



Tremblay, N., **J. Gómez Gutiérrez**, T. Zenteno-Savín, C. J. Robinson & **L. Sánchez Velasco** (2010). Role of oxidative stress in seasonal and daily vertical migration of three species of krill in the Gulf of California. *Limnology and Oceanography*, 55(6): 2570-2584. DOI: 10.4319/lo.2010.55.6.2570

## Role of oxidative stress in seasonal and daily vertical migration of three species of krill in the Gulf of California

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Vertical distribution and abundance of three numerically dominant krill species (*Nyctiphanes simplex*, *Nematoscelis difficilis*, and *Euphausia eximia*) were surveyed in the Gulf of California to understand the role of oxidative stress in their daily vertical migration (DVM) and zoogeographic patterns. Superoxide radical production, lipid peroxidation, and antioxidant enzyme activities were analyzed from krill collected with stratified nets from the surface down to 200 m during January, July, and October 2007. The upper boundary of the oxygen minimum zone (OMZ) was significantly shallower during October than during January. *N. simplex* was always distributed above the hypoxic layers, mostly in coastal upwelling areas. *Ne. difficilis* and *E. eximia* were relatively abundant during January, but detected mostly during their ascending migration. *N. simplex* was the most sensitive species to high temperatures and low oxygen concentrations, showing evidence of oxidative stress during summer (100 times more lipid peroxidation and 30 times more antioxidant enzyme activities than in winter). *Ne. difficilis* had higher glutathione peroxidase activity than *N. simplex*, which could facilitate its larger DVM. Low abundance of *Ne. difficilis* at 100 m during summer suggests that high temperature was also an environmental limiting factor. Oxidative stress indicators could explain the absence of *N. simplex* and *Ne. difficilis* in the eastern tropical Pacific and the ability of *E. eximia* to live in the OMZ and the eastern tropical Pacific. The latter had higher superoxide radical production and smaller lipid peroxidation during October. This suggests that *E. eximia* antioxidant enzyme activities are enough to avoid oxidative damage when exposed to hypoxic conditions during DVM.