SPATIO-TEMPORAL PATTERNS OF LARVAL FISH SETTLEMENT IN THE NORTHWESTERN MEDITERRANEAN SEA

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INTRODUCTION

The intensity of larval supply to coastal habitats at settlement often largely determines recruitment success (i.e. settlers that survive and metamorphose into juveniles) and local population dynamics (Ammann, 2004). Monitoring the intensity of settlement may therefore provide valuable information to anticipate the abundance of future fish stocks, for fisheries management and conservation efforts in general (McLeod and Costello, 2017). Here, we used light-traps to estimate the larval supply along the French Mediterranean coast, over 3 years.

MATERIALS & METHODS

- 13 sites were sampled along the French Mediterranean coast, with different specificities (eg. rocky vs. sandy bottoms, close or away from Marine Protected Areas, MPAs)
- A total of 7036 samples were collected over 3 years, using the same gear (CARE light-traps, Fig. 1) and protocol
- Sampling frequency was site-specific, with higher frequency around the new moon in some sites (eg. Bastia) and even distribution throughout the year in others (eg. Villefranche)
- All data were analyzed with quantile-based regressions (ie. quantiles q25%, q50%, q75% and q90%)

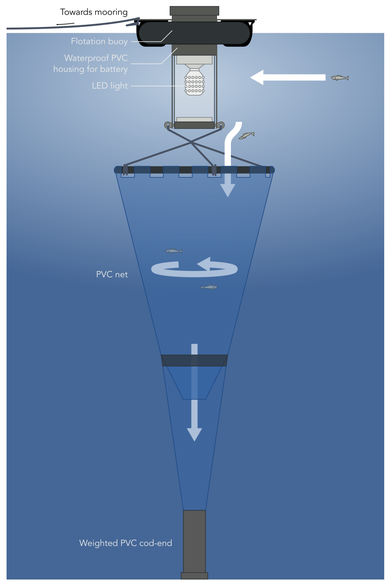

Fig 1. Scheme of a CARE light-traps and its principle.

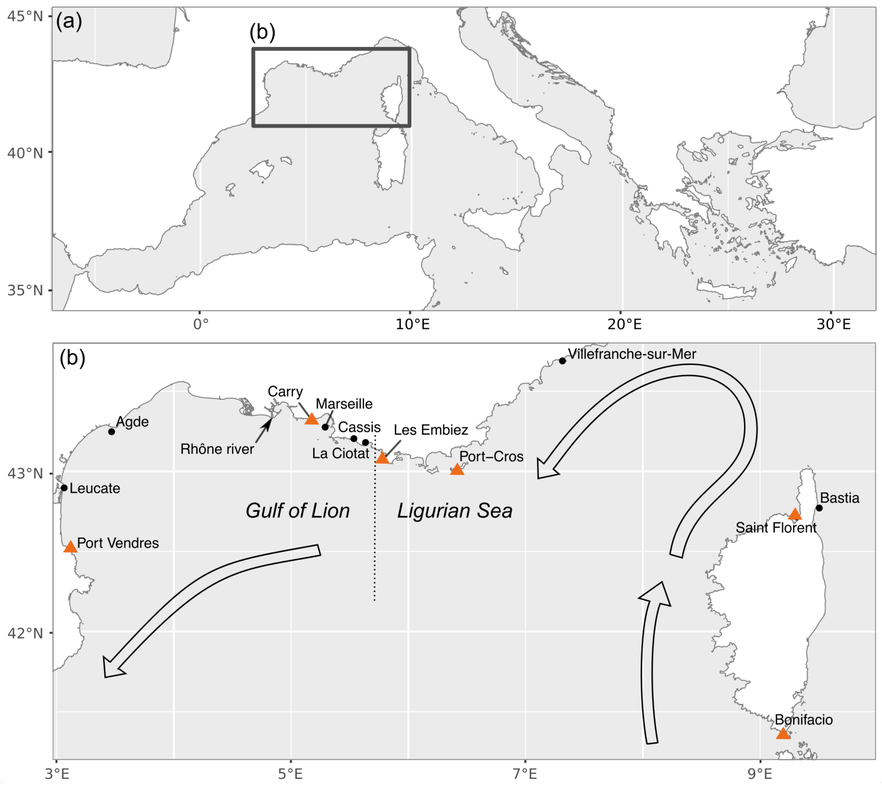

Fig 2. (a) Location of the sampling region within the Mediterranean Sea, and (b) detailed position of the 13 sampling sites. Sites located at proximity to a MPA are indicated with orange triangles. The two main topographic regions (Gulf of Lion and Ligurian Sea) are indicated, along with the average path of the Liguro-Provençal current (arrows).

