Fisheries management in spatially structured Atlantic salmon populations

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Abstract: Despite extensive research on the causes and consequences of spatial dispersal, the implications of connectivity for conservation and management are poorly appreciated, especially for species for which dispersal rates are ignored or considered negligible such as salmonids. For such species, exploitation by fishing usually does not consider populations connectivity, and fisheries management rather focuses at population scale. To date, prior work already warned about the danger of ignoring spatial structure and connectivity of populations but a very few studies have explicitly compared different strategies of exploitation while also considering the spatial structure of populations. We use a spatially explicit demo-genetic agent-based model as a virtual laboratory to mimic a realistic Atlantic salmon populations network and compare several spatialized fishing strategies (e.g. fishing all populations, sink, or source only). We assess their consequences at the demographic, phenotypic and genotypic levels. We show different effects of spatialized exploitation strategies on metapopulation size, stability and synchrony, as well as life history strategies and genetic evolution of traits. Importantly, we show that the consequences of spatialized fishing strategies depend on the exploitation pressure acting on the local populations and on the metapopulation as a whole. Altogether, we argue that it is critical to account for metapopulation structure in defining fisheries management because spatialized exploitation of connected populations can lead to various demographic outcomes but also complex evolutionary trajectories.