Translocation and re-use of dredged sediment: bioavailability and toxicity evaluation using the brittlestar *Amphipholis squamata*

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Introduction: The ophiuroid *Amphipholis squamata* (Echinodermata) is a bioluminescent species whose light production is associated with many visual functions of intra- and inter-specific communication [1]. *A. squamata* is a species that lives in contact with and feed on sediments and seawater particulates and bioluminescence could vary with levels of contamination [2]. Changes in light production are used in sub-lethal toxicity bioassays to evaluate the organism general condition, and, indirectly, the environmental quality. Within the framework of sustainable management of sediments in Venice Lagoon, the Venice Water Authority, through its concessionary Consorzio Venezia Nuova promoted a pilot-scale project (SIOSED Project) to evaluate the effects of mobilization and reuse of low contaminated sediments in Venice Lagoon. Together with traditional bioassays, evaluation of bioavailability and toxicity of contaminants has been performed using a novel bioassay, a sub-lethal neuro-toxicity test based on changes in *A. squamata* bioluminescence, which is a property with a relevant ecological function.

Methods: Two set of subtidal banks were built by transplanting low contaminated sediments in different shallow areas of the lagoon. The banks and their surrounding areas were monitored periodically for about 18 months after construction. The bioassay with brittlestar *A. squamata* have been performed under both field and laboratory controlled conditions. After one and two weeks of exposure, total amount and kinetics of light production in *A. squamata* have been measured together with metal accumulation in disc and arms. Number of autotomies (arm breakage), reaction to external stimuli and mortality were also recorded.

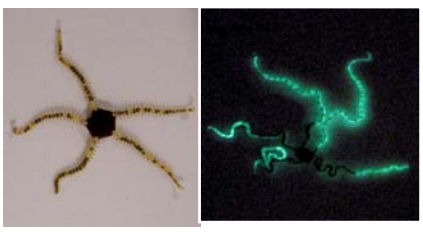

Fig. 1: Bioluminescence of *A. squamata*.

Results: Both field and laboratory experiments pointed out significant changes in bioluminescence capacity in brittlestars exposed to banks sediment, for about six months after their construction. The reaction of the bioluminescence was slower in brittlestars transplanted on the newly built banks compared to the surrounding areas, highlighting an effect on kinetics of the luminous process. Observations on physiological conditions of brittlestars exposed to the banks recorded an increase in number of autotomies, reduced reaction to external stimuli and increased mortality. Neurotoxicity was not recorded thereafter, thus confirming a small time window (3-6 months) of sub-lethal toxicity associated with the banks.
Most of the metals analyzed didn't show a significant bioaccumulation in brittlestars arms and disc.

Discussion: The toxicity bioassay didn't indicate negative effects on brittlestars due to contaminant level in the banks, before and after translocation. The observed toxic effects were associated with high ammonia and sulfide levels in recently remobilized sediments due to natural biogenic processes related to organic matter degradation as confirmed by data on bank sediment chemistry. A dose-response effect of ammonia on brittlestars bioluminescence was confirmed under laboratory condition together with worsening of physiological conditions. Such effects of bank chemistry have shown to be transient, diminishing several months after relocation of the dredged sediment.
The application of the novel bioassay pointed out that impairment of luminous capability of *A. squamata* could affect not only individuals bioluminescent properties but the overall ophiuroid ecological success as this property is associated to defense and communication functions.

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References: [2] Herring (1990) *Cambridge University Press* 245-264. [2] Deheyn et al., (2000) *Sci. Total Environ.* **247**: 41-49.