Name of indicator	## 2.2 Accumulated cover of submerged vascular plants
Type of Indicator	State indicator
Author(s)	Nicklas Wijkmark
Description of the indicator	This indicator reflects quantity of the submerged vascular plant community measured as accumulated cover, thus indicating biodiversity quantity as the amount of the vascular plant community and associated species. It indicates biodiversity quantity on shallow soft bottoms in more sheltered areas and can be used simultaneously with the macroalgae indicator for shallow hard bottoms. All species of submerged vascular plants are included in this indicator, both eelgrass meadows and mixed stands of taxa such as *Stuckenia, Potamogeton, Myriophyllum* etc. Most studies on submerged vascular plants focus on seagrasses (e.g. Bonström and Bonsdorff 1997, Hemminga and Duarte 2000,), but two studies by Hansen *et al.* (2010) on other vascular plants and charophytes show that invertebrate abundance is higher on structurally complex species.
Relationship of the indicator to marine biodiversity	This indicator reflects the amount of the submerged vascular plant community, thus indicating biodiversity quantity of submerged vascular plants and associated species. Submerged vascular plant meadows are habitats for a range of other species in the Baltic Sea (e.g. Bonström and Bonsdorff, 1997) and it is known both animal abundance and species richness are higher when vascular plants are present (Orth *et al*. 1984, Hemminga and Duarte 2000).
Relevance of the indicator to different policy instruments	MSFD descriptors: Mainly relevant for MSFD descriptor 1 "Biological diversity is maintained". May also be of relevance for descriptor 5 "Eutrophication". HELCOM BSAP: Relevant for BSAP segment 4: "Towards favourable conservations status of Baltic Sea biodiversity" by providing data on community level for one aspect of Baltic Sea biodiversity as well as habitat building species. Habitats Directive: May provide relevant data for habitats such as 1110 (sublittoral sandbanks).
Relevance to commission decision criteria and indicator	1.5.2. Habitat volume 1.6. Habitat condition 1.6.1. Condition of the typical species and communities 1.6.2. Relative abundance and/or biomass, as appropriate
Method(s) for obtaining indicator values	Suggested sampling method is drop-video, which is a time efficient method for covering large areas (Svensson *et al*. 2011). Methods such as diving may also be used. Geographical aggregation – Sampling may be performed in different ways. Example using drop-video: sampling performed in a randomized stratified way within monitoring areas. Both soft and hard substrates may be sampled, thus also providing data for the macroalgae indicator within the same survey. However, only soft bottoms are included in this indicator. Monitoring areas can be natural such as coastal basins, or artificial such as administrative units. Temporal aggregation – Repeated sampling and modelling of submerged vascular plant cover in monitoring areas within a monitoring program provides temporal trends of the quantity of this community. Within a monitoring year sampling is performed once, typically in late summer or early autumn.
Documentation of relationship between indicator and pressure	Eutrophication is the main anthropogenic pressure affecting values of this indicator. CHL a, Secchi depth and N and P concentrations had negative effects on accumulated cover in a random Forest analysis performed on data from the Hanö Bight, CHL a being the most important of these predictors (Fig. 2).
Geographical relevance of indicator	4. Baltic Sea wide
How Reference Conditions (target values/thresholds) for the indicator were obtained?	Reference conditions were established by spatial modelling and prediction with environmental layers adjusted to reference conditions (e.g. adjusted predictor layers where effects of anthropogenic pressures have been removed). Adjusted environmental layers were CHL a, Secchi depth, proximity to environmentally hazardous activities, marine traffic and urban developments. The analysis was performed with data from the Hanö Bight study area in Sweden.
Method for determining GES	GES-levels were set as 25 % acceptable deviation below modelled reference conditions in 2 m depth intervals. Suggested depth interval for determining GES is 1-9 meters.

See Table 1 for GES-values.

References

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Illustrative material for indicator documentation

Table 1. Predicted reference conditions and GES-levels for the Hanö Bight in suggested 2 m intervals.

Predicted RefCond and GES-levels (mean % acc. Cover)		
Depth	GES level	Reference condition
1-3 m	30	40
03-5 m	30	40
05-7 m	20	27
07-9 m	6	8

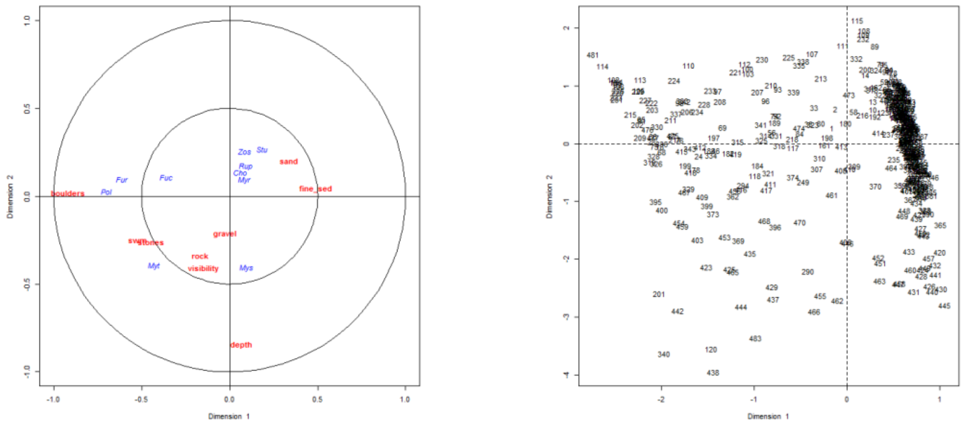

Figure 1. CCA-plot showing the vascular plant community in relation to some other abundant species and environmental variables. Accumulated cover of vascular plants and Accumulated cover of perennial macroalgae will together indicate biodiversity quantity in two important coastal communities.

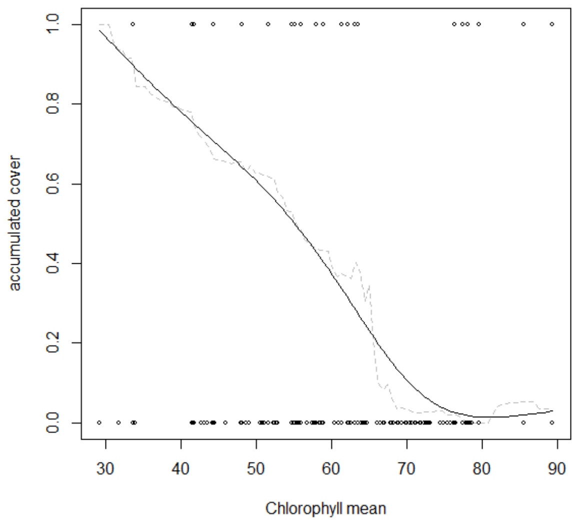

Figure 2. rF partial dependence of CHL a for accumulated cover of submerged vascular plants