SEABASED

SEABASED MEASURES IN
BALTIC SEA NUTRIENT MANAGEMENT

Practical Guidelines: Future utilization of the piloted measures

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WP 1: Practical Guidelines for sea-based measures

A compilation of neutral and verified information on

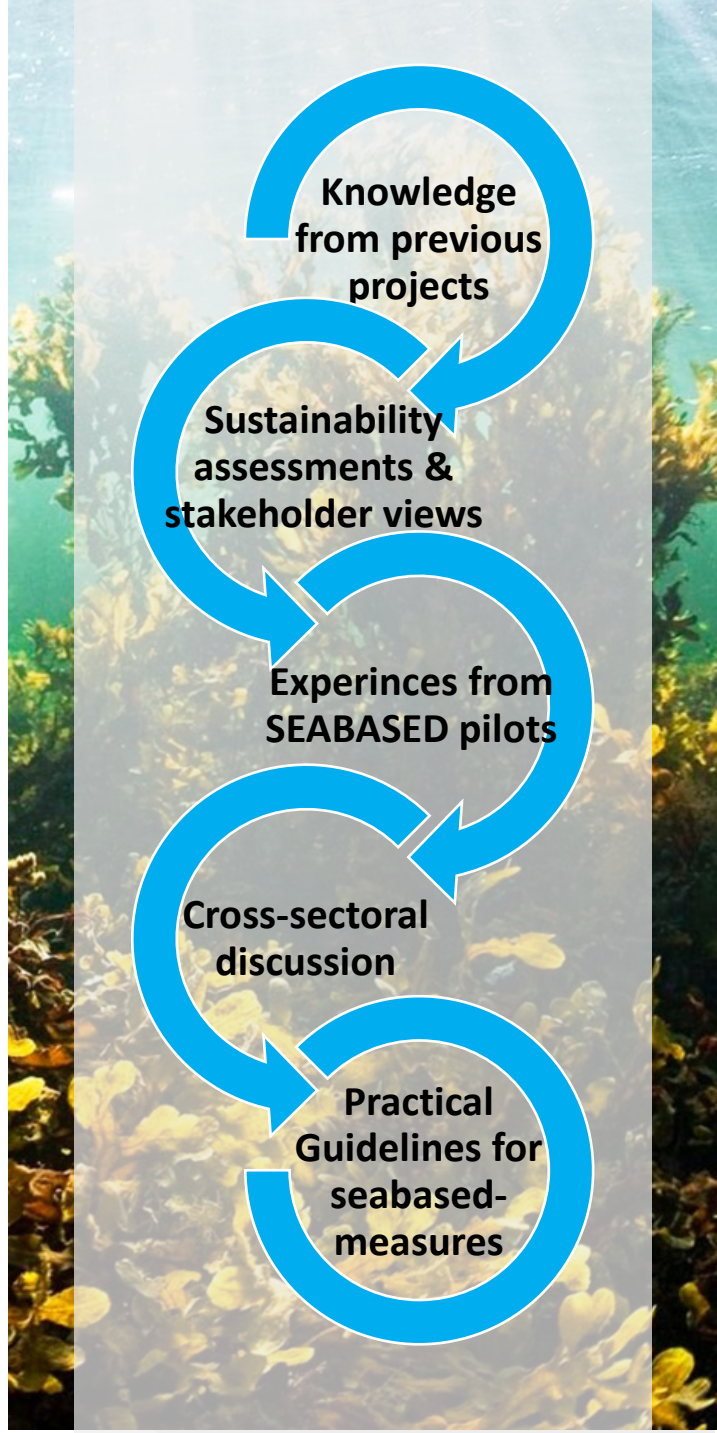
- Practical and scientific knowledge on different measures
- Sustainability assessments of piloted measures
- Potential effects and risks
- Costs and technical feasibility of measures

Participatory approach in Guideline development

- Comments and experiences of SEABASED partnership
- Stakeholders' views (interviews, surveys, national forums)
- Scientific knowledge (scientific forums)
- Cross-sectoral discussion (interviews, events, international forums)

Aim of the Guidelines is to provide

1) Guidance for organizations planning to carry out sea-based activities
2) Decision support for relevant authorities (e.g. permitting)
3) Practical information to national and international decision making



The Practical Guidelines - contents

1) Summary
2) Background
3) Aim of the Guidelines
4) Introduction to sea-based measures
5) Environmental aspects
6) Cost-efficiency of measures → **Comparison based on pilot examples**
7) International legislative framework → **Literature review & permitting**
8) Social aspects
9) Guidance for project planning
10) Attachments, e.g.
    - Reports from SEABASED Pilots

