Marine Management Organisation

Identifying strategic areas of sustainable aquaculture production [MMO184]

Aim

This project aims to support decision making by defining areas of potential aquaculture production in English waters. Environmental variables are used to (1) define optimal growth areas for 14 species and (2) identify technical constraints on six infrastructure types, to refine the areas. Areas where existing uses of the marine area exclude, or limit aquaculture are then removed (3). Data outputs should be used with aquaculture marine plan policies to encourage marine license applications to demonstrate consideration of, and compatibility with aquaculture.

Introduction and methodology

English aquaculture production has significant growth potential and may provide multiple benefits, particularly the potential to contribute to domestic food production in the UK. However, a lack of availability of new production sites is a major limiting factor. In 2016, the marine planning process cited the identification of sites suitable for aquaculture, and their inclusion in marine plans to ensure they are accounted for in marine licensing decisions as an important way to overcome this barrier.

The MMO led an evidence project to determine viable areas for aquaculture. 14 species of commercial importance and six culture types were considered. Cefas provided spatial data on environmental variables that mainly influence species' growth (sea surface temperature, salinity, light climate, total oxidized nitrogen, dissolved oxygen and chlorophyll concentration), and separate physical conditions that limit infrastructure siting (depth, wave height, current speed and substrate type). Environmental data were each classified into optimal, suboptimal and unsuitable ranges using thresholds in published literature. These were merged for each species, to produce composite maps of growth suitability, rated from 0 (low) to 1 (high).

The MMO integrated the outputs to produce separate composites for each infrastructure type, with only areas where all variables were optimal being carried forward. Composites were overlaid on the growth suitability maps to produce a series of combined species/culture suitability maps, e.g., optimal areas for bottom culture of blue mussel. Distance offshore, as a proxy for several limiting economic considerations including fuel price, was used to constrain data to the inshore marine area. The final component of the work involved accounting for "planning constraints"; i.e., other users of the sea. These are either "hard" (exclude aquaculture) or "soft" (reduce suitability) constraints. Representative datasets were sourced, and buffers applied. All constraints were combined in a single dataset, which was applied as a 'mask' to all species/culture maps, making the aquaculture areas strategic by focussing on areas where the chance of conflict is minimised. To produce a final layer to support decision-making, all species/culture combination files were merged (Figure 1).

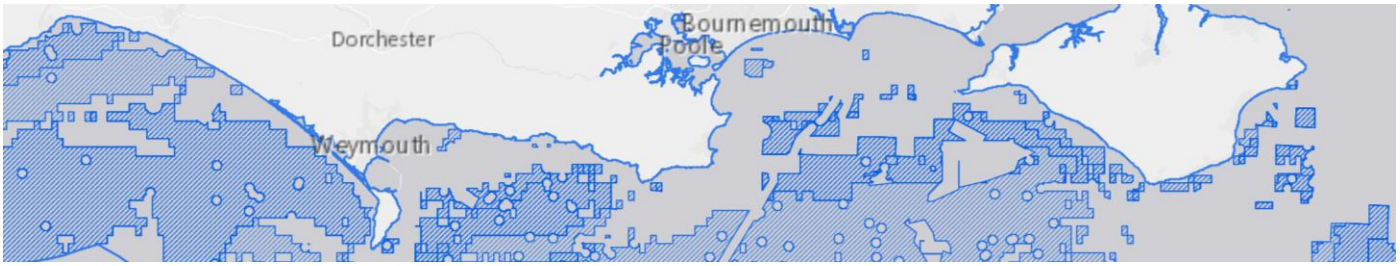

Figure 1: Final outputs showing strategic areas of sustainable aquaculture production in the south marine plan area.

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Results

The main output of this project is a *strategic areas of sustainable aquaculture production*, dataset; the result of a process that selects optimal growth areas and uses constraint data to maximise spatial delineation, thereby focussing only on areas that are most suitable for aquaculture so that these can be accounted for in marine licensing decisions. Outputs also include a series of species/ culture layers which show where culture of individual species using select infrastructure can thrive.

Conclusions and recommendations

- The strategic layer should inform decision making under policy AQ-1 in all marine plans, which requires that within existing or potential aquaculture areas, applicants should demonstrate consideration of, and compatibility with aquaculture - this data fulfils the “potential” aspect; with future aquaculture opportunities being provided a degree of protection within strategic areas.
- Individual species/culture layers were also produced; these included areas where growth conditions are suboptimal: these layers may be of interest to potential developers, though do not provide any weighting under aquaculture policies.
- Aquaculture developers are not obligated to locate developments within the strategic areas; while these can be used to inform site selection based on the detailed considerations in the report, the primary purpose is in supporting the decision-making under AQ-1.
- The outputs of this report function at a national/regional level, fulfilling legislative and consenting requirements, and should complement and inform more local investigations into site selection.

MMO comments

This project builds on previous work to map areas where aquaculture should be prioritised (according to marine plan policy wording). While based on the best available evidence, the methodology is not without caveats; the nuance of if/how soft constraints impact aquaculture was not included; these were instead considered as hard constraints. This was in the interest of simplicity, and because impacts are case-specific; activities such as fisheries and recreational boating do not necessarily exclude aquaculture, and marine planning encourages investigation of coexistence and colocation and resolution of conflicts in the decision-making process. Some key variables (e.g., water quality) were not considered as their impacts are seen at a resolution finer than that used in this work. Future work may consider working at a higher resolution and with more variables, and investigating the how soft constraints can be accounted for.

This work was based on current environmental conditions which are assumed to be appropriate for at least the next 6 years. Marine plans have a 20-year life cycle, and a 3-year monitoring and reporting cycle where a need to amend may be considered. With the impacts of climate change, outputs may need to be updated. In addition, due to increasingly busy seas, outputs that consider coexistence and colocation of activities, both of different types of aquaculture (integrated multitrophic aquaculture) and of aquaculture with other marine users, should be investigated.

Further information

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