

Project title: Biological and Economic Strategies for sustainable Ecosystem-services and Management (BESTEMT)

Duration: January 2021 – June 2025

Client: The Research Council of Norway

Project leader: Stein-Ivar Steinshamn

### Project summary

The project aims at evaluating environmental and distributional effects of various political instruments for fisheries management, such as quotas or taxes among other. Emission quotas and emission fees will also be among the instruments we analyze. Thereby we aim at filling knowledge gaps by including and combining environmental, ecological, biological, economic and social information into our assessment. This includes a variety of things such as fleet composition, interaction between fish species (predator vs. prey, etc.) and interaction between humans (between different types of fishers, between buyers and sellers in the marketplace, etc.).

For this aim we plan to use models that combine biology and economics, so-called bioeconomic models. The basic models already exist but will be developed further for the purposes in this project. One of the existing models was developed for the Ministry of Fisheries in 2005. The original purpose of this model was to find optimal size and structure of the Norwegian fishing fleet together with the optimal allocation of fish quotas between different vessel groups. In the present project, we plan to introduce a number of new features. These features include taking into account the dynamics of the fish stocks and analysis of various financial instruments (fees and taxes) in addition to just harvest quotas. For example, implementing emission taxes for the fishing sector will have positive environmental effects in addition to collecting tax revenue. This is a win-win situation.

Another interesting aspect of financial instruments such as taxes, is to apply them as tools for structuring the fleet. Taxes may reduce overcapacity, improve the fleet composition and at the same time contribute to collect tax revenue. As far as we know, this way of using financial instruments has received little or no attention earlier, and a thorough analysis of this will be an important novel contribution. The project is divided in five work packages.

In the period from the start in October 2021 until the end of november 2022, work has been carried out on all these aspects. During these 14 months, members of the project have produced one report and seven scientific publications, held 12 presentations at conferences and workshops and given three interviews in newspapers and radio.

The following scientific results ought to be highlighted. Using an age-structured model to analyze the error that can be made by assuming that natural mortality and weight parameters are constant when

in reality they are endogenous has resulted in an international publication. The main result is that this error, i.e. assuming exogenous weight and mortality, can lead to catch, spawning stock and net present value being overestimated.

Results from the tax models have been presented at several workshops, as has work with a multi-species age-structured model. In the former, we find that if the tax is flexible enough, a tax combined with a total quota is enough to both maximize and collect the resource rent. In the latter, we have found that it is not always optimal to preserve the young fish as traditional models say.

The work with so-called resilience-based management has already resulted in four international publications, in which we, among other things, look at the effects of negative shocks in weight and in the recruitment of a fish stock, and how one can optimally deal with these. Two principles emerge. 1) Harvest when the number of small cohorts in the population is expected to be close to its minimum. 2) Harvest when shocks to growth has least impact on the weight distribution.