

Output 3.3

Connectivity among and adaptation within Mediterranean stocks of red shrimp and octopus

ConFish

- Connectivity among Mediterranean fishery stakeholders and scientists resolves connectivity of fishery populations –

WP3 – STUDYING

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The genomic study provided deep insight into connectivity, genomic diversity and adaptation capacity of common octopus (*Octopus vulgaris*) and red shrimp (*Aristeus antennatus*) within the Mediterranean area. According to the sampling design that covered areas roughly 10x10km² per site, we estimate these results are applicable to 2900km² of the Mediterranean Sea inhabited by either of the two species investigated in this study. Here, we present the overall perspective of connectivity and selective forces acting on octopus and red shrimp within the investigated Mediterranean habitats.

For octopus, clear genomic differentiation was found between populations from the Adriatic Sea and the population from Atlantic Ocean, with the Western Mediterranean populations exhibiting a mix of genomic signatures from those two groups. This highlights the previously unreported reduced connectivity and population structuring between octopus populations from Western Mediterranean basin and Adriatic Sea. Within the Western Mediterranean basin, both octopus and red shrimp populations showed varied levels of differentiation. Notably, high levels of genomic differentiation were found for shrimp populations from Eastern Balearic Islands and South of Spain. Interestingly, those populations also showed more genetic similarity to those of the Italian coast. Indeed, both octopus and shrimp populations along Spanish coast are genetically distinct from one another, despite their apparent geographic proximity.

While the large-scale population structure for octopus seems to be in part influenced by geographical distance, the observed patterns of genomic differences indicate that the large part of differentiation is also stemming from environmental differences. Both species investigated in this study showed correlations between patterns of genomic differentiation, and differences in environmental factors such as temperature, salinity and dissolved oxygen among sites. Octopus populations in the Adriatic and shrimp in Balearic Islands especially appear to be locally adapted to those specific environments. Further data analysis will be necessary to determine exactly how much of this difference between the populations stems from either geographical obstacles to migration, or local adaptations arising due to different environment they inhabit.

Yet, populations that are genetically isolated and well adapted to their specific environment tend to be less diverse. Indeed, several octopus populations from Adriatic showed lower levels of genetic diversity, as did the shrimp populations from Eastern Balearic and South of Spain that also exhibited higher population differentiation. These populations should be taken special care of as they exhibit limited connectivity, high local adaptation, and, under fast shifting environmental scenarios, lower evolutionary potential. In theory, those populations would not easily recover and are particularly endangered from changes in external stressors. This also means that in the case of population collapse it would be harder for migrants from other populations to replace them, as they are not specifically adapted to those environments.

The disparity in connectivity levels exhibited by octopus and shrimp in the Mediterranean appears to be due to species different life histories and juvenile development. These findings emphasises the need for stock identification based on each species particular characteristics, and not necessarily geopolitical boundaries. Recognizing these populations as separate (Figure 1 and 2) and implementing stock specific management into Mediterranean fisheries should be the first step towards their effective management.

