

EFFECT OF DEPTH AND CANOPY HEIGHT ON THE NURSERY VALUE OF *CYSTOSEIRA BALEARICA* FORESTS FOR MEDITERRANEAN ROCKY REEF FISHES

A. Cuadros-Casado ^{1*}, A. Cheminée ², E. M. Vidal ¹, P. Thiriet ², O. Bianchimani ³, S. Basthard-Bogain ³, P. Francour ² and J. Moranta ⁴

¹ IEO-COB Estació d'Investigació Jaume Ferrer, - amalia.cuadros@ba.ieo.es

² Université Nice Sophia Antipolis, EA 4228 ECOMERS, 06108 Nice Cedex 2, France

³ Association Septentrion Environnement, Maison de la Mer, Corniche Kennedy, 13007 Marseille, France

⁴ IEO—Centre Oceanogràfic de les Balears, Moll de Ponent s/n, 07015 Palma, Spain

Abstract

We studied effects of depth and *Cystoseira balearica* forests canopy height on coastal juvenile fish assemblages of Minorca Island. Results showed a clear differentiation of juvenile fish assemblages due to depth: assemblage in the shallowest range (3-4m) was characterized by higher densities of *Thalassoma pavo*, deeper ones (6-8, 10-12 m) by higher densities of *Coris julis*. Smallest juveniles of both species were more abundant within forests displaying the highest canopy height; meanwhile largest juveniles were more abundant within low *Cystoseira* forests. Also, both species showed predominantly a cryptic behavior on forest of higher canopy height, and a temporal one when canopy was lower. This study supports the importance of preserving healthy *Cystoseira* forests in order to preserve their nursery value for these two Labrid species.

Keywords: Teleostei, Algae, Life cycles, Bathymetry, North-Western Mediterranean

Introduction

Many fish species of the Mediterranean present at least some disjunction between adult and juvenile habitats. Usually adults occupy a broader range of depth and habitats, while juveniles appear in littoral waters in specific habitats [1], called juvenile habitats. For a given species, among juvenile habitats, nursery habitats are characterized by higher nursery value (i.e. contribution per unit area of individuals to adult populations). Nursery value can vary spatially according to factors that create site-specific variation. These factors may be biotic (such as structural complexity) or abiotic (such as water depth) [2]. Along the Mediterranean coasts, *Cystoseira* forests display a high nursery value for some Labridae species [3] but simultaneously are threatened by human pressures, and tend to regress [4]. It is important to understand site-specific factors molding suitability of this nursery habitat in order to design management actions that assure the replenishment of adult fish populations. We aim to study the effect of depth and micro-habitat characteristics (canopy height) on the nursery value of *Cystoseira* forests along Minorca Island coasts.

Material and Methods

In September 2012 we sampled 3 sites of 2 separated localities containing *Cystoseira balearica* forests of similar cover (>70%), at three depth ranges (3-4, 6-8, 10-12 m). In each depth range, a diver haphazardly selected 8 sampling points within the forest. The diver recorded canopy height and cover, as well as abundance, size and behavior of juvenile fishes during 5 minutes within a quadrat area of 1m² [3]. Other habitat parameters (slope, etc.) were kept constant. Analysis of data were made by multivariate and univariate exploratory and inferential approaches, using R and Primer6/Permanova+ softwares [3].

Results and Discussion

Assemblages of juveniles significantly differed according to depth (Fig 1; PERMANOVA, F=10.6, p=0.004). Assemblages at shallow depth were characterized by higher densities of *Thalassoma pavo*, and deeper assemblages by higher densities of *Coris julis*. Additionally, we found for juveniles of *C. julis*, that different juvenile size classes showed contrasted abundance patterns according to depth, which was not the case for *T. pavo*. For both species, smallest juveniles were more abundant within forests displaying the highest canopy height (~13 cm); meanwhile largest juveniles were more abundant within *Cystoseira* forests displaying the lowest canopy height (~5 cm). Furthermore, both species showed more cryptic behavior in forests of higher canopy height, and a rather temporal behavior when canopy was lower. Results are consistent with previous studies investigating the range of depth distribution of juveniles of *C. julis* and *T. pavo* [1]. It has been previously demonstrated for *C. julis* a clear disjunction between adults and juveniles distribution. Not for *T. pavo* [1]. This study may support that when adults are well segregated from juveniles

by depth, migration of juveniles to a broader range of depth occurs gradually as they grow and gain maturity. Also this study supports the importance of preserving healthy *Cystoseira* forests (with dense and high canopy) in order to guarantee their nursery value for these two Labrid species.

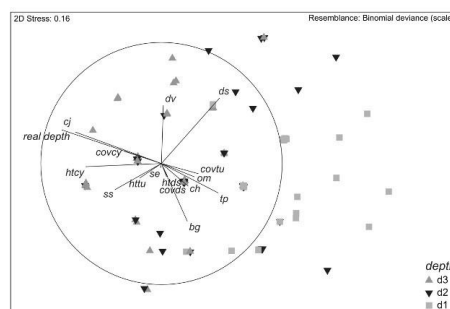


Fig. 1. 2D ordination plot of juvenile assemblage among sampled *Cystoseira* forests: non-metric multi-dimensional scaling ordination plot (nMDS). Correlation vectors (Spearman) are plotted – Juvenile taxa: tp: *Thalassoma pavo*, cj: *Coris julis*, ch: *Chromis chromis*, ds: *Diplodus sargus*, dv: *Diplodus vulgaris*, bg: Blennidae-Gobiidae, om: *Oblada melanura*, se: *Serranus* spp., ss: *Symphodus* spp. - Abiotic and biotic features: *Cystoseira* percent cover (covc) and canopy height (htcy), turf percent cover (covt) and depth (d1= shallow, d2= medium, d3 = deep)

References

- 1 - García-Rubies A, Macpherson E (1995) Substrate use and temporal pattern of recruitment in juvenile fishes of the Mediterranean littoral. *Marine Biology* 124:35-42.
- 2 - Beck MW, Heck KL, Able KW, Childers DL, Eggleston DB, Gillanders BM, Halpern B, Hays CG, Hoshino K, Minello TJ, Orth RJ, Sheridan PF, Weinstein MP (2001) The Identification, Conservation, and Management of Estuarine and Marine Nurseries for Fish and Invertebrates. *BioScience* 51:633-641.
- 3 - Cheminée A, Sala E, Pastor J, Bodilis P, Thiriet P, Mangalajo L, Cottalorda J-M, Francour P (2013) Nursery value of *Cystoseira* forests for Mediterranean rocky reef fishes. *Journal of Experimental Marine Biology and Ecology* 442:70-79.
- 4 - Thibaut T, Pinedo S, Torras X, Ballesteros E (2005) Long-term decline of the populations of Fucales (*Cystoseira* spp. and *Sargassum* spp.) in the Albères coast (France, North-western Mediterranean). *Marine Pollution Bulletin* 50:1472-1489.