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Characterisation of juvenile flatfish habitats using generalized additive models

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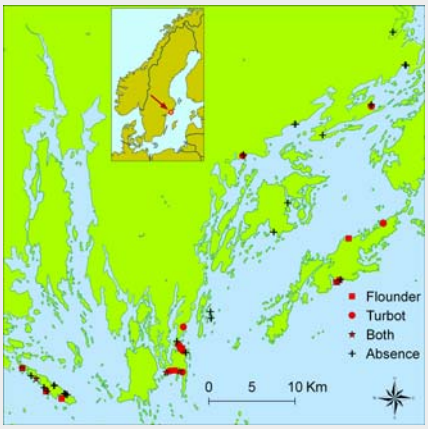
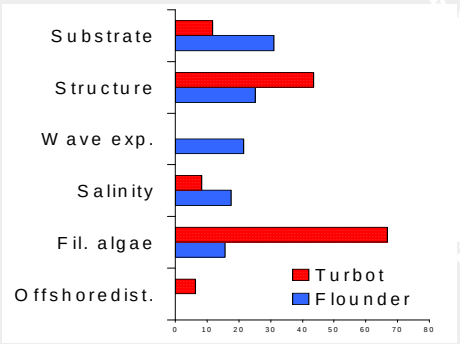
In late summer 2006 juvenile flatfish abundance was surveyed in a Baltic Sea archipelago region using a push net. Collection of biotic and abiotic variables were done simultaneously in all 48 investigated sites.

Generalized additive models (GAM) were applied using the GRASP package (Lehman et al 2004). Binomial models were fitted on the presence/absence of juvenile flatfish as response to environmental variables. Only significant variables were kept in the model.



Map of juvenile flatfish presence in the Stockholm archipelago, Sweden. Turbot and flounder were each found in 15 of the 48 investigated sites.



Model summary

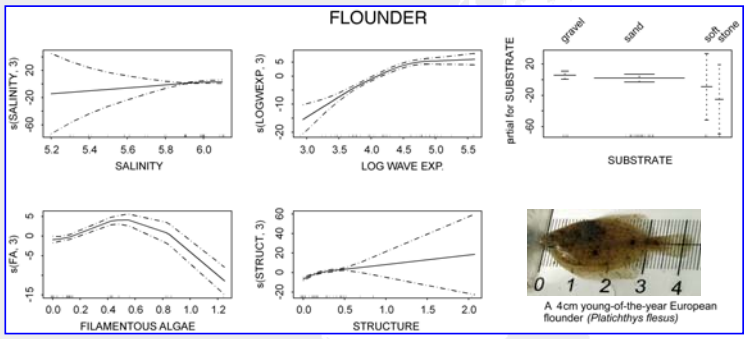
D2 is analogous to R2 in regressions, ROC is a measure of model fit to the data and CVROC is a cross validated test of predicted vs observed and indicates model stability. Values >0.7 is considered reasonable while values >0.9 is very good.

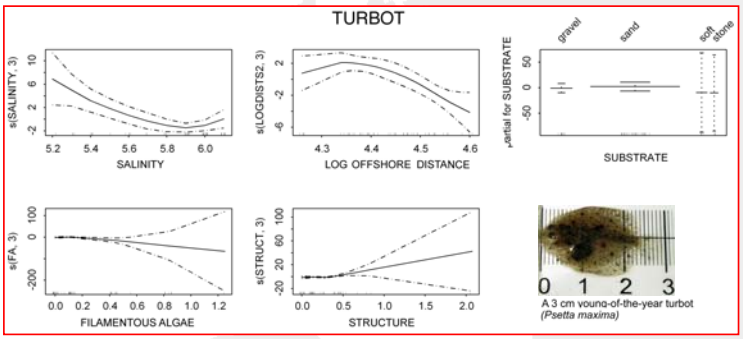
	Flounder	Turbot
D2	0.873	0.687
ROC	0.996	0.978
CVROC	0.817	0.741

Variable contribution inside the model. The X-axis is expressed in the linear predictor scale and indicates sensitivity of the model to changes of values along the range of each predictor. The following predictors were kept in the models: field estimates of dominating substrate: soft (<0.06mm), sand (0.06-2mm), gravel (2-60mm) or stone (60-100mm), habitat structure/complexity approximated by the sum of field estimated per cent cover of vegetation and boulders, GIS modeled wave exposure (Isæus 2004), field measured salinity, per cent coverage of filamentous algae and distance from offshore calculated in GIS.

Response curves

Flounder and turbot response curves expressed in the linear predictor scale with twice standard errors.





SUMMARY

- Using GAM the probability of presence for flounder and turbot was modelled using salinity, distance from off shore, wave exposure, substrate, occurrence of filamentous algae and habitat complexity/structure.
- Sand and gravel were preferred over soft and stony bottoms for both species.
- Both species were positively affected by increasing structure while the occurrence of filamentous algae had a negative influence on their occurrence.
- Flounder presence was positively affected by increased salinity and moderate to high wave exposure.
- Turbot presence was negatively affected by increased salinity and by increased distance from off shore areas.
- The ability to describe and model flatfish nursery habitats would benefit the on-going efforts to map essential fish habitats and assess potential problems with habitat reduction in disturbed areas.
- Knowledge on the spatial distribution of high quality habitats will be of particular interest in coastal zone management and future studies of life-stage specific habitat modeling and potential bottle necks for population size and viability.