Macrophyte ecosystems host high biodiversity and stabilize shore-lines, providing valued ecosystem goods and services. Macrophyte ecosystems are also characterized by intense carbon flows. Yet, little information is available on inter-annual variability of carbon cycling in macrophyte ecosystems that can be driven by climatic forcing, or long-term trends due to various anthropogenic pressures. This research is a contribution for the development of a low cost passive acoustic system

- to long-term monitor the O$_2$-based productivity of a seagrass meadow at the ecosystem level with high time resolution
- to estimate the production of O$_2$ as bubbles, which is difficult to assess by other methods

The acoustic signals were recorded by 2 digitalHyd SR-1 self-recording hydrophones SR1 mooring (100 m distant from the source at 10 m water depth location (DA1)) and the 8 hydrophone short array (DTU) moored at approximately 50 m from the source.

The instantaneous (dots) and half-hour moving average (solid lines) environmental noise power in the band 2-7 kHz show a diurnal pattern, where the energy sudden decreases at sunrise and increases at sunset. The magnitude of the variability observed during the period of one week was similar at the various receivers/locations. Due to different system gains and location of the receivers the absolute values changed among hydrophones and/or periods.

The data were gathered in front of the Station de Recherches Sous-marine et Oceanographiques (STARESO) Calvi, Corsica, over a Posidonia oceanica meadow from May 9 to 15, 2013. A sound source (Acoustic Source) transmitted 2 min long sequences of low frequency signals followed by a 3 min period of silence. A previous experiment was conducted in the area in October 2011, but the acoustic data was acquired only during transmissions.

The acoustic data shown herein is environmental noise acquired when the sound was not transmitting. Dissolved O$_2$ data was acquired hourly at 4.0 7.0 and 9.5m depth above the meadow by a 3-optode array (Optodes) moored at 10 m depth.

The magnitude of the variability observed during the period of one week was similar at the various receivers/locations. Due to different system gains and location of the receivers the absolute values changed among hydrophones and/or periods.

The comparison between the changes in dissolved O$_2$ at 7 and 9 m and the changes in noise power shows a high correlation.

At sunrise the high gradient of change occurs earlier in acoustic data than in dissolved O$_2$, what could suggest that the air in plant tissues (aerenchymas) plays a major role in the acoustic signature of photosynthetic activity. These measurements of environmental noise have confirmed the correlation between active acoustic signals transmitted through a seagrass meadow and the photosynthetic activity of the plants observed in the October 2011 experiment.

- O$_2$ production of seagrasses give rise to a visible acoustic signature in environmental noise
- changes in environmental noise were highly correlated with dissolved O$_2$ measurements—the sudden change of noise power at sunrise occurs earlier than the change of dissolved O$_2$, what can be ascribed to the formation of O$_2$ bubbles within plant aerenchymas
- since the amount of O$_2$ bubbles are not assessed by conventional chemical methods, combining the acoustic method with those methods will allow to obtain more robust, and accurate in situ estimates of the productivity of seagrass meadows.