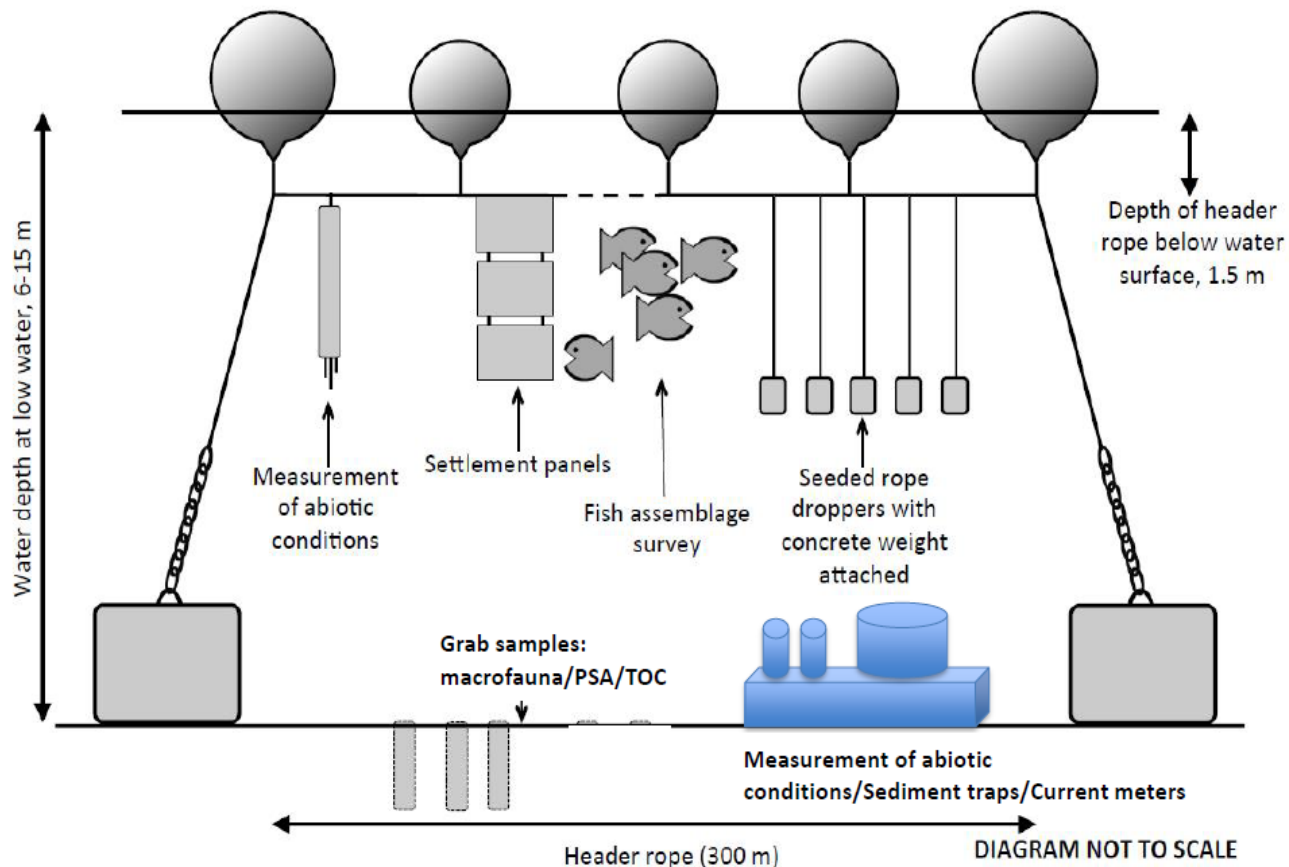
see the next slide for
better understanding



Module 1 - Seaweed Cultivation and Monitoring Protocols

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ENVIRONMENT



POTENTIAL EFFECTS

SEAWEED FARMING OUTDOOR

Potential effects on the physical environment

1. Nutrient and pollutant removal:

- Ameliorate eutrophication (+)
- Competition with primary producers (-)
- Wave and current attenuation: Coastal protection (+)



POTENTIAL EFFECTS

SEAWEED FARMING OUTDOOR

Potential effects on the physical environment

2. Increased sedimentation:

- Reduce turbidity/ Enhanced water clarity (+)
- Changes in seabed composition (-)
- Increased organic loads (-)
- Increased provision of food to seabed communities (+)





WHAT CAN BE DONE?

