Population structure and local adaptations in marine fishes - DTU Orbit (12/05/2019)

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This thesis consists of five main parts; a general introduction to knowledge and future perspectives for studies of population structure and local adaptations in marine fishes, and four manuscripts presenting the major findings from my PhD.

The first manuscript describes the analyses of population structure in European flounder (Platichthys flesus) on both large and local geographical scales. Using microsatellite genetic markers, we found high levels of genetic structuring between different flounder populations. Importantly, these differences apparently had very different causes, some being driven by changes in life history characteristics, while others were more likely to be associated with physical oceanographic forces or gradual environmental changes. This study thus adds to our understanding of how evolutionary forces may interact in the sea to structure species of marine fishes into discrete and reproductively isolated units.

The second manuscript focuses specifically on adaptive population divergence. By applying a candidate gene approach we found strong indications of adaptive population divergence of flounder populations despite seemingly high levels of gene flow between populations. This approach has not previously been applied in marine fishes, and the results indicate that adaptive divergence and local adaptations are indeed possible in the high gene flow marine environment. A result which is encouraging for future studies of local adaptations in marine fishes, of which we know very little.

In the third manuscript, we are investigating potential genetic introgression from plaice (Pleuronectes platessa) to flounder populations in different parts of the distributional area of the flounder. We found strong indications of significant introgression throughout the areas where the two species have overlapping distributions. However, levels of introgression were low, indicating relatively strong selection against hybridization between the two species. Hence, in contrast to other studies which have demonstrated high levels of introgression in hybrid zones between other species, there seems to be considerable selective constraints on plaice-flounder hybridization. This could in turn allow the two species to remain genetically separate despite apparently sharing distributional and spawning areas.

The forth manuscript examines the stability of population structure on a local scale in the Baltic Sea. Specifically, we are investigating interactions between populations with different life-history characteristics; some populations are spawning pelagic eggs, while others are spawning benthic eggs. We found relatively strong temporal shifts at the same locality between samples collected in two different years and at different times of the year (one close to time of spawning, the other in the feeding season). Hence, the results indicate substantial intra-annual movements and potential mechanical mixing at feeding grounds of individuals from populations exhibiting very different life-history characteristics. These findings thus add to our understanding of how genetically differentiated populations may interact genetically and ecologically.

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