Piloting Marine Ecosystem Accounts in Finland

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Habitat forming eelgrass *Zostera marina* in SW coast of Finland. Photo: Mats Westerbom

Objectives

1. Link species and habitats to ecosystem services
2. Use species and habitat modelling to determine ecosystem extent and condition
3. Use this information to develop biophysical marine ecosystem accounts in Finland

Background

The capacity of a species or a habitat to provide ecosystem services (ES) depends on the area covered (extent) and its state (condition).

Progress in marine ecosystem accounting has been hampered by the lack of information on (*i*) linkages between ES and marine ecosystem components and on (*ii*) the influence of the state of the marine environment on ES supply. Establishing such links will enable assessing the costs of degradation of the marine ecosystem.

Methods

Data & models

- Underwater inventory data on species and habitats (since 2004): 170,000 sites across the entire Finnish sea area (https://paikkatieto.ymparisto.fi/velmu/).
- Ca. 200 species distribution models (SDMs) at 20 m resolution for the entire Finnish sea area: algae, vascular plants, invertebrates (cf. Virtanen et al. 2018; Fig. 1)

Extent

Because SDMs describe the probability (*p*) of detecting a species at a given modelling grid (400 m^2), *p* needs to be translated into spatial extent (E):

E = C * p * 100, where

C = median cover (0…1) for each species, based on the VELMU inventory data (assessed by a diver for 4 m^2 sampling units)

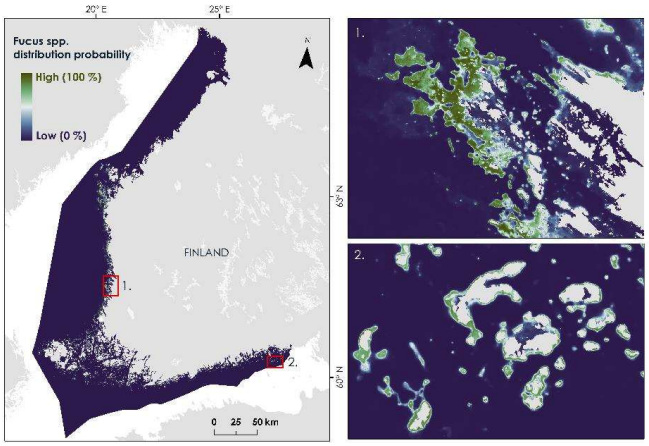

Fig. 1. Projected distribution probability of *Fucus* spp. In Finland and zoomed-in examples.

Condition

Human activities may degrade condition of species and habitats producing ES. If the area covered by a species is presently, e.g., 30 % smaller than that projected by the SDMs, we can hypothesize that direct human impact decreases the ES production by this species by 30 %.

Condition was estimated for species and habitats affected by human activities: dredging, dumping, landfill, building of infrastructures (and artificial shorelines), extraction of seabed material and shipping lanes and anchoring areas.

The geographical distribution (in km^2) of ES producing species was calculated for species in the present degraded condition and in a situation projected by SDMs.

Results

- 48 habitats and 11 species were linked to ES (Fig. 2)
- By using SDMs, the geographical distribution (in km^2) of species producing ES was assessed
- The condition is reported for human activities which lead to direct habitat loss per grid cell. The loss of an area is based on the average extent (m^2) of the activity in question, estimated from aerial images (Fig. 3)
- For instance, small jetties which cover on average 20 m^2, were identified from 58 850 grid cells. In this case, the area of habitats lost under the jetties totals 1.77 km^2

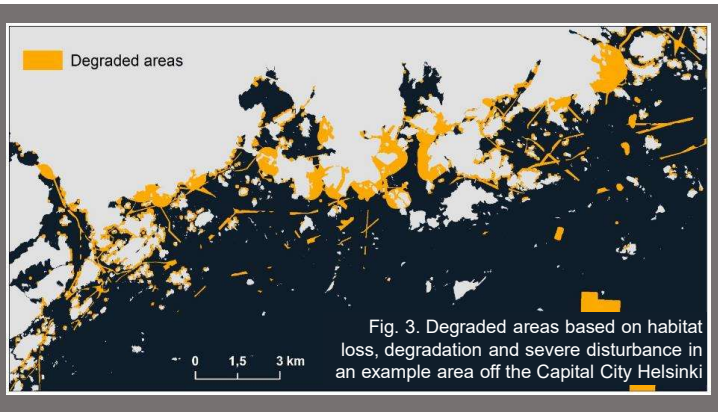

Fig. 3. Degraded areas based on habitat loss, degradation and severe disturbance in an example area off the Capital City Helsinki

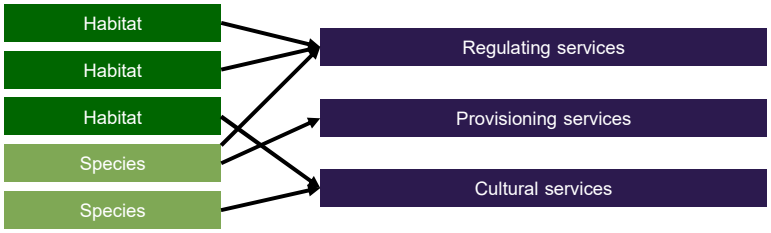

Fig. 2. Conceptual presentation of linking of species and habitats to ES (Jernberg et al., in prep.).

Conclusions

- Extent of ES-producing areas can be estimated by combining ES to species and habitats
- Condition of ES producing species (and habitats formed by species) can be estimated by comparing the projected and realized (current) distributions of species