Background, SEABASED Project

- State of the play: current knowledge on sea-based measures
- Aims of the SEABASED Project

Sea-based measures in Baltic Sea Protection

- Examples of different measures – experiences from SEABASED pilots & from some previous projects
- Technical feasibility of measures – examples from pilot projects (SEABASED & some previous projects)
- Potential effects of measures – results from pilots

General acceptability and views

- Stakeholder workshops
- Views among environmental authorities, other stakeholders and local communities
- Helcom

Ecological risk assesment framework

1) Site selection
2) Choosing of measures
3) Ecological impact assessment
    - General indicators
    - Measure specific indicators
4) Potential risks related to sea-based measures
5) Monitoring and risk management

Ecological impact assessment

Ecological impact assessment for the planned measure should aim at:

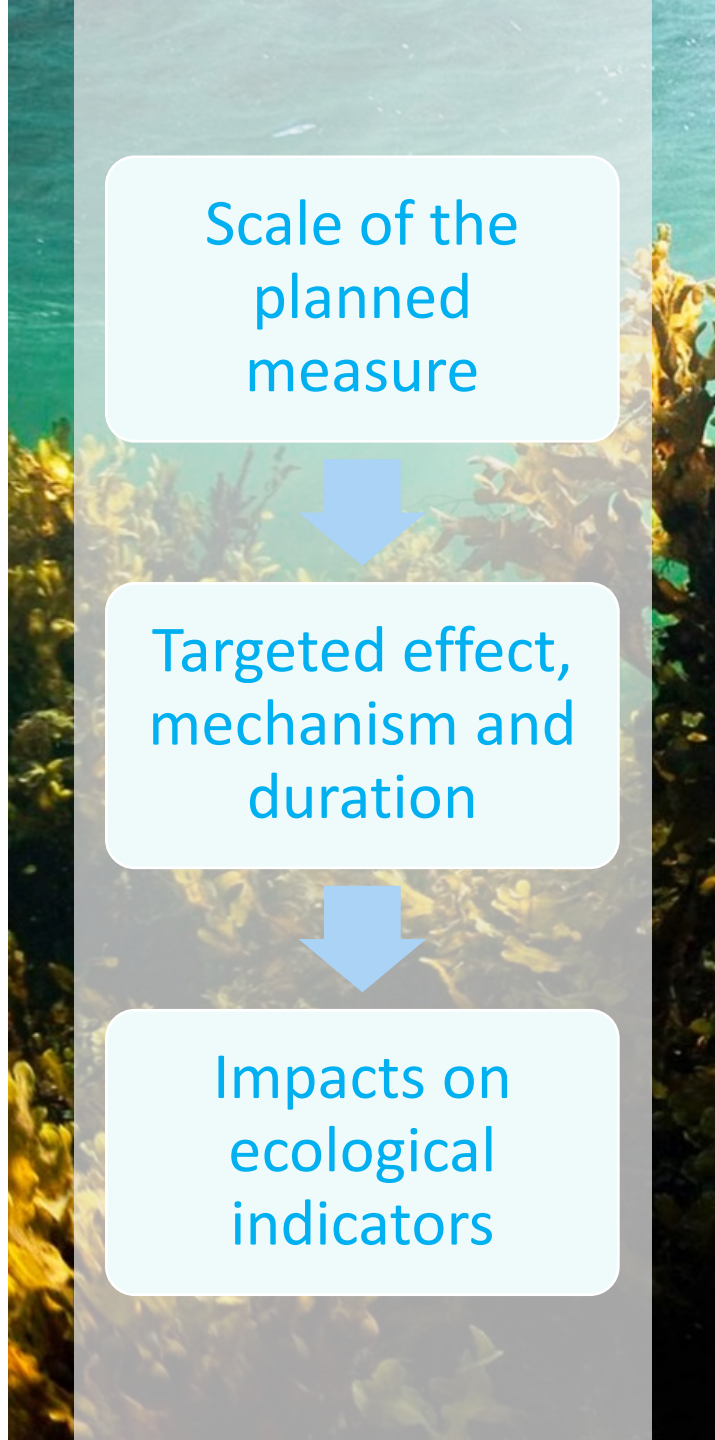
a. Identifying potential ecological effects, benefits and risks and

b. Understanding e.g.
   - direction (positive/negative, indicators)
   - magnitude
   - extent
   - duration (in time)

   of the identified effects.

