Automatic eDNA collection as a gateway towards high resolution biodiversity and fisheries management data

Derycke Sofie[1], Cornelis Isolde[2], Carneiro Antonio[3], Marques Pedro[3], Martins Alfredo[3], Pape Daan[4], Polet Hans[2], Hostens Kris[2] and Maes Sarah[2]

[1] ILVO Marine, ILVO
E-mail: sofie.derycke@ilvo.vlaanderen.be
[2] ILVO, Jacobenstraat 1, 8400 Oostende, Belgium
[3] INESC TEC, R. Dr. Antonio Bernardino de Almeida 431, 4200-072 Porto, Portugal
[4] DPTechnics, Westkapellestraat 396/44, 8300 Knokke-Heist, Belgium

Marine organisms release DNA molecules into the environment through tissue, excrements and slime. This environmental DNA or eDNA allows to detect fish and other species by simply collecting seawater, as such generating a tremendous potential for environmental and fisheries-related research, especially when eDNA collection can be automated. In this context, we developed an automatic eDNA multi-sampler that can be mounted on a fishing vessel, to collect eDNA from subsurface seawater at pre-specified geographic locations. The sampler can be pre-programmed or controlled remotely in real-time without intervention of the vessel crew. The successful deployment of the sampler on one Belgian fishing vessel for almost three months, initiated the rollout of eDNA sampling towards other fishing vessels within the SoleMATES project (2025-2027), funded and supported by the fisheries sector. The vast number of commercial and recreational fishing vessels that are at sea throughout most of the year, provide great potential for the gathering of biodiversity and fisheries data at spatial and temporal resolutions that cannot be achieved through scientific surveys alone.

Furthermore, we developed a standardized user-friendly protocol for low-cost passive eDNA sampling. The so-called metaprobes (Maiello *et al.* 2023) can be easily attached to the fishing net and beam trawl chains by the fishermen. After sampling, the metaprobes are simply preserved at room temperature in ethanol or silica beads. So far, eDNA collected by metaprobes inside the net and preserved in ethanol gave the most accurate reflection of the catch composition in the beam trawl net. However, finetuning of the preservation with silica beads is ongoing, as sample handling and transportation is easier with silica beads compared to ethanol.

The eDNA data collection by the fishing fleet generates much needed data from data-poor regions, to allow more accurate fish stock and biodiversity estimates. For example, in the southern Celtic Sea/southwestern Ireland (ICES areas 27.7hjk) the allowable fishing quota for sole and plaice were downsized in recent years, mainly due to insufficient data and knowledge regarding their stock size and biomass. Consequently, nor the industry nor the policy are able to efficiently conduct a sustainable fishery in these fishing grounds. Reliable data on fish stock biomass might substantially contribute to a potential revision of the precautionary principle, leading to a better fisheries management as quotas would be adjusted to 'reality' rather than 'rule'. Species-specific dPCR assays that amplify sole and plaice eDNA show a clear correlation between eDNA concentration and fish stock biomass, indicating that eDNA can be used as a proxy for fish biomass, at least in shallow waters like the southern North Sea (Maes *et al.* 2023). The potential relationship between eDNA and fish biomass in deeper waters will be further investigated in the SoleMATES project.

The participation of the fishing fleet in eDNA sample collection invokes the data collection framework of the future, where standardized protocols and easy-to-use samplers will ensure reliable data collection in the marine environment, at scales scientists alone can never achieve.

References

- Maiello *et al.* (2023) Net gain: Low-cost, trawl-associated eDNA samplers upscale ecological assessment of marine demersal ommunities. DOI: 10.1002/edn3.389
- Maes *et al.* (2023) Detection and quantification of two commercial flatfishes (*Solea solea* and *Pleuronectes platessa*) in the North Sea using environmental DNA. DOI: 10.1002/edn3.426

Keywords
Marine Biodiversity; Fisheries Management; Automatic EDNA Sampler; Metaprobes