Elucidating food webs in infralittoral rocky coastal habitats invaded by *Caulerpa cylindracea* (Sonder 1845)

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Introduction

The Mediterranean Sea is one of the most affected areas worldwide by invasive alien species, representing up to 5% of the described flora and fauna (1). New inhabitants modify natural and local communities occupying native ecological niches through predation or competition. Macroalga *Caulerpa cylindracea* Sonder, 1845, native from the southwestern coast of Australia, has broadly colonized soft bottoms, seagrass meadows and rocky shores ranging from 0 up to 70 m (2).

Lampedusa Island, in central Mediterranean Sea is a hotspot for assessing invasive alien species with an interesting scenario since *C. cylindracea* and invasive herbivorous fish *Siganus luridus* are co-existing.

Stable Isotopes Analysis (SIA) techniques can be used to study effects of invasive species in food webs in a rapid and cost-effective way. The presence of a new basal resource such as *C. cylindracea* would be expected to create a greater degree of trophic diversity with higher carbon and nitrogen isotopic values having implications at community and ecosystem level.

Aims

✓Describe food webs in invaded and non- invaded conditions in coastal rocky bottoms in Lampedusa Island, Central Mediterranean

✓Test the hypothesis that the introduction of a new source of primary production and basal resource can cause an enlargement of trophic niche within the food web

Material and Methods

Field work

Scuba diving with visual census at Lampedusa Island during highest biomass of *Caulerpa cylindracea* in November 2013

Two invaded hard substrate surfaces by *C. cylindracea* (frequency > 0.9) and two rocky surfaces colonized by native macroalgae (frequency > 0.9) were sampled at depths between 9.5 and 11.5 meters

Samples of macroalgae (*C. cylindracea*, *Codium bursa*) and invertebrates (*Hermodice carunculata, Palaemon* spp, *Lysidice* spp, and different species of Brachyura, Capitellidae, Gammaridea, Gastropoda,, Nemertea,, Porifera, Serpulidae, Sipuncula*)* were obtained

Macrobenthivore native fish species *Diplodus vulgaris* and *Spondyliosoma cantharus* were sampled to investigate the presence of an indirect effect at higher trophic levels due to *C. cylindracea.* To investigate the direct trophic effect, native herbivore fishes *Sparisoma cretense* and *Sarpa salpa* and the herbivore Lessepsian species *S. luridus*, were also sampled by spear fishing in the same surfaces for benthic sampling

Stable Isotopes Analyses (SIA)

$\delta^{13}C$ and $\delta^{15}N$ stable isotopes signals were determined in all biological samples with a continuous flow mass spectrometer (Thermo Finnegan Delta x-plus)

Isotopic niche enlargement was calculated applying Layman metrics for all biological data and the convex hull area was added to the plot for comparison between invaded and non-invaded conditions (3)

