

## Protected yet unmanaged: insights into the ecological status of conservation priority stony reefs in Belgian waters based on the integrative use of remote sensing technologies

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Stony reefs are complex and heterogenous habitats that host a unique fauna and provide irreplaceable ecosystem services. These habitats are as ecologically valuable as they are fragile and susceptible to anthropogenic disturbances. Bottom-contacting fisheries are one of the principal sources of anthropogenic disturbance to the seafloor's physical and ecological integrity having immediate and destructive consequences on stony reefs and compromising ecological functions. In this study we aimed to assess the ecological status of two stony reef areas – the Northwest and Hinder Banks study sites – in Belgian waters in relation to their chronic exposure to bottom-contacting fishing pressure. We used three hierarchically nested data sources obtained from multiple minimally invasive remote sensing techniques at both study sites; i) publicly available commercial fishing activity data, ii) hydroacoustic surveys, and iii) images of benthic communities from underwater video transects. We used a trait-based approach linked to the organisms' resistance and recovery potential to trawling to compare community compositions in function of fishing pressure. At both study sites trends revealed a significant decline in species characterized by low resilience and recovery potential scores parallel with a significant increase in species displaying moderate scores when fishing pressure was higher. More than 85% of the stony reef area within both study sites appeared impacted by varying degrees of bottom-contacting fisheries.

While the overall richness and abundance of species remained similar at both study sites, our study revealed that chronic fishing disturbance has induced shifts in community composition with implications for ecosystem integrity and functionality. Stony reefs are recognized as conservation priorities by all relevant European policies. In Belgium, the Hinder Banks stony reef area is part of the Natura 2000 network, while the Northwest area has been designated as a search zone for biodiversity protection. Nevertheless, detrimental bottom-contacting fishing activities are still allowed within their range regardless of their management regime.

This study provides the scientific evidence needed to argue against the coexistence of such activities with marine protected areas comprising natural hard substrates, while it supports the enforcement of fisheries exclusion measures. With our research we hope to inspire environmental managers to strive for adequate implementation of environmental legislation in the face of rapid and widespread anthropogenic changes.

### **Keywords**

Stony Reefs; Fishing Impact; Hydroacoustics; Underwater Video; Ecological Status; Conservation; Environmental Policy