SETTLEMENT FEATURES OF JUVENILE STAGES OF YELLOWMOUTH BARRACUDA (*SPHYRAENA VIRIDENSIS*) IN THE LIGURIAN SEA

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Abstract
The yellowmouth barracuda *Sphyraena viridensis* is a termophilic fish species, now very common in the Ligurian Sea. In the available literature, information on this species is very scanty. In particular the early stages of the life cycle (e.g. settlement) are virtually unknown. An analysis of this crucial phase can be very important to understand the dynamics of the species, since the study of the characteristics of the settlement, post-settlement and recruitment is crucial to obtain information on the supply of the local population. A Visual Census survey was carried out in some locations of western Ligurian coasts between April and November 2011. Uni and multivariate analyses were used in order to evaluate the preferential habitat types and other information on these early life stages of the species.

Keywords: Fish behaviour, Ligurian Sea, Fishes

Introduction
Yellowmouth barracuda, *Sphyraena viridensis* is one of the two species reported in the waters of the north-western Mediterranean Sea (the other is *Sphyraena sphyraena*) [1, 2]. Visual Census has allowed us to collect the necessary data for the analysis of the habits and distribution, during the important stages of settlement, post-settlement and recruitment, so far little known.

Materials and methods
To investigate the habits and distribution of juveniles of *S. viridensis*, we applied a sampling design with four habitats (semi artificial pier, gravel beach, artificial ballast, semi submerged cliff), replicated in two areas along the western Ligurian coast. 3-way ANOVA, with the factors time (orthogonal and random), area (orthogonal and random) and habitat (fixed and orthogonal), and 2-way with the factors time (orthogonal and random) and habitat (orthogonal and fixed), incorporating the two areas in a single series of replicates, were used to determine whether the juveniles of *S. viridensis* show a preference for specific habitat types among those taken into consideration and to show how their abundance varied over time. Further investigations on the differences among habitats and among times were made taking into account also the species that have are known to be preyed upon by juveniles of *S. viridensis* and could affected their distribution (juveniles of *Diplodus sargus*, *Oblada melanura* and *Atherina sp.*). An MDS plot was produced using the Bray-Curtis index to measure the similarity between the different visual transects collected at different times and in different habitats. PERMANOVA was used to assess the differences between the tested factors.

Results
Boyh 3-way and 2-way ANOVA results have shown that the factor habitat does not influence significantly the settlement of juveniles, whose density varies rather significantly in time. This result is confirmed by the MDS plot and PERMANOVA, for which also those fish species preyed upon by *S. viridensis* have been taken into account. Furthermore, these species seems not to affect the distribution of juveniles of this species, as demonstrated by the low correlations obtained with correlation plots.
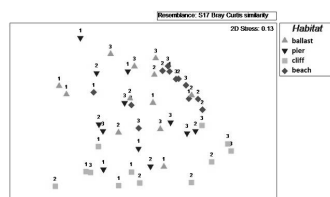

Fig. 1. MDS plot developed to investigate the differences among habitats and among times taking into account the distribution of juveniles of *S. viridensis* and their main preys

Other studies have been done in this framework regarding the mortality of small *S. viridensis* and their growth rate, that were never conducted earlier for this species. In particular, growth seems quite rapid (almost 2 mm per day, achieveing recruitment at a length of about 20 cm).

Discussion
From all the results we can affirm that *S. viridensis* can establish without distinction in all the considered habitat types, when their length is 5 or 6 cm, showing a variation of abundance that, after an initial period of settlement, which occurs in early summer, is decreasing to settle on values rather constant during the remaining summer months. The fact of not having spotted juveniles of *S. sphyraena* leads us to think that probably the settlement for this species occurs in habitats different than those used by juveniles of *S. viridensis*. This could be an example of segregation between juveniles of congeneric species [3], in this case spatial. The information obtained from the literature [4] could reinforce this conclusion: it is shown that the habitats suitable for settlement of juveniles of *S. sphyraena* are mainly sandy bottoms, an habitat type that is not between those sampled in the study. Finally, the high growth rate recorded, which allows to reach a larger size before winter, makes it possible to accumulate a good amount of lipids and to face more successfully the cold season [5].

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