- By evaluating the effects on different ecological indicators, biggest risks and risk thresholds, "no-go's", can be identified.
- These are also the key issues to consider when evaluating the applicability of possible future pilots of sea-based measures.

Different ecological indicators can be used for evaluating the effects of sea-based measures. Part of the indicators are measure-specific, and, thus, might not be relevant in case of all measures. Therefore, the impact assessment should be planned thoroughly to ensure the selection of the suitable indicators for different measures.

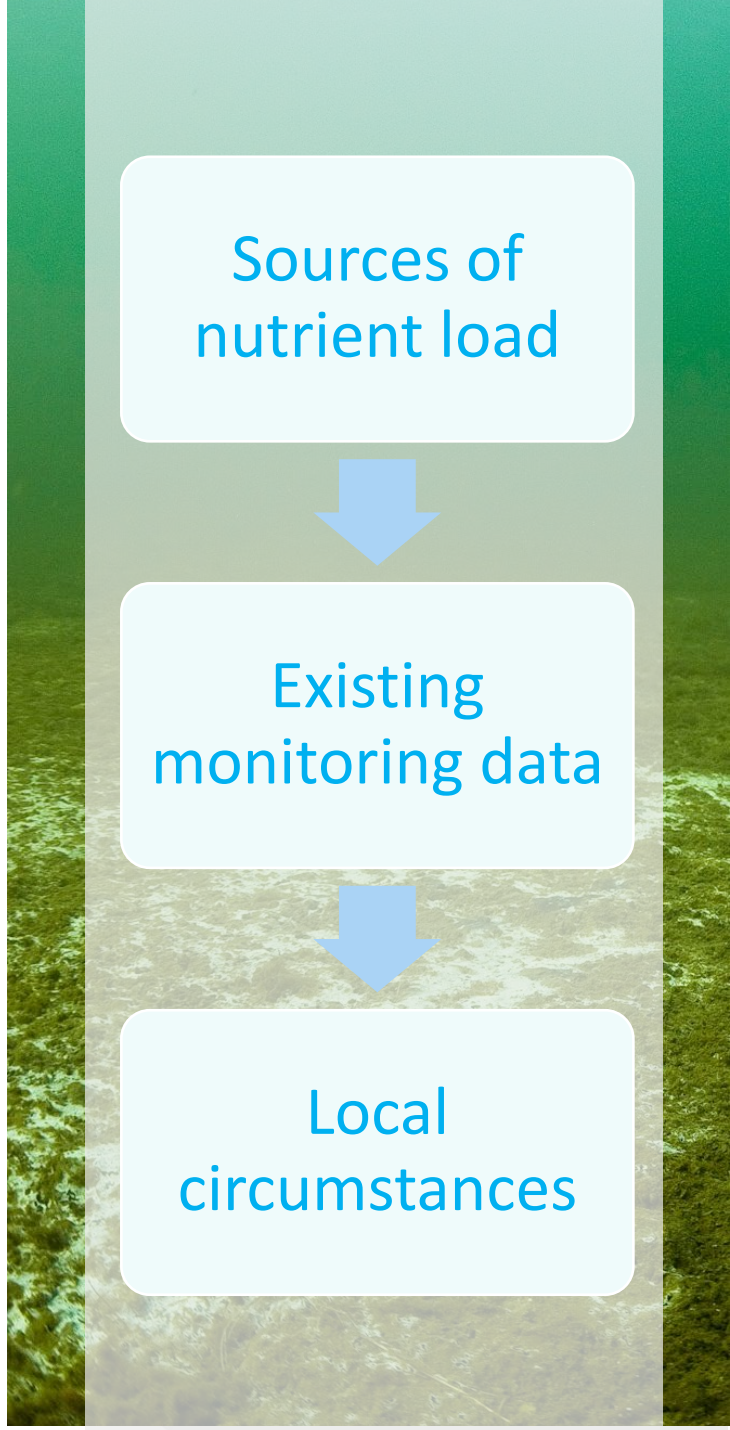


Site selection

In general, sea-based measures should be targeted only at areas identified as potential/significant sources of internal nutrient loading.

<u>The following preconditions should be considered:</u>

- Reduced external loading from land-based sources
- Enclosed/ semi-enclosed conditions to control and limit the effects
- Existing monitoring data before implementation
- Specific attention should be paid to hazardous substances (avoiding of contaminated areas)
- Selection of measures should be based on site-specific conditions
- At oxic, shallow areas with high pools of mobile nutrients, thorough evaluation of negative and positive impacts on local ecosystem is needed before the implementation of sea-based measures.