SEAWEED FARMING OUTDOOR

Potential effects on the physical environment

- Quantification of nutrient removal by cultivated seaweed (water quality)
- Evaluation of changes in local hydrodynamics, sedimentary processes and turbidity



In situ - water column and near-bottom sampling monitoring

Coupled with bio-physical hydrodynamic modelling

- Is shading an issue? Measure PAR (Photosynthetic Active Irradiance)



SEABED SURVEYS



SEAWEED FARMING OUTDOOR

- Detect potential effect on benthic communities: shading (PAR light loggers), increased organic loads (sediment traps)
- Video/dive surveys coupled with sediment sampling (grabs or cores)
- BACI survey design approach ensures detection of farm related effects against seasonality
- Transects to detect spatial change from source of “impact”



POTENTIAL EFFECTS

SEAWEED FARMING OUTDOOR

Potential **positive** effects on local biodiversity

1. Cultivated seaweed as keystones:

- Essential habitat for fish/bivalves (spawning/spat settlement).
- Habitat/refuge
- Enhanced feeding opportunities



POTENTIAL EFFECTS

SEAWEED FARMING OUTDOOR

Potential **positive** effects on local biodiversity

2. Longlines and ancillary structures

- Provision of settlement substrate and refuge from predators
- Acting as artificial reefs
- Foraging opportunities for fish, birds and crustaceans
- Fishing exclusion zones (habitat protection)

3. Feeding opportunities for birds and mammals



POTENTIAL EFFECTS

SEAWEED FARMING OUTDOOR

Potential **negative** effects on local biodiversity

1. Seaweeds:

- Increased deposition of organic matter: community/biotope changes
- Shading
- Nutrient competition
- Stepping stones for invasive species



POTENTIAL EFFECTS

SEAWEED FARMING OUTDOOR

Potential **negative** effects on local biodiversity

2. Longlines, buoys and anchors:

- Abrasion
- Smothering
- Scouring
- Stepping stones for invasive species



WHAT CAN BE DONE?



SEAWEED FARMING OUTDOOR

Potential **positive** and **negative** effects on local biodiversity

- Biodiversity enhancement and presence of invasive species in longlines:
 - ↳ Direct seaweed samples and experimental seaweed droppers
- Essential Habitat for Fish
 - ↳ Surface header ropes – Replicated dive videotransects, i.e. Fixed distance (30m) or timed (5 minutes) replicates
 - ↳ Surface header ropes and droppers - Remote GoPros yield satisfactory results
 - ↳ Seafloor: Baited Remote Underwater Cameras



SEAWEED FARMING OUTDOOR

QUALITATIVE

- Identify presence of sensitive or protected habitats
- Initial habitat description (i.e. inform monitoring design and record impact).

SEMI-QUANTITATIVE

- SACFOR scores for species abundance/coverage
- EUNIS biotope assignation

QUANTITATIVE

- Photoquadrats for colonial/epifaunal taxa present (seagrass, mussel beds or rocky substrata) combined with grab or core sampling for infaunal communities



SEABED HABITAT CHARACTERISATION AND MONITORING



SEAWEED FARMING OUTDOOR

- Sedimentary habitats
- Detect change in sediment composition (granulometry), organic matter content, infaunal communities.
- Baseline (on a virgin site), mid-season, peak biomass, post harvest
- Univariate and multivariate data analysis:
 - Biodiversity indices (e.g. Number of taxa, Shannon and Evenness index)
 - Community composition (e.g. MDS, SIMPER, PERMANOVA)





LESSON 4 OF
MODULE 2
FINISHED

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