Results

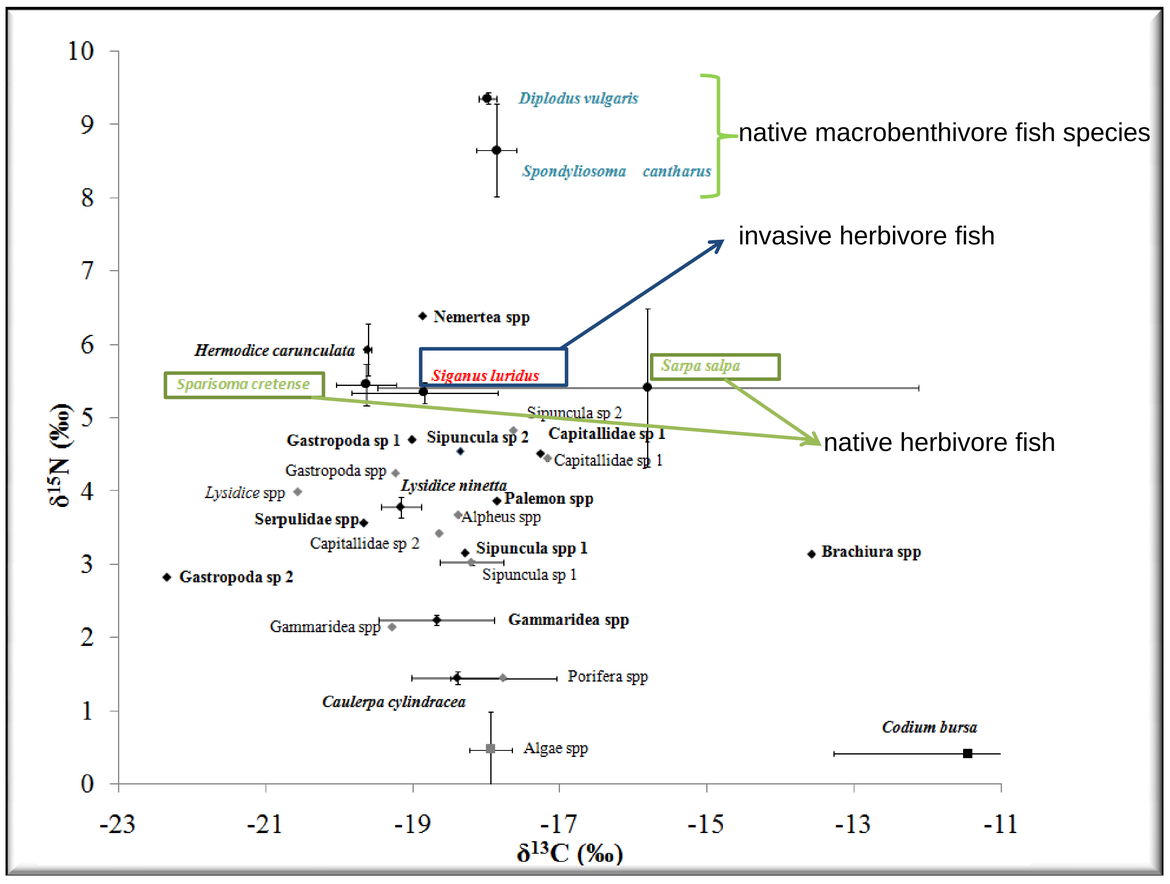

Fig. 1-Mean SIA values: slightly higher in invaded than in non-invaded conditions (invaded; $\delta^{13}C$ = -17.94 ‰ and $\delta^{15}N$ = 3.60 ‰ and non-invaded; $\delta^{13}C$= -18.48 ‰ and $\delta^{15}N$ = 3.14 ‰; t-test p > 0.05)

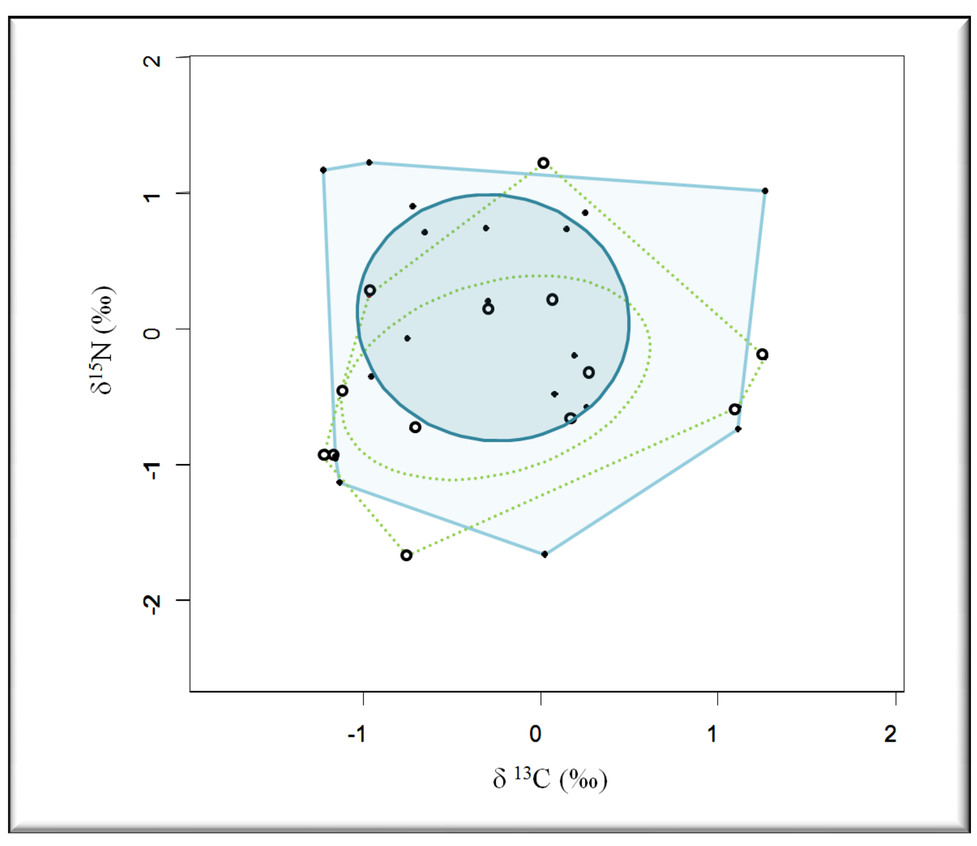

Fig. 2-Trophic diversity according to the convex hull area (irregular shapes) and Bayesian estimate of the standard ellipse area (ellipse shapes) for non-invaded conditions (green and isotopic values = ○) and invaded conditions (blue and isotopic values = ●).

Discussion and conclusions

✓Macrobenthic community in invaded conditions shows slightly higher carbon and nitrogen isotopic values than in non-invaded conditions (Fig. 1)

✓Bionvasion by *Caulerpa cylindracea* causes an enlargement of trophic niche of at least 1.4 times in coastal rocky infralittoral habitats (Fig. 2)

✓According to results, invasive herbivorous fish, *Siganus luridus* is reported to feed at the same trophic level as the native herbivorous fishes *Sparisoma cretense* and *Sarpa salpa*

✓It is essential to remark the need to continue investigating the spread of non-native species in the Mediterranean Sea to decipher the ecological consequences across the food web

Acknowledgements

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