RESULTS

- 27800 larvae collected belonging to 29 families and 72 species
- Assemblages were dominated by Sparidae (58% of total CPUE), Pomacentridae (16%), Blenniidae (10%), Mullidae (6%), Mugilidae (4%), Atherinidae (2%), and Gadidae (1%) (Fig. 3)
- Settlement is extremely sporadic, with few short events of very high supply in summer and fall (Fig. 4)
- Larval supply was higher in the east side of the Rhône river (ie. away from the river's influence), with site-specific associations (Fig. 5)
- Higher larval supply occurred to sites close to MPAs, while species richness and diversity indices were not different at proximity or away from MPAs (Fig. 6)
- Larval supply was the highest around the new moon (Fig. 7)

Fig 3. Examples of settlement-stage fish larvae collected in the light-traps. From left to right, and top to bottom: *Diplodus puntazzo*, *Oblada melanura*, *Scorpaena porcus*, *Diplodus sargus*, *Apogon imberbis*, *Hippocampus* sp. Credits: Black background pictures from KahiKai, (www.kahikao.org), others from R. Crec'hriou.

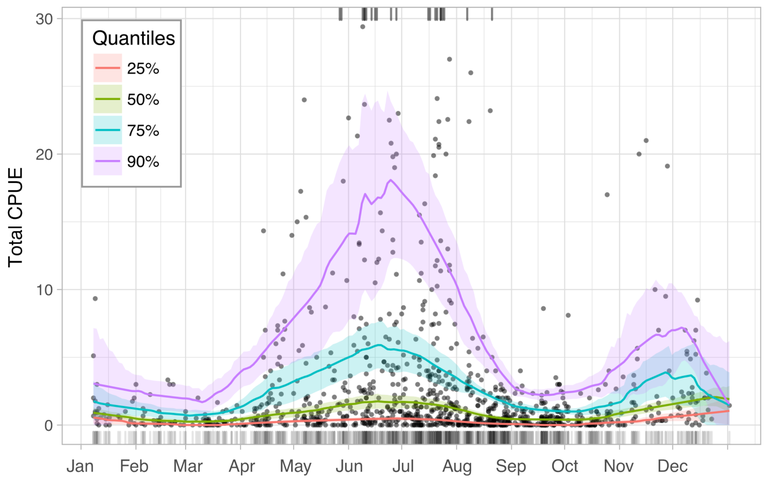

Fig. 4. Seasonality in total CPUE. Points are observed CPUEs; lines display the local quantile regressions for q25%, q50%, q75% and q90%, along with their 95% confidence interval (shaded areas). Catch events with CPUE >30 fish larvae/trap/night/site are cropped for plotting and indicated by ticks at the top of the figure.

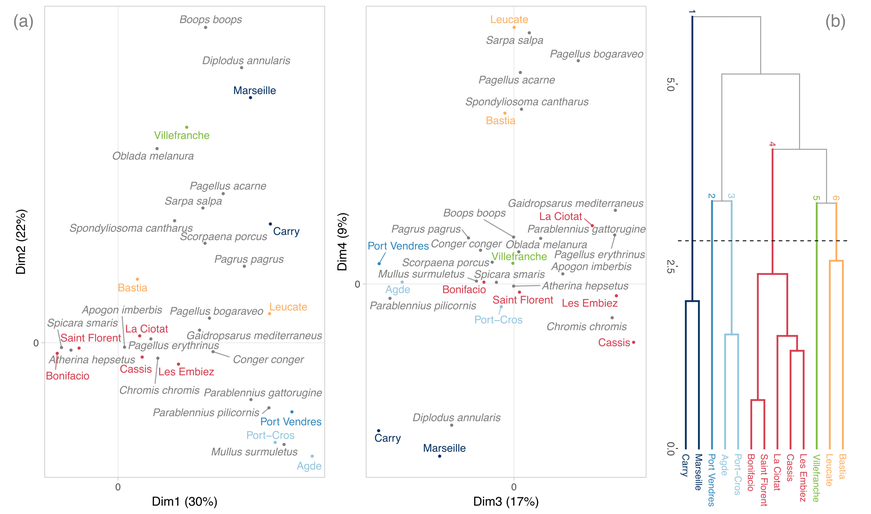

Figure 5. (a) Plots in the four first dimensions of the correspondence analysis and (b) tree of the hierarchical clustering computed per site, on species assemblages (19 most common and abundant species only). The proportion of variance explained is given for each dimension (%). Colors indicate sites displaying similar assemblages according to the hierarchical clustering.

