

Video monitoring of Sparidae temporal rhythms: Three-year study by OBSEA cabled observatory

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*Abstract - The abundance and composition of fish assemblages varies at different temporal scales as a product of diel and annual rhythms. In this study, we used a video-wired observatory (OBSEA, www.obsea.es) to monitor annual rhythms in a coastal fish assemblage with a 3-year data set (2012-2014). The photographs were acquired at 30 min frequency. Five species of the family Sparidae were studied (i.e. *Dentex dentex*, *Diplodus sargus*, *Diplodus vulgaris*, *Diplodus annularis* and *Diplodus puntazzo*) together with water temperature and daylength. The results of the annual rhythmicity analysis indicated that most of the peaks of abundance occurred in the autumn months. Results suggest differentially temporal use of the reproductive or trophic niche.*

Keywords: OBSEA, cabled observatory, long-term monitoring, annual rhythms, temporal niche, Sparidae.

INTRODUCTION

The abundance and composition of fish assemblages varies at different temporal scales as a product of diel (i.e. 24-h based) and annual rhythms. In this context, the development of a suitable technology for the continuous

and long-term monitoring *in situ*, allows grasping those changes otherwise impossible to describe with other types of sampling [1]. Fishes can be considered good biological indicators because they modify their behavior and physiology within certain ranges of temperature [2]. Furthermore, fishes are mostly visual feeders and light thresholds also play a paramount role in controlling seasonal changes in behavior [3]. Here, we used a video-wired coastal observatory (OBSEA, www.obsea.es) to monitor annual rhythms in a coastal fish assemblage in the vicinity of an artificial reef with a 3-year data set (2012-2014).

MATERIALS AND METHODS

Photographs were acquired at 30 min frequency over a constant field of view [4]. Two important environmental factors were also measured: water temperature and daylength. During the night hours, two spotlights were used to illuminate the area for few seconds only during image acquisition to avoid constant light contamination.

The photographs were manually processed to determine the number of fish individuals at species level. Then, we defined “abundance” as the total number of counted individuals divided by the number of photographs used for the counting. This type of normalization is needed because the number of the photographs available was variable.

Five model species (representing the family Sparidae) were chosen given their abundance and phylogenetic proximity: common dentex (*Dentex dentex*), white seabream (*Diplodus sargus*), common two-banded seabream (*Diplodus vulgaris*), sharpsnout seabream (*Diplodus puntazzo*), and the annular seabream (*Diplodus annularis*). We calculated the total monthly abundance for each species (36 time points), while the environmental factors were averaged at a monthly basis.

The rhythmicity of the time series has been studied with a non-parametric analysis using the computational language R(www.r-project.org) through one of its add-on packages: Rain (Rhythmicity Analysis Incorporating Non-Parametric Methods) [5].

RESULTS

The number of pictures taken was 52609, while the actual number of used photos is 40989 (78%). The total abundance of the selected species during were: *D. dentex* (1359); *D. sargus* (11420); *D. vulgaris* (89767); *D. puntazzo* (997); *D. annularis* (20577). These 5 species together represent 58% of the counts recorded in the dataset. The results of the annual rhythmicity analysis indicated that most of the peaks of abundance occurred in the autumn months (Fig. 1, Table 1). *Dentex dentex* showed a significant ($p < 0.001$) annual rhythmicity and a peak of abundance in August (8). The abundances of *Diplodus sargus*, *D. vulgaris* and *D. annularis* indicated a significant ($p < 0.001$) annual rhythmicity but with a peak respectively in October the former two and in December the latter. Differently, the abundance of *D. puntazzo* did not show significant ($p = 0.766$) rhythmicity. Finally, as expected, the temperature of water and daylength showed a significant ($p < 0.001$) annual oscillation with a peak in the month of August and June, respectively.

	<i>p</i> value	Phase	Period
<i>D. dentex</i>	< 0.001	Aug	12
<i>D. sargus</i>	< 0.001	Oct	12
<i>D. vulgaris</i>	< 0.001	Oct	12
<i>D. annularis</i>	< 0.001	Dec	12
<i>D. puntazzo</i>	0.766	-	-
Temperature	< 0.001	Aug	12
DayLength	< 0.001	Jun	12

Table 1. The results of the statistical test (rain) on time series of species and environmental variables. The *p* value is reported together with the peak (indicating by the month) and period of the oscillation.

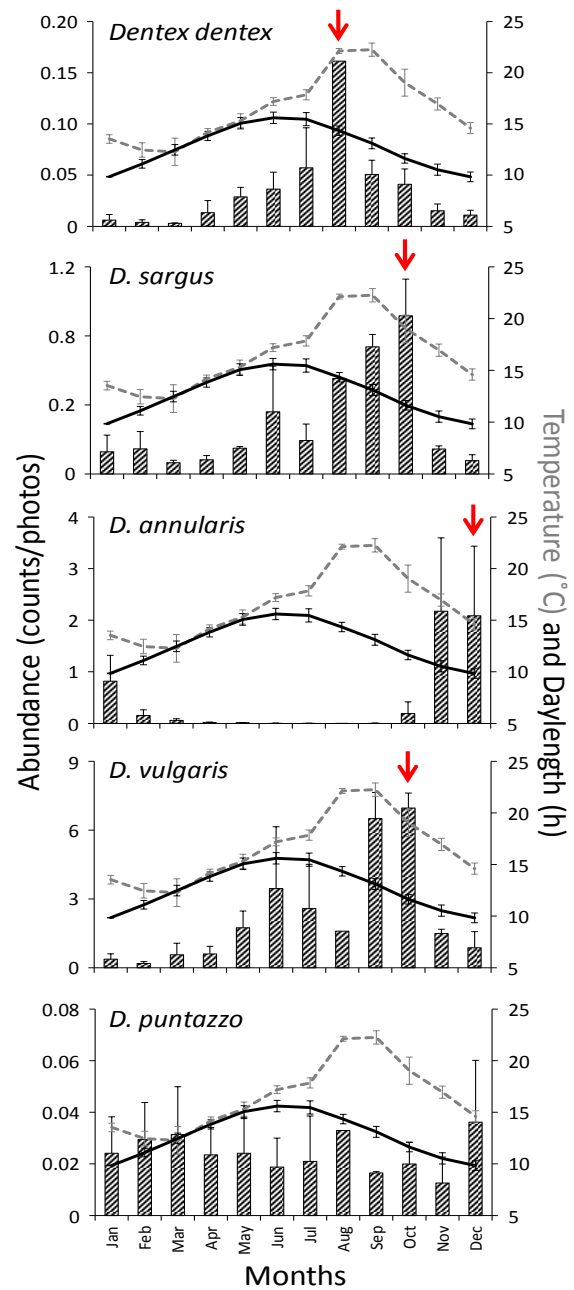


Fig. 1 The figure shows the trend of abundance of the species compared to the performance of the two environmental variables: temperature and daylength. The bars represent the monthly abundance of the selected five species. The grey dashed line represents the average monthly water temperature. The dark continuous line represents the daylength. Arrows indicate the significant peak (see Table 1).

DISCUSSION

The three-years data set showed to be promising to detect temporal rhythms of fishes at the annual scale. In the next future, the analysis will be implemented at the daily basis and statistical modelling (GAMLLS; [6]) will be used to describe the correlations of fish abundance with other environmental parameters. Results are promising to reveal novel feature on the temporal use of ecological niche of Sparidae. In fact, preliminary interpretation suggests that the family evolved differentially annual pattern in the use of the niche, probably related to reproductive or feeding constrains.

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