

Alien species play havoc with fish

Researchers in Italy suggest that one of the main limits of spatially explicit forms of marine conservation, such as Marine Protected Areas (MPAs), is that they cannot protect areas from major threats, including coastal modifications and changes in hydrodynamic and sedimentary regimes, as well as the spread of exotic species. Alien species, in particular the green algae *Caulerpa racemosa*, have invaded the Mediterranean Sea and other MPAs, significantly impacting the feeding habits of demersal species, and in turn potentially affecting fish populations. The study, presented in the journal *PLoS ONE*, was funded in part by the PERSEUS ('Policy-oriented marine environmental research in the southern European seas') project, which has received almost EUR 13 million under the Environment Theme of the EU's Seventh Framework (FP7).



White sea bream
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Led by the Università del Salento, CoNISMa, in Italy the researchers assessed the coasts along the northern Ionian Sea in south-eastern Italy to evaluate the occurrence and the extent of the interaction between the invasive seaweed and the endemic white sea bream (*Diplodus sargus*). They found that sea bream is eating *C. racemosa*, and in turn accumulating the alkaloid caulerpin in many of its tissues.

'Relationships between subcellular mechanisms of algal metabolites and indirect effects on marine biodiversity have seldom been investigated,' the authors write in the paper. 'In light of [the] results obtained, this study aimed at investigating the effects of such a new trophic interaction, by measuring toxicological responses at several biochemical and physiological levels in organism living in invaded and non-invaded environments. By conjugating organic chemistry, ecotoxicology and ecology, this study attempts to elucidate potential impact of *C.*

racemosa on *D. sargus*, providing new insights into cellular mechanisms by which biological invasions can affect marine biodiversity and, hence, the effectiveness of protection regimes.'

The team identified 11 major food items in the stomachs of the sea bream, with *C. racemosa* being the most important item in terms of frequency of occurrence and relative significance in fish. The researchers also observed a negative interaction between invasive species and native ones, specifically in terms of how the availability or quality of nutrients, food and physical resources are changed.

'*Caulerpa racemosa* has become a major food item in the diet of this important fish species,' they wrote. 'Here, we confirm the frequent occurrence of invasive alga in stomach contents of the fish with the concomitant accumulation in fish tissues of the caulerpin. The switch from a diet composed of animal and plant items to a diet based mostly on the invasive alga, could influence organoleptic properties and nutrition quality of this economically important fish resource. The nutritional value, taste and flavour of the fish fillet in fact, depend both on the amount of fat and fatty acid composition and on the muscle amino acids which are all strongly influenced by the dietary history.'

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