

# BIOLOGICAL INDICATORS OF ENVIRONMENTAL STRESS IN POPULATIONS OF *ZOSTERISSESSOR OPHIOCEPHALUS* (TELEOSTEI, GOBIIDAE) IN THE VENICE LAGOON

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## Abstract

EROD activities and fluctuating asymmetry were measured in grass goby samples collected in the Venice lagoon in order to evaluate the presence of environmental stress. Results evidenced significant differences across sampled sites. Lago Teneri showed the highest EROD activities, due to higher environmental contamination level in this site, while Chioggia presented the lowest level of fluctuating asymmetry, probably due to more stable environmental conditions in this area. These results show the needs of a multiple bioindicators approach to correctly evaluate environmental stress conditions.

**Keywords:** bio-indicators, lagoons, teleostei

Living organisms respond to environmental stressors by continuously challenging their homeostatic mechanisms. Stress response can be evaluated at different levels of biological organisation (from biochemical and physiological to ecological and population level), to obtain an integrative information (1). In this study the grass goby *Zosterisessor ophiocephalus* (Teleostei, Gobiidae) living in the venetian lagoon is used as "sentinel" species of lagoonal conditions. The grass goby is a territorial, cavity nester species, strictly associated to the bottom sediments, and is widely distributed in the lagoon. Thus it may represent a suitable biological indicator of stress, especially as regards the sediments contamination. Fish samples were monthly collected during March and April 2000 (the core of reproductive season) in 4 stations (Chioggia, Ca' Zane, Lago Teneri and Lido) of the Venice lagoon, which were known to differ in their environmental conditions (different hydrodynamic features, confinement degree and sediment contamination). The stress responses were measured at the biochemical level as the hepatic activity of ethoxiresorufin-O-deethylase (EROD), since this enzyme is known to be induced by the organic pollution due especially to poli-chlorinated byphenils (PCBs) and other organic contaminants, like pesticides (2, 3). At the morphological level the stress response was evaluated as degree of fluctuating asymmetry (FA), that is an indicator of developmental instability, which appears to be enhanced by extreme conditions, pollution and declines in habitat quality (4). EROD activities were evaluated in 10 females and 10 males from each site in April and comparisons across sites were done by applying a variance analysis test. Asymmetry of six bilateral morphological traits (number of pectoral fin rays, maximal length of pectoral fin rays, preorbital length, postorbital length, testes weight and ovaries weight) was measured in March samples (187 males and 89 females) and tested for fluctuating asymmetry. The "total individual FA" (which resumes the asymmetrical conditions of the different bilateral traits by means the sum of their asymmetry data within each specimen) was then evaluated and its variance was compared by using the Levene's test.

Grass goby males showed EROD activities always higher than females, and the highest levels of induction were recorded in the Lago Teneri site (fig. 1a). No differences across sites were found in the females. This result supports the hypothesis of the inhibitory effect of circulating reproductive hormones in females (estradiol) on EROD induction (5, 6). Higher EROD activities identify Lago Teneri as the site with the highest levels of contamination of PCB and organo-alkenated compounds, as confirmed by data about sediment pollution (7). As regards the morphological level, four bilateral traits only (maximal length of pectoral fin rays, preorbital length, postorbital length and ovaries weight) showed FA. The degree of FA did not differ between sexes and in the comparison between sites the specimens sampled in Chioggia showed a significant lower level of total individual FA (fig. 1b). The higher developmental stability in Chioggia together with the lower levels of EROD activity could suggest that this area represents a more stable environment for the species. So these results show that a multiple bioindicator approach, integrating the different stress responses, is necessary in order to adequately evaluate environmental stress within a medium-large spatial scale.

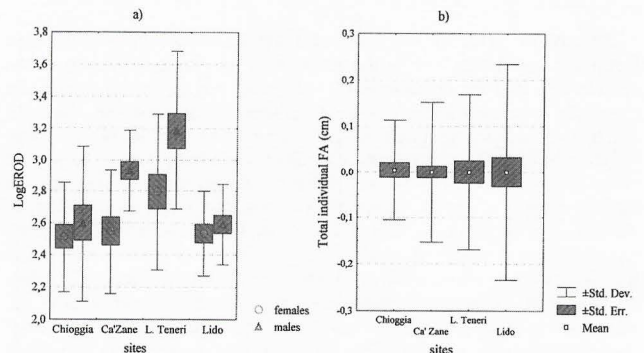


Fig. 1 a) EROD activities (F=females, M=males) and b) total individual fluctuating asymmetry (FA) in fish samples from the 4 sites (mean  $\pm$  SD).

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