Risks management

- Spatio-temporal coverage of the monitoring plan: possible long-term effects or effects on neighboring water areas
- Impacts on Natura 2000 and other marine protected areas
- Plan for minimizing the potential identified risks or negative effects
- Risks with severe consequences, depending on the measure, e.g.
    - Disturbing of the ecosystem functioning as a whole
    - Risk of biodiversity loss
    - Risk of releasing of nutrients/ hazardous substances
    - Impacts on nutrient concentrations in productive water layer
    - Effects of changes in the environment over longer period of time
    - The measure-specific aspects

In addition to the ecological risks, an assessment and management plan for other identified risks should be included in project planning, e.g. for technical, juridical, social or economic risks in project implementation.

How to proceed when planning a project?

<u>Preconditions for suitable site:</u>

- Efficiently reduced external load
- High nutrient load from internal sources
- Closed/semi-enclosed area

Environmental Risk Assessment

- Local water protection targets
- Status of ecological indicators
- Choosing of measure(s)
- Implementation plan
- Monitoring plan
- Financing plan

Permitting

- Consulting of relevant authorities
- Economic and social impact & risks assessment
- Views of local stakeholders
- Project plan and budget

Implementation

- Financial resources for implementation
- Resources for monitoring
- Documentation of all steps
- Monitoring, before and after (long enough, even years)

Adequate documentation of all steps of the implementation, results and monitoring data!

Social sustainability survey – mapping views of environmental authorities

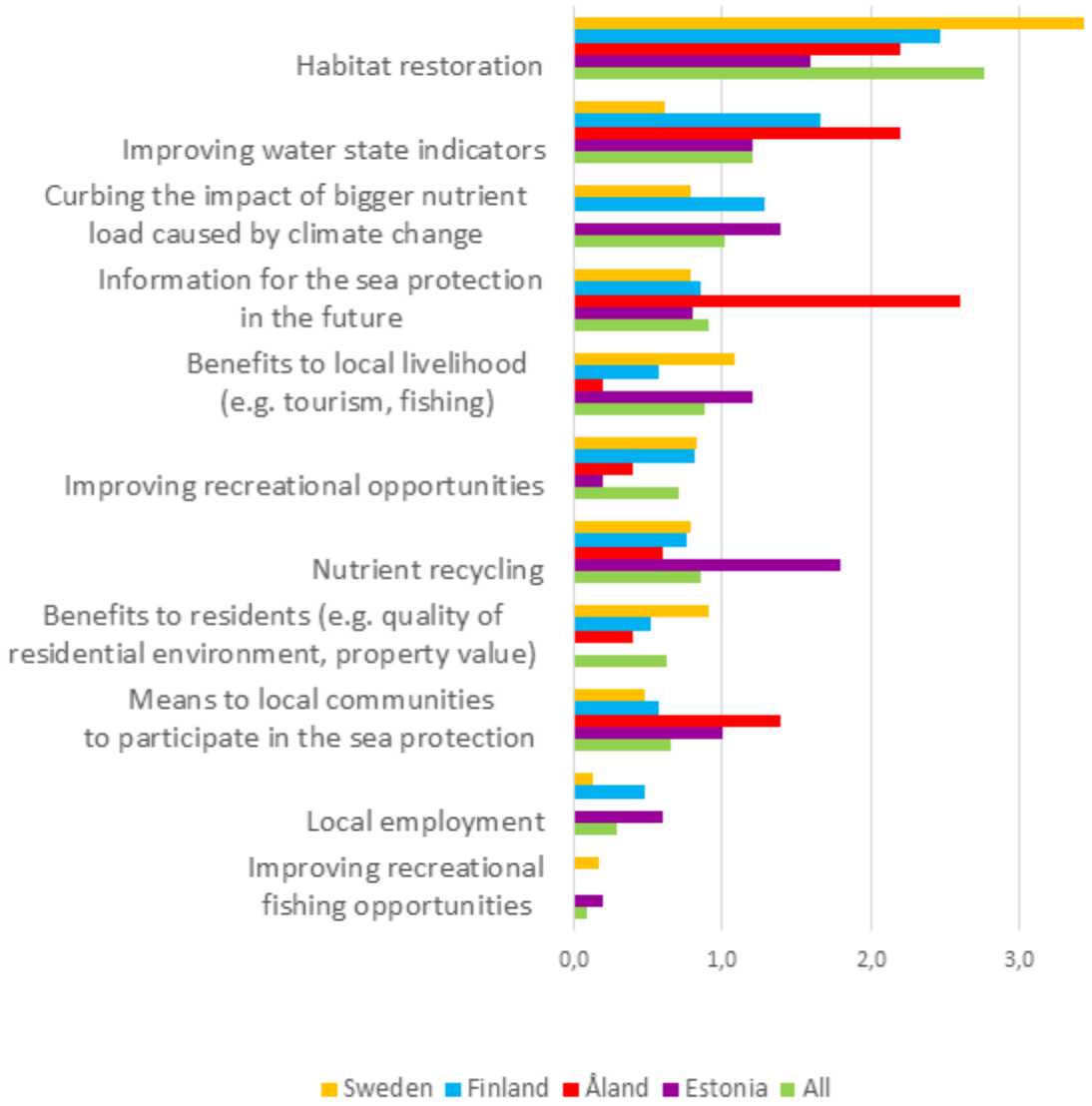
- Questionnaire was sent to approx. 240 contacts in Finland, Sweden and Estonia.
- Altogether 54 answers (22,5%)
  - 23 from Sweden
  - 21 from Finland
  - 5 from Åland
  - 5 from Estonia
- Division of answers:
  - Majority of answers (approx. 50%) from regional authorities (e.g. County administrations, ELY-centers)
  - 25% from local level authorities (e.g. municipalities)
  - 25% from national authorities (e.g. environmental and other relevant ministries)