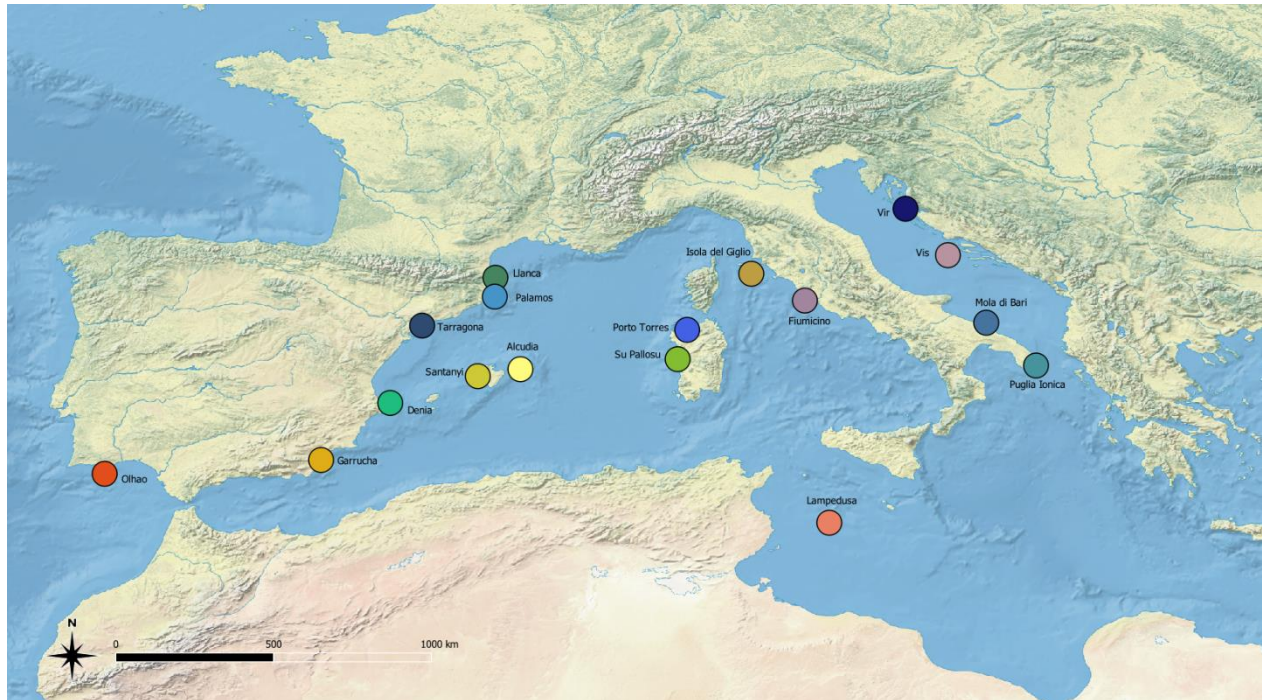


Figure 1 Octopus stocks in the Mediterranean Sea

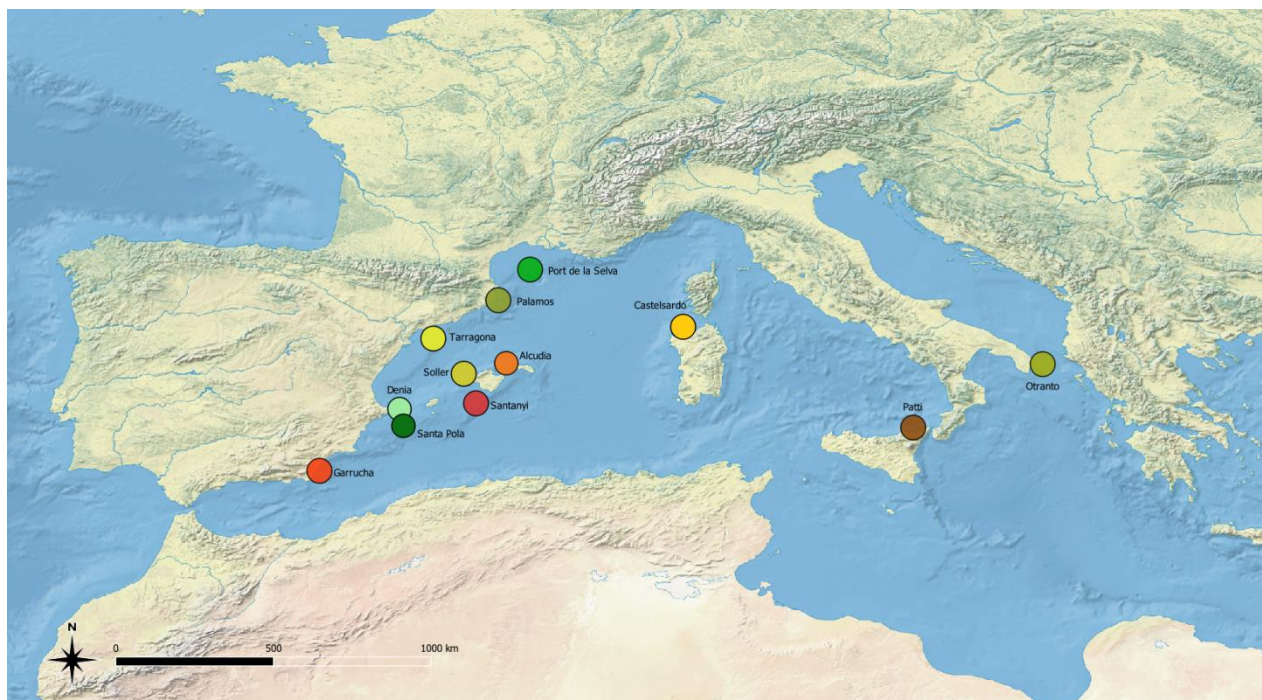


Figure 2 Red shrimp stocks in the Mediterranean Sea