ELUCIDATING FOOD WEBS IN INFRALITORAL ROCKY COASTAL HABITATS INVADED BY *CAULERPA CYLINDRACEA* (SONDER 1845)

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Abstract
Invasive species including *Caulerpa cylindracea* affect coastal benthic communities inducing structural changes. To assess effects in rocky ecosystems, food webs have been depicted based on stable isotopic data collected from invertebrates and fishes at invaded and non-invaded coastal areas. Isotopic values of invertebrates were slightly higher in invaded than non-invaded habitats of Lampedusa Island, however no significant differences were found. Invasive fish *Siganus luridus* and native *Sparisoma cretense* had similar isotopic signatures indicating similar food sources.

Keywords: Food webs, Stable isotopes, NIS, Mediterranean Sea

Introduction-The Mediterranean is one of the most affected areas by invasive species and Lessepsian migrations are the major driving force for this bioinvasion (1) but other factors as globalization and international trade, climate change, anthropogenic activities (aquaculture, shipping and transportation) are also responsible. *C. cylindracea* colonization causes deterioration in sediment quality and seagrass decline impacting on food webs. Effects in trophic levels can be rapidly addressed with Stable Isotopes Analysis (SIA) (2). Accordingly, shifts in trophic structure are expected and therefore we examined changes in coastal benthic communities of invaded and non-invaded habitats.

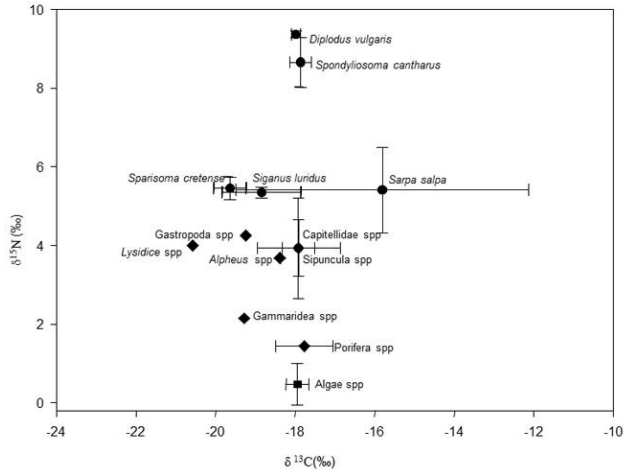

Fig. 1. Stable isotope signatures for macroalgae (squares), benthic invertebrates (rhombus) and fish (circles) in non-invaded habitats (mean ± SE).

Materials and Methods- Sampling was performed at Lampedusa Island in November 2013. One invaded (coverage > 90% of *C. cylindracea*) and one non-invaded (coverage > 90% native macroalgae) hard substrate were sampled by scuba divers and biological components were identified to the lowest taxonomic level in laboratory. In addition, 5 fish species (*Diplodus vulgaris, Spondyliosoma cantharus, S. luridus, S. cretense, Sarpa salpa*) were sampled to investigate indirect effects throughout the food web at higher trophic levels. Carbon and nitrogen SIA were performed in all biotic samples to describe changes in the trophic web.

Results- Values of $\delta^{13}C$ and $\delta^{15}N$ in primary producers and consumers were slightly higher in invaded than in non-invaded habitats by *C. cylindracea* (invaded; $\delta^{13}C$ mean = -17.94 ‰ and $\delta^{15}N$ mean = 3.60 ‰ and non-invaded; $\delta^{13}C$ mean= -18.48 ‰ and $\delta^{15}N$ mean = 3.14 ‰) (Fig. 1 and 2) but no significant differences were found (t-test $p > 0.05$). Macrobenthivore native fish *D. vulgaris* and *S. cantharus* were grouped together while the invasive fish, *S. luridus* had similar isotopic signals as native herbivore *S. cretense*.

Discussion- The lack of significant differences among $\delta^{15}N$ values in herbivorous, deposit and benthic invertebrates feeders of both habitats is probably linked to differences in movement capacity of these trophic groups and to their food selectivity (3). Similar isotopic signatures between invasive *S. luridus* and native *S. cretense* provide further evidence of feeding similarities and analogous $\delta^{15}N$ isotopic values among herbivore fish indicate that these feed at the same trophic level however spatial segregation according to $\delta^{13}C$ probably minimizes trophic interactions according to basal food sources.

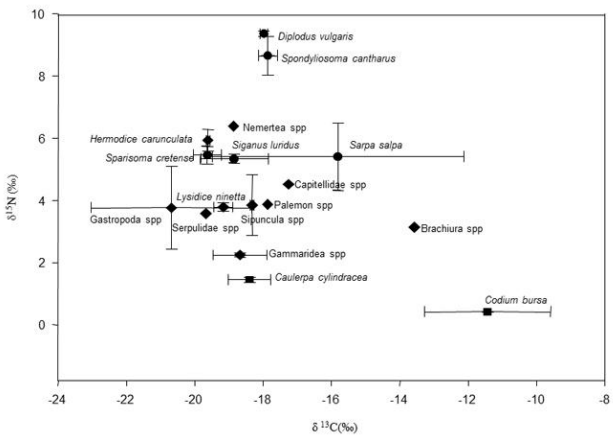

Fig. 2. Stable isotope signatures for macroalgae (squares), benthic invertebrates (rhombus) and fish (circles) in invaded habitats (mean ± SE).

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References
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