What we asked (examples):

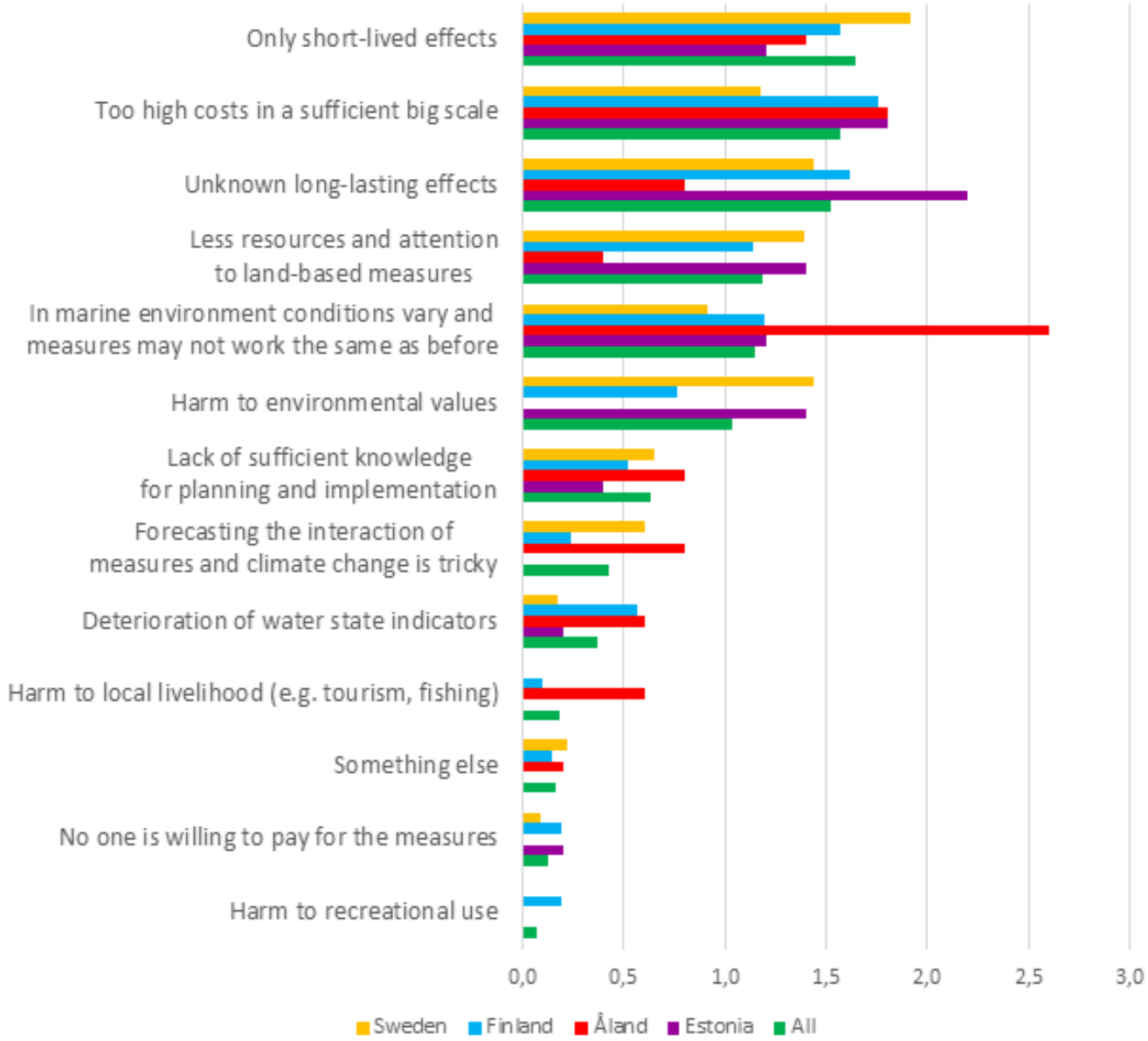
- **What would you see as biggest benefits of utilizing small-scale sea-based measures?**
- **What, in your opinion, are the biggest risks related to the small-scale sea-based measures?**
- **When there is enough information on the effects, risks and feasibility of sea-based measures, should these measures be extended to larger scale?**
- **Which are the main reasons that hinder the use of sea-based measures?**
- **Should the internal load and sea-based measures be included in water management plans?**

