



## **Underwater noise assessment in Harbour areas: a case study of Port of Civitavecchia.**

Valentina Cafaro, Daniele Piazzolla, and Cristiano Melchiorri

Laboratory of Experimental Oceanology and Marine Ecology, Department of Ecological and Biological Science (DEB), University of Tuscia, Civitavecchia, Italy (v.cafaro@unitus.it)

The Marine Strategy Framework Directive (MSFD) (2008/56/EC, EU 2008), with the European Commission Decision of September 2010 (2010/477/EU, regarding the criteria and methodological standards on good environmental status, GES), underwater noise has been recognised as pollution for the first time and included in the qualitative high level descriptors (D11) to achieve GES. In particular, indicator 11.2.1 was described to assess the issue of marine life chronic exposure to low frequency ambient noise, whose main contribute is given by commercial shipping noise. It requests to monitor the ambient noise level trend within the 1/3 octave bands 63 Hz and 125 Hz (centre frequency) (re  $1\mu$  Pa RMS; average noise level in these octave bands over a year) measured in different observation stations. In the last century a strong growth of noise sources number and size was observed which led to a consequent copious increase in background noise in the oceans. The port of Civitavecchia, chosen as case study, has become the most important Port for cruise traffic in the Mediterranean sea with over 2 million transit passengers each year. From May to September 2017, we carried out a monthly underwater noise surveys on 14 predefined acoustic stations located between 35 and 100 m deep. The stations extend 4 nautical miles to the north and to the south of the port entrance, in order to identify a spatial distribution of noise level. The hydrophone was lowered at a fixed depth of 20 m in each sampling stations in order to minimize the boundaries effect and the vessel engine was shut-down to minimize the platform noise. All the 14 acoustics stations were monitored along the same days, and for each one a 60-second recording was obtained. All acoustic recordings were made under similar sea state condition (1 Beaufort scale) to minimize the variation in shallow water ambient noise levels due to such weather condition (e.g. wind), and data were stored in the WAV file format. The instantaneous Sound Pressure Level (SPL) for every 1/3 octave bands (frequency range 12.5 Hz – 16 kHz) was calculated taking into account the analog-to-digital conversions, namely the recorder and amplifier gain and the hydrophone sensitivity as well. A single SPL value was obtained in dB re  $1\mu$ Pa for each sampling station and for each of the 1/3 octave band. According to the MSFD requirements, the resulting values for the 1/3 octave band centered at 63 Hz and 125 Hz, were compared with the threshold of 100 dB re  $1\mu$ Pa and used to create a noise map to show the monthly variation and also to identify the period with the highest noise level.