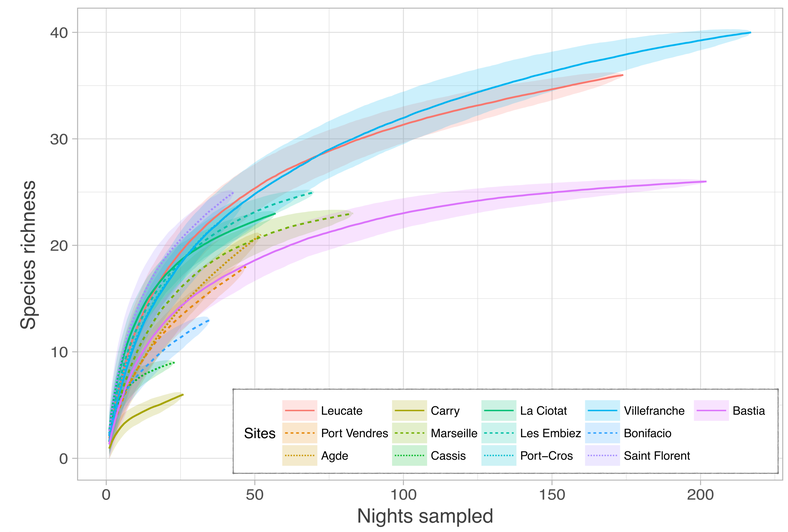

Fig. 6. Species accumulation curves per site (lines) and standard deviation around them (shaded areas).

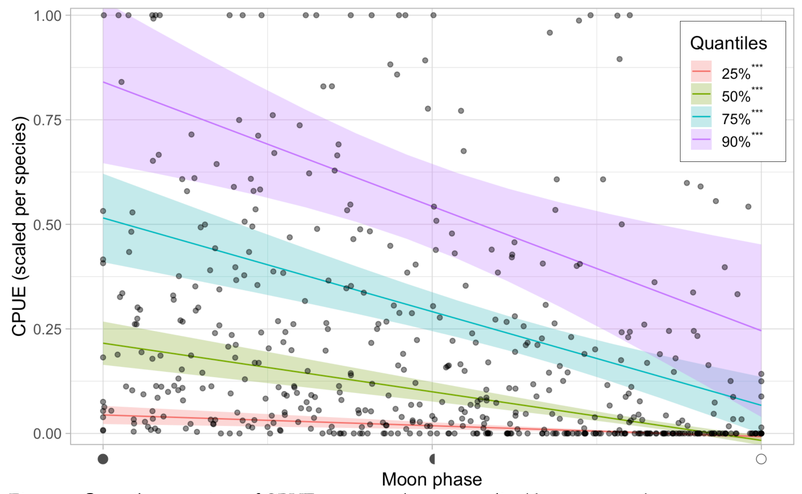

Figure 7. Quantile regressions of CPUE on moon phase, normalized between 0 and 1 per species to use all species together. The solid lines and shaded areas represent the quantile regressions and their 95% confidence interval for quantiles 25%, 50%, 75% and 90%. All regressions were significant ($p < 0.001$).

TAKE HOME MESSAGES

- No large-scale patterns in species diversity indices…
- But composition of the larval pool strongly linked to geographical locations and their geomorphological characteristics;
- Spatio-temporal variability similar to tropical habitats;
- Identification of potential sites to study emblematic or protected species;
- Fishing effort in further studies should focus around the new moon if targeting high abundances, or throughout the year and moon phases if focused on assemblages;
- Quantile-based analysis is an efficient tool to detect patterns in such episodic data;
- Long-term monitoring of larval supply may provide good ecosystem state indicators;
- Continuous time-series is key to understand the fluctuations in fish populations.

REFERENCES Ammann, 2004. SMURFs. J. Exp. Mar. Biol Ecol 299, 135–154; McLeod & Costello, 2017. Light traps for sampling marine biodiversity. Helgol. Mar. Res. 71, 2;