In addition, questions e.g. on level of knowledge, existing information, financing and organizations responsible for implementation were included, with the possibility to comment also in open answering fields.

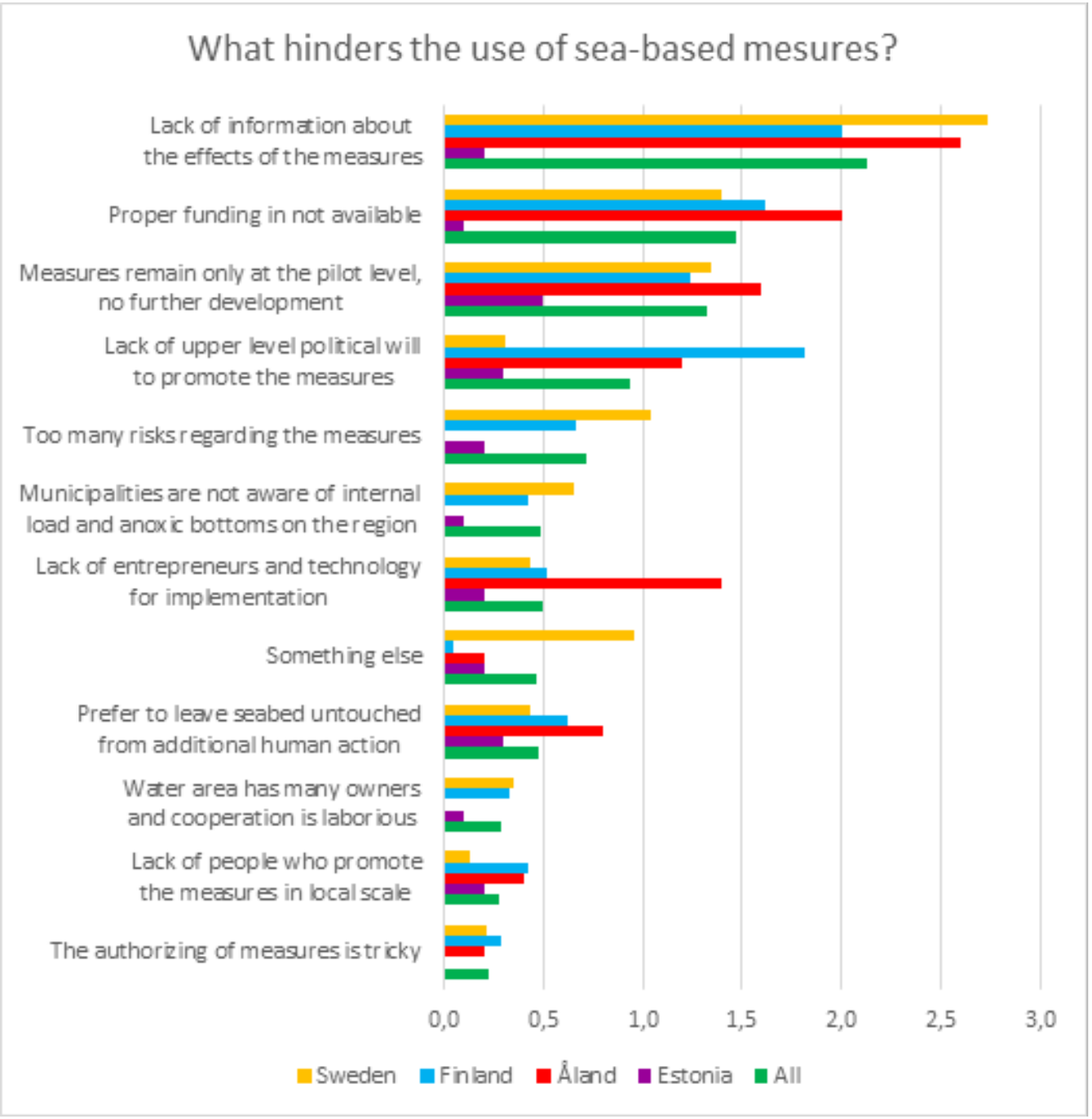
The most relevant benefits

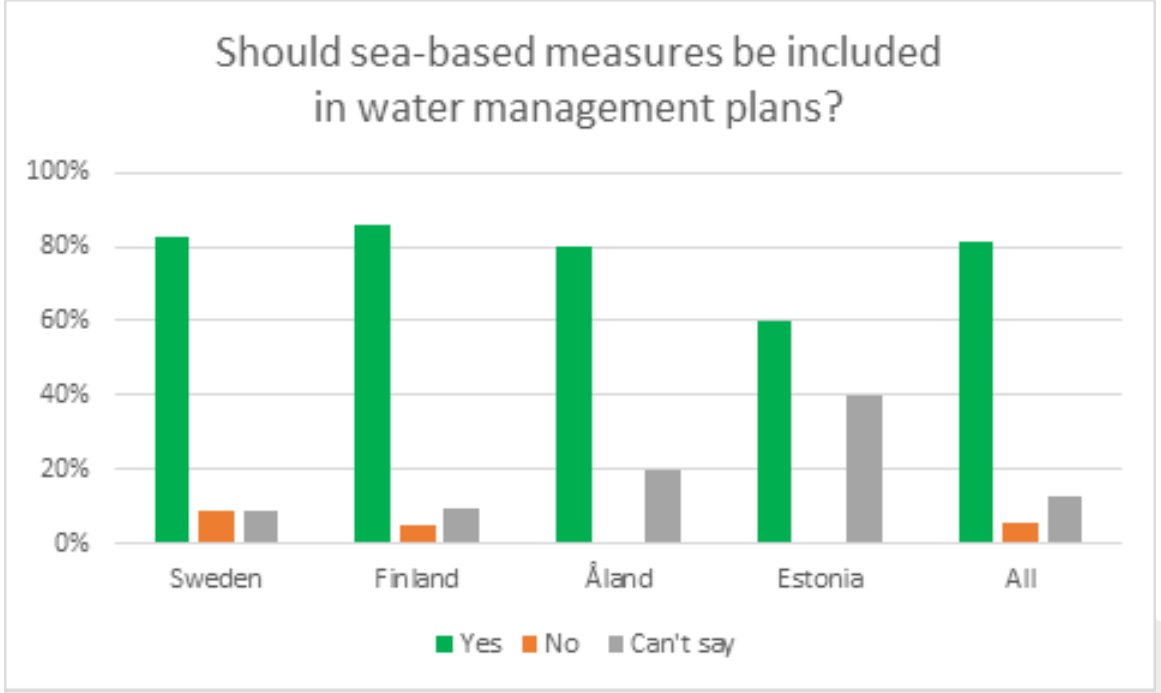


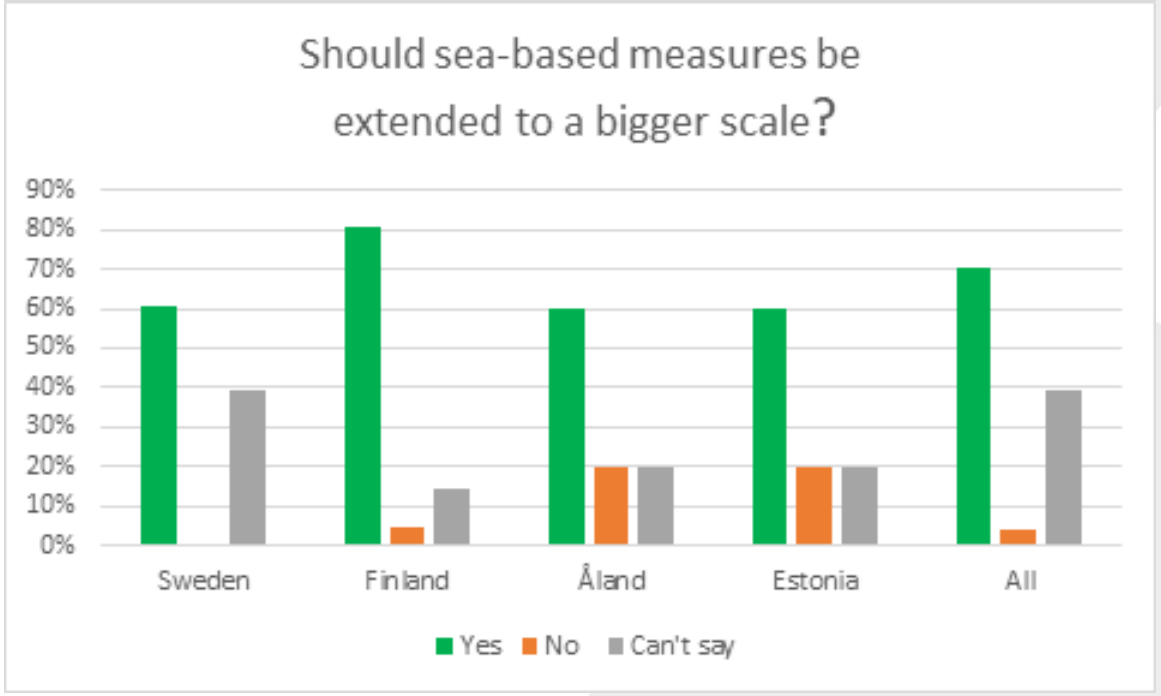
The most relevant risks regarding sea-based measures



Results from SEABASED Social Sustainability Survey for environmental authorities in 2020 (n=54)







Results from SEABASED Social Sustainability Survey for environmental authorities in 2020 (n=54)

Cost-efficiency of sea-based measures?

- Only verified costs taken into account in the estimations in SEABASED Guidelines.
- Some preliminary estimates can be provided for
  - Al treatment
  - mussel farming
  - management fishing
  - Reed harvesting
  - irrigation with nutrient rich water from coastal bays
- For the other measures, missing information on costs or impacts prevent reliable calculations.
- For some measures cost-effectiveness calculations have been distorted by using unrealistic assumptions for the market value of e.g. the removed biomasses or marine sediment.

“Geo-engineering” measures

(e.g. sediment removal, P binding, oxygenation)

- Calculating cost-effectiveness is impossible for measures that
  - lack information on P removal/binding efficiency
