CRO-M01: Sea urchin barrens as drivers of Adriatic fish and invertebrate community structure and abundance.

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Summary

Sea urchins (Echinoida) are spread worldwide. In the Adriatic Sea there are 20 recorded species. The most abundant species is the purple sea urchin *Paracentrotus lividus* (Lamarck, 1816) and the black sea urchin *Arbacia lixula* (Linnaeus, 1758). Their habitat is a shallow infralittoral rocky bottom overgrown by algae. A research monitoring program of sea urchins populations is being conducted due to increased interest in commercial exploitation and their role in trophic cascade. Priority habitats of research are urchin barrens, where at depths 0 – 5 m the sea urchin individuals are identified by species, counted and their size is recorded.

Background and possible objectives

Sea urchins (their gonads) have been used in the diet since the ancient Greeks and Romans, but the intense exploitation, including global trade, had risen in the last few decades. Although the global trade is weakening compared to the end of the last century, urchins' food product is increasingly popular and sought after around the world. In the Mediterranean, the largest demand is for *P.lividus* (purple sea urchin), although the *Sphaerechinus granularis* is also sought after. *P.lividus* is a relatively large sea urchin species with a maximum diameter of 75 mm without spines. Their colour may vary from dark purple to olive green. It mostly settles the infralittoral area from the lower tidal zone to 10-20 m. *P.lividus* is sympatric with the black sea urchin *A.lixula*. The black sea urchin's main food is incrustrating algae, while the purple sea urchin prefers softer, thin or filamentous algae. The growth rate of the urchin mostly depends on the temperature of the sea, the quality of food and the development of gonads. In the Mediterranean Sea, the urchins are the fastest growing at temperatures between 12 and 18 °C. In areas with low-availability of foods, growth is slower. Sea urchins are among the most important herbivores, and thus have a major role in shaping benthic algae communities. The ecology of these communities can be disrupted if feeding of sea urchin surpasses the new colonization and growth of the algae. This scenario can lead to a complete replacement of habitats, from photophilic community rich in algae, to habitat with dense population of sea urchins we call urchin barrens, a habitat widely spread across the Adriatic.

Methodology

After a mapping of the coast using the CARLIT method to determine areas of urchin barrens, research of sea urchin communities is being conducted. The barrens are considered ecologically stable. Assemblage, descriptors and ecological interactions of sea urchin communities is the main research focus. Density of sea urchins on such areas provides statistically better analysis and changes will be clearly visible. Such populations will not be under much influence, and negative changes in their numbers will clearly indicate the presence of other negative pressures.

Data collection is performed on sites around the island of Silba. Sites are min. 1 km distance. At each of the sites, three research stations are included, min. 100 meters apart. Each site, 0.5 m x 0.5 m quadrants will be placed and moved 10 times parallel to the shore; as well as transverse transitions and placed at five depths: 1, 2, 3, 4 and 5 m in depth. In addition to the target species, it is also necessary to monitor the condition of *A.lixula* and *Sphaerechinus granularis*, whose number and size may depend on the density of *P.lividus*. Different descriptors will be observed on research stations to research the communities in detail. The surface of barren (bare rock) is estimated on each quadrant and the species, abundance and size of the individual is determined, and the dead individuals are recorded. It has been observed that in this sympatric community indications of preference of the surfaces of different angles between *P.lividus* and *A.lixula* exist. This variable will also be included as one of the descriptors.

Other abiotic and biological factors can be monitored and collected during research fields' depending on the objectives and the hypothesis of a research candidate.

Skills gained

Develop an independent research project.

Learn to identify common Adriatic infralittoral sea urchins, fish, algae and invertebrates.

Collect data using simple but effective methodology with SCUBA and / snorkeling.

Learn how to organize and analyze large data sets.

Site conditions

Work conditions

During research diving – it is likely that a combination of shore and boat survey sites will be used. We conduct a maximum of two dives per day. Moderate fitness is recruited, diving to collect data quite long and the temperature can make it tiring.

Climate

Croatian coast has Mediterranean climate which means warm hot summers and mild winters. Spring weather (May, early June) in Croatia is changeable, and sea temperature is around 20 degrees. Croatia is hot during summer months. The daytime temperature rarely drops below 30 degrees and can reach

40 degrees in peak summer. The sea temperature during summer months are between 22 to 24 degrees.

Recommended reading

Cvitković, I., Despalatović, M., Žuljević, A., Vučić, I., Lučić, P. and Nejašmić, J., 2024. Distribution of sea urchin barrens in shallow algal communities along the eastern Adriatic coast. *Mediterranean Marine Science*, *25*(1), pp.213-219.

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