Integrating ecological systems into input-output analysis: the importance of feedback loops

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The Blue Economy is an important driver of economic growth in the EU. Input-Output (IO) valuation methods have been long established for consumption-based environmental impacts such as GHG emissions, and more recently for fisheries. An increased emphasis on ecosystem based management approaches in policy and decision making has led to greater demand for integrative economic models. Depletion of natural resources beyond threshold values can affect the ecosystem capacity and its ability to replenish renewable resources. IO modelling can be used to assess how marine industries impact upon one another and interact with natural resources, by linking ecological systems to the economy. IO tables capture the indirect effects of economic activity but feedback loops between ecological systems and the economy must also be incorporated to capture the net impact of activities within the marine environment.

This study applies ecologically-extended IO techniques to enable application beyond fisheries to other important marine industries such as offshore wind energy. A Leontief demand-driven IO model is presented here that evaluates the sustainable harvest of resources from the ecological system by applying a limit to demand. Cross-sectoral and self-affecting ecological feedback loops are considered to reflect complex interactions between the economy and the natural environment. An adaptation of the Ghosh supply-sided inoperability model is also extended to the ecological system and its validity is considered in the context of the Blue Economy. Illustrative results are produced using 2013 UK analytical tables with a disaggregated electricity industry and applied to several marine sectors. This approach can be used to assess different scenarios for growth strategies in the marine environment, evaluating trade-offs between value-added and the health of ecological stocks. It can also provide an important link between IO modelling and natural capital satellite accounts in EU member states.