  - Lack information on implementation costs

  → **The steps to gather this information need to be taken first**
- For some measures, piloting even in coastal scale has turned out to be challenging due to high implementation costs.

  → **Poor cost-effectiveness or major technical development needs?**
- Based on the project pilots and earlier projects, the most of “geo-engineering” measures still seem to be clearly less cost-effective than land-based measures.
- However, some of these measures could be used locally for small coastal areas, where the role of internal load on eutrophication is proven and water quality cannot be improved with other means.

Measures based on biomass removal

(e.g. management fishing, reed harvesting, mussel farming)

- Market value of the biomass is decisive for cost-efficiency and economic sustainability of the activity.
- The amount of nutrient reduction can be reliably verified
- Often difficult or impossible to prove any direct improvements on local water quality.
- Some measures based on biomass removal seem to be cost-effective
  - with estimated costs of less than 200€ / kg P removed
  - when compared to the measures in reducing land-based load from diffuse sources (e.g. agriculture)
  - even when no assumption on market value for the biomass has been included in the calculation

Conclusions, part 1

- The suitability of the sea-based measures is always site-specific.
- Results from one site can’t be directly applied to other locations.
- Concerning large-scale (open sea) applications, no techniques are mature enough yet. Results from local pilots can’t be generalized to open sea as such.
- Impacts to be considered might not be restricted to the marine environment (e.g. utilization of biomass, biodiversity)
- Cost estimates should be based on realistic information on both, costs and nutrient reduction efficiency of the measure.
- Some of the sea-based measures could be cost-efficient in local scale water protection, for supporting nutrient load reductions from land.

Conclusions, part 2

- More research and techical development is needed for future applications of the geo-engineering measures.
- Identified knowledge gaps exist e.g. in understanding of sediment processes, nutrient cycles and impacts of the climate change in the Baltic Sea marine environment.
- Monitoring and documentation of all pilots is crucial!

→ Focus should be kept in reducing land-based nutrient load.

→ Some of the sea-based measures can be cost-efficient for utilization in small-scale local marine protection.

→ Also, some of the novel measures are potential but need further research and technical development.

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