# *Paracentrotus lividus* and *Artemia* sp.: never too old model organisms to give new end-points

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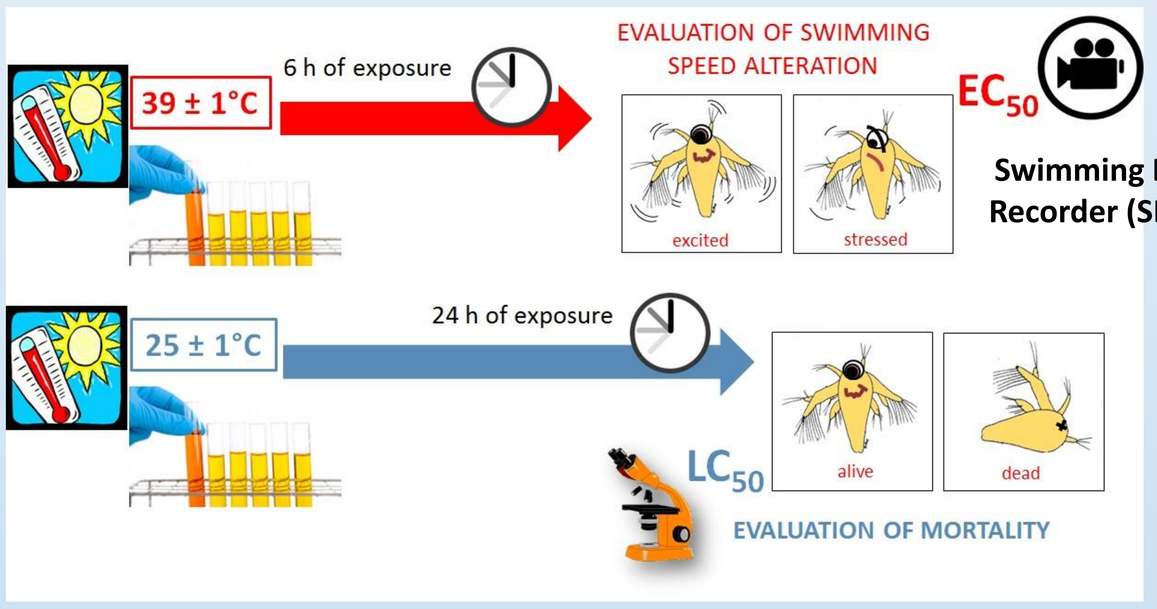
In this work, we reported a novel research on the use of swimming behavior of two "old" marine model invertebrates in ecotoxicology, the crustacean *Artemia* sp. and the echinoderm, *Paracentrotus lividus*, as sub-lethal endpoint. Swimming speed was recorded using an automatic recording system (SBR system) developed at the laboratory of CNR-ISMAR, Genoa, Italy (Morgana et al., 2016)

## *Artemia* sp.

A new short-term test was carried out based on swimming alteration of nauplii of *Artemia* sp. A 24h mortality test was performed in order to compare the sensitivity of the new test ($EC_{50}$ *vs*. $LC_{50}$)

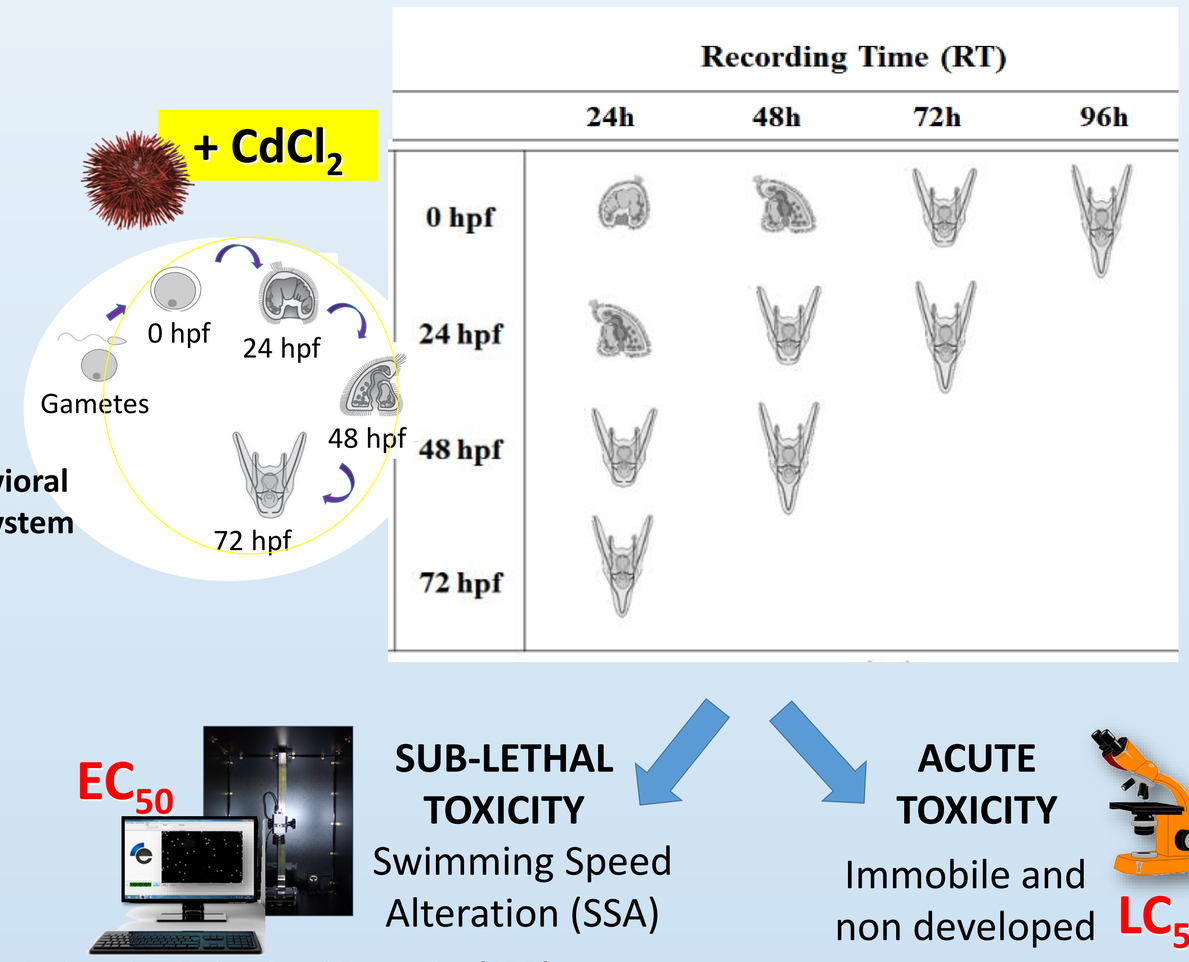
**New 6h test:** Swimming speed alteration test with nauplii of *Artemia* sp. exposed to different toxicants at 39 °C for 6 hours.

