# Using open fisheries data to analyze and reduce CO$_2$ emissions in Norwegian fisheries

There is a rapidly growing amount of ocean data openly available around the globe. This data can allow us to better understand sustainability issues and to identify measures that may make a difference for sustainability. Many of the sustainability issues in marine ecosystems are linked to the activity of fishing fleets and emissions from the fishing vessels.

In the last decade, scientists have started using data from the tracking of boat movements to investigate many different sustainability issues in fisheries. Boat tracking systems like Vessel Monitoring System (VMS) and Automatic Identification System (AIS) generate data on boat movements that can be of great use in marine sustainability science. For example, VMS/AIS data from the Global Fishing Watch project has been used to investigate the effectiveness of marine protected areas (Dureuil et al., 2018; McDermott et al., 2018), the impacts of fisheries on other marine wildlife (Kroodsma et al., 2023; Womersley et al., 2022), fisheries management issues (Seto et al., 2022; 2023), and the extent of illegal fishing (Park et al., 2020; 2023) and forced fisheries labor (McDonald et al., 2020). This shows that knowing how to handle and analyze such data makes you able to answer many interesting questions about ocean sustainability.

An important sustainability issue in fisheries is the CO$_2$ emissions from the fishing fleet. Producing food with a low CO$_2$ footprint is important to achieve global climate goals, and different types of fish have very different emissions per amount of food produced (Gephart et al., 2021). It can be hard to find data on the emissions from specific fisheries, but studies have shown that it is possible to use VMA/AIS data to estimate the fuel consumption of fishing vessels (Coello et al., 2015; Sala et al. 2018).

In the Future Fisheries project at BIO, we are investigating CO$_2$ emissions and sustainability in Norwegian fisheries. Comprehensive data on vessel movement (VMS data) is available from the Directorate of Fisheries, and combined with a simple method to model emissions (Coello et al., 2015), we have performed a first analysis of the CO$_2$ efficiency in Norwegian mackerel fishery. We are now looking for curious master's students who want to learn how to use large data sets to answer questions about emissions and sustainability with the Norwegian fishing fleet as starting point because of the excellent data. Examples of questions that can be asked in the master's thesis project are:

- How do CO$_2$ estimates from open VMS/AIS data compare with estimates from Life Cycle Assessments (which use much more data and therefore are much less available)?
- How do the emissions compare between different types of fisheries?
- What drives changes in CO$_2$ emission in Norwegian fisheries over time?
- Under what conditions can fishing vessels be the most fuel efficient?

The theme has space for 2-3 master's students, and fits students both following the marine biology programme and the interdisciplinary marine sustainability programme. The students will learn how to handle large data sets, perform data analysis in R, visualize data, get insight into carbon footprint analysis, and Norwegian fisheries and their sustainability challenges. Such skills and knowledge are very valuable for a future career both within and outside of academia.

Supervisors will be Kim Scherrer (main supervisor) with help from Tom Langbehn and with Christian Jørgensen as responsible contact at Department of Biological Sciences, UiB.