THE EFFECT OF LIGHT INTENSITY ON THE INVASIVE ALGAE *CAULERPA RACEMOSA* IN FOURNI ISLAND, AEGEAN SEA, GREECE

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Abstract
Caulerpa racemosa is found predominantly in the Mediterranean Sea as an invasive algal species. Its presence has been seen to negatively impact native biodiversity and cause homogenisation of the environment. *C. racemosa* has a high degree of morphological plasticity and this study aimed to further current knowledge of the impact of light intensity on the growth morphology and abundance of this species around Fourni island complex, NE Aegean Sea.

Keywords: Aegean Sea, Alien species, Algae

Introduction
The green macroalgae, *Caulerpa racemosa* var. *cylindracea*, is an invasive species native to Australia that has rapidly spread across the Mediterranean since 1926 [1]. *C. racemosa* colonises a variety of substrata, and its dominating presence has been found to alter indigenous flora and fauna biodiversity [2]. It is thought that the algae's extensive morphological plasticity has contributed to its invasive success [1]. The aim of this study is to determine the effect of light intensity on the abundance and growth morphology of *C. racemosa* populations at littoral ecosystems of Fourni island complex, NE Aegean Sea, Greece to aid design of efficient control strategies for this invasive species.

Materials and methods
Data was collected in July and August 2012 at four different habitats types with differing light regimes, where *C. racemosa* was present. Each habitat was termed the following: shallow; data collected at 1m(±0.1m) depth, deep; data collected at 5m(±0.5m) depth, wall; data collected at 1m(±0.1m) depth from quadrats placed perpendicular to the sea floor on a rock wall, cave; data collected at 1m(±0.1m) depth inside a shallow open air cave-like habitat. Light intensity at each habitat type was recorded over a 72 hour period using an underwater datalogger. *C. racemosa* abundance was measured by photographic quadrat analysis using 30cmx30cm quadrats [5]. Percentage abundance was calculated per habitat using photo-Quad computer software [3]. Scrapings were collected at the deep and shallow habitat and morphological measurements concerning the stolen, fronds, ramuli and rhizomes were measured in the lab. One-way ANOVA was performed to analyse the abundance of *C. racemosa* data. Students T-test and Mann-Whitney U were performed to determine significance of variance between morphological measurements.

Results and discussion
Percentage abundance of *C. racemosa* was significantly different between habitats ($p<0.0001$) and greatest abundance was observed in the shallow habitat where light intensity was greater (Fig. 1), presumably due to increased photosynthetic rate. Morphological measurements demonstrated total stolen length ($p=0.04$, N=6); diameter of ramuli ($p=0.002$, N=157) and number of rhizomes ($p<0.005$, N=6) were significantly greater in the shallow habitat, creating a compact morphology allowing concentrated growth under favourable conditions. It is suggested that *C. racemosa* in low light intensity adopted an elongate growth form to increase surface area and escape unfavourable conditions. Stolen diameter and colouration of *C. racemosa* were not uniform across quadrat samples leading to the proposal that they are involved in reproductive stress strategies that occur under low light intensity [1].

Conclusion
This study confirmed that in the Aegean Sea, the invasive algae *C. racemosa* is sensitive to light intensity, and alters its growth, biomass production and morphology accordingly. The significant morphological differences followed the predictions made in light of the 'forager growth hypothesis' proposed by de Kroon and Knops [4]; where elongate morphs dominate low light habitats and compact morphs dominate high light habitats. Furthering the knowledge on this species may aid with accurately predicting the potential impacts an invasion may have in novel environments.

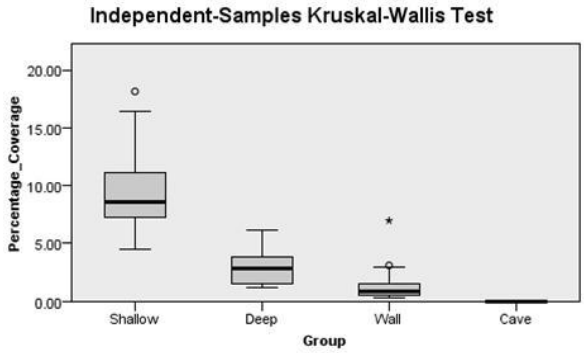

Fig. 1. Boxplot created by 1-way ANOVA of mean percentage coverage of *C. racemosa* in habitats of varying light intensity. $p=0.0001$. N=60. Mean percentage coverage of *C. racemosa* at shallow: 7.72%, deep: 3.58%, wall: 1.53%; cave: 0%. '**o**' represents outliers. ***** represents extreme outliers.

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