**Comparative 24h test:** Mortality test with nauplii of *A. franciscana* exposed to different toxicants at 25 °C for 24 hours.




## *Paracentrotus lividus*

Early developmental stages of *P. lividus* (0, 24, 48 and 72 hpf-hour post fertilization) were exposed to $CdCl_2$ and swimming speed alteration was assessed at different Recording Times (RT) with SBR system together with immobility as acute endpoint.




## Results

The 6h SSA test showed a similar sensitivity to the 24 h mortality test. All the 95% CL calculated for SSA test overlapped with those of the mortality test. Moreover, both the $LC_{50}$ and $EC_{50}$ values obtained were comparable to literature values.

| Toxicant | 6h SSA test $EC_{50}$ (mg/L) CL* 95% | 24h mortality test $LC_{50}$ (mg/L) CL* 95% | Literature range $LC_{50}$ (mg/L) |
|---|---|---|---|
| $K_2Cr_2O_7$ | 41.40 (39.17-43.75) | 40.68 (37.35-44.30) | 30-50 Svensson et al. 2006 |
| $Cu(SO_4)_2$ | 29.06 (25.25-33.44) | 27.75 (20.99-36.71) | 19.5 Kokkali et al. 2011 |
| SDS | 8.59 (7.72-9.56) | 8.43 (7.79-9.13) | 18.4-20.4 Manfra et al. 2015 |
| NaClO | 3.34 (2.30-4.85) | 4.36 (3.84-4.95) | Not available |
| Sertraline | 7.26 (6.70-7.87) | 9.58 (8.47-10.83) | 0.067-4.4 Minguez et al. 2014 |
| $Cd(NO_3)_2$ | >10 | >10 | 626 Huang et al. 2015 |

*CL: confidence limit

| | | $EC_{50}$ (mg/L) CL* 95% | | | |
|---|---|---|---|---|---|
| | | 24h RT | 48h RT | 72h RT | 96h RT |
| ACUTE TOXICITY | 0hpf | 1.13 (0.90-1.41) | 0.32 (0.28-0.36) | 0.98 (0.28-1.21) | 0.39 (0.31-0.47) |
| | 24hpf | 20.45 (18.75-22.34) | 12.63 (11.12-14.35) | 2.50 (1.64-3-81) | - |
| | 48hpf | 13.07 (3.75-45.62) | 16.68 (4.31-50) | - | - |
| | 72hpf | 34.68 (10.83-50) | - | - | - |
| SSA TOXICITY | 0hpf | 0.52 (0.37-0.73) | 0.13 (0.10-0.17) | 0.18 (0.11-0.30) | 0.11 (0.05-0.25) |
| | 24hpf | 9.43 (7.91-11.25) | 13.42 (11.39-15.82) | 1.41 (0.74-2.66) | - |
| | 48hpf | 6.05 (2.53-14.47) | 5.73 (4.51-7.29) | - | - |
| | 72hpf | 4.83 (1.35-17.26) | - | - | - |

Results show that the swimming speed of all the developmental stages was easily recorded. The swimming speed was inhibited as a function of toxicant concentration. Considering $EC_{50}$ values, swimming speed alteration was found to be more sensitive than the acute end-point.

## Discussion

This study provides evidence of the importance and adaptability of two conventional model organisms widely used in ecotoxicology, the brine shrimp Artemia and the sea urchin *P. lividus.* By applying an automatic video-tracking recording system, such as the SBR system, new possible applications and innovative solutions for ecotoxicological purpose can be developed.

Morgana, S., Gambardella, C., Falugi, C., Pronzato, R., Garaventa, F., Faimali, M., 2016. Swimming speed alteration in the early developmental stages of Paracentrotus lividus sea urchin as ecotoxicological endpoint. Mar. Environ. Res. 115, 11–19