Popular science summary of the PhD thesis

PhD student	Tobias Karl Mildenberger
Title of the PhD thesis	Towards sustainable fisheries: Improving the robustness and effectiveness of management procedures for data-limited fish stocks
PhD school/Department	DTU Aqua

Science summary

Marine fisheries are very important from a socio-economic point of view, providing food and employment for hundreds of millions of people around the world. However, evidence suggests that roughly half of all fish landed come from unsustainable fisheries. To ensure sustainability of fisheries resources, management procedures capable of adequately assessing the current exploitation status of fish stocks and predicting future stock development under various exploitation scenarios are required. The reliable assessment of stock status and the resulting management advice, however, is complicated by a lack of available and informative data, as well as a high degree of uncertainty. This uncertainty typically arises from natural variability, sparse and inaccurate data collection, incorrect model structure, and the parameter estimation process. The aim of this thesis is to improve the robustness and effectiveness of data-limited management procedures by evaluating and advancing state-of-the-art assessment methods, as well as accounting for the estimated uncertainty in the management advice. This is done by simulation frameworks that allow for the validation and evaluation of existing and novel management procedures by analysing their impact on simulated stock and fisheries dynamics. The stock dynamics are simulated by fully stochastic individual-based and age-structured population models. The results of the thesis show that uncertainty can lead to inaccurate and imprecise estimates of stock status, and that the magnitude of bias and variance does not only depend on available data, but also on the life history parameters of the species/stock as well as the exploitation history of the stock. Newly developed methods show a higher accuracy and precision. Furthermore, current management procedures can lead to high risk of overfishing and stock collapse in the face of high uncertainty. The results demonstrate that additional reference points and buffers accounting for the uncertainty as well as a novel suit of procedures can reduce the risk of overfishing and lead to high and stable long-term yield. Overall, it can be concluded that the sustainable management of data-limited fisheries will not only rely on comprehensive guidelines on the application and implementation of current management procedures, but also on the further development of new procedures that account for uncertainty in the management advice. This thesis offers a promising step in that direction and identifies avenues for further research within the field of fisheries science.