Functional redundancy in Barents Sea fish

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Introduction

When facing environmental change and intensified anthropogenic impact on marine ecosystems, extensive knowledge of how these systems are functioning is required in order to manage them properly. However, in high-latitude ecosystems, where climate change is expected to have substantial ecological impact, the functionality of the constituent species has received little attention, partly due to limited biological knowledge of Arctic species. The functionality of biological communities can be assessed by means of functional redundancy, i.e. the number of species that contribute similarly to ecosystem functioning. Ecosystems with higher functional redundancy are expected to be less affected by species loss, and thereby less sensitive to disturbance such as fishing and environmental change.

Material and methods

Based on functional traits and fish community composition data, we assessed functional redundancy of the Barents Sea fish community for the period 2004-2009, a period during which the region was characterized by warming water masses and declining sea ice coverage.

Results and discussion.

We identified eight functional groups of species which likely play distinct functional roles in the ecosystem. Some functional groups, such as the pelagics and the small demersals, displayed persistent spatial patterns of functional redundancy, whereas the long demersals group showed decreasing redundancy and the redfish group showed an expansion towards the north-east (Fig. 1). Presently, the observed patterns of functional redundancy would seem to provide sufficient scope for buffering against local diversity loss. Yet, the rapid borealization of the northern Barents Sea is associated with a functional reconfiguration that may affect future ecosystem functioning in the area. In a period of rapid environmental change, ecosystem monitoring programs will be pivotal in providing the information on structural and functional properties needed for a sustainable ecosystem management.

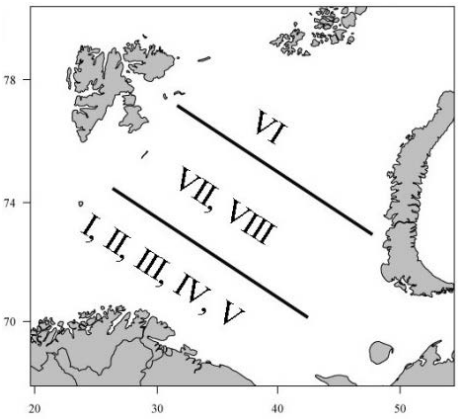

Fig. 1. Functional redundancy of Barents Sea fish. Roman numerals indicate where the functional groups displayed the highest redundancy (i.e., either in the south-west, in the central or in the northeastern Barents Sea). I: “large demersals”; II: “redfish”; III: “fecund demersals”; IV: “pelagics”; V: “elasmobranchs”; VI: “small demersals”; VII: “long demersals”; VIII: “demersal planktonfeeders”.