Popular science summary of the PhD thesis

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Title of the PhD thesis	Trophic Transfer Efficiency in the Pelagic Food Chain: A Carbon Odyssey
PhD school/Department	DTU Aqua

Science summary

The ocean is a vast energy highway, where sunlight powers photosynthetic plankton at the base of the food web. These tiny organisms convert carbon dioxide into organic matter, which fuels the entire marine ecosystem as energy flows upward through predators and prey—from plankton to fish. The efficiency of this energy transfer, called trophic transfer efficiency, is crucial for maintaining ecosystem services like fish production and carbon burial. However, environmental change may alter these processes, making it vital to understand and predict these shifts.

In my thesis, I introduce the NUM library, a computational tool that simulates plankton dynamics and their effect on marine ecosystems. The Nutrient-Unicellular-Multicellular (NUM) model describes plankton functions, using their size and feeding strategies to study energy transfer from the smallest organisms to fish. This model operates at multiple scales, from lab-like conditions to global oceans.

Throughout my research, I:

1. - Developed an algorithm to show how plankton optimize resource use in changing environments.

2. Expanded the NUM library by including diatoms (a key type of plankton) and evaluated its ability to reproduce global ocean patterns.

3. Created a new method to measure energy transfer from plankton to fish and used it to map efficiency in the global ocean.

These findings highlight how the NUM library can help us predict changes in marine ecosystems, supporting efforts to protect fisheries and combat climate change.