Light dependent growth, biomass production and morphological adaptability of *Halimeda tuna* (*Chlorophyceae, Caulerpales*), Island of Elba, Italy

Diploma thesis
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Abstract

In the frame of the diploma thesis a *Halimeda tuna* population was observed at the Punta di Fetovaia (headland of Fetovaia; Island of Elba/ Italy) by SCUBA diving. In approximately 12 - 18 m depth SE of the headland an area of coralligène formations is found. The faunistic composition and structural form corresponds to the précoralligène type (LAUBIER, 1966). The boulders are partially arranged in groups, which are connected by biogenic bridges or they are found solitary. Their different sizes lead to areas, exposed to different light intensities on the north and on the south side of the boulders. Because of this, special attention has been given to light as a factor.
The present study deals with growth, biomass and morphological adaptability of *Halimeda tuna*. The goal of the study was the determination of differences in light supply and the quantification of the corresponding effects on the algae.
Of (on average) 100,700 Lux (approximately 2015 µmol photons $m^{-2}s^{-1}$) reaching the water surface, a mean of 14.6% (14,700 Lux) was measured in the working depth of 16 m on the south and 6.3% (6340 Lux) on the north side of the boulders.
Halimeda tuna - as all representatives of this genus - grows by development of new segments at the ends of its ramified branches. A difference was noticed regarding the size and number of the segments per thallus. Based on this, special attention was given to the individual segments. By measuring the sizes of 100 segments of thalli exposed to the south, and 100 segments of thalli exposed to the north, considerable differences were revealed: thalli of the south side showed segments which were on average 20% wider and 10% higher (=longer).
This difference is also reflected in the individual weights of the segments. The biomass assessed for *H.tuna* in this study exceeds the annual means of biomasses from New Caledonia: 88 g DW m^{-2} (north) and 114 g DW m^{-2} (south) vs. 17,2 g DWm^{-2} (GARRIGUE, 1991), but is lower as calculated for the same species from Spain (243 g DW m^{-2}, BALLESTROS, 1991).
The growth rate of the population in this study amounts to 0.13 segments per thallus and day (S/T*d) for the south and 0.12 S/T*d for the north side of the boulders. Therefore the values are smaller than the segmental rates of increase of 0.16 S/T*d (DREW, 1983) and 0.15 S/T*d (GARRIGUE, 1991) determined for tropical waters and smaller than 0.2 S/T*d found for another Mediterranean *Halimeda* population (BALLESTEROS, 1991).
The experiment for morphological adaptation to artificially changed light conditions revealed unexpected results:
The shaded thalli showed an increase in size of 11% (north-thalli), respectively 39% (south-thalli). The control-organisms (from the growth experiments) showed an

opposite trend: they decreased in size by 11% (north-thalli) respectively 45% (south-thalli).
Light is a central parameter with impacts of different intensities. Firstly, different light intensities seem to be compensated regarding growth. But already biomasses show partially great differences when the two sides are compared. After all, *Halimeda* appears to be highly adaptable. On the one hand, its morphology is long-term adapted to prevailing lighting conditions by producing segments of different sizes. On the other hand it is capable to acclimatize on short-term as shown in the shading experiment.
Furthermore, the experimental considerations revealed the importance of detailed observations of growth and biomass of the mediterranean *Halimeda tuna* on the level of single segments.
Comprehensive data of abundances and depth-distributions of this alga in the Mediterranean are lacking yet.
Future studies should give detailed insights into the contribution of *Halimeda tuna* to sediment production and production of calcareous compounds as for instance already known for tropical waters on a large scale.
Thus, the meaning of *Halimeda tuna* as a structure forming alga in the Mediterranean Sea has not been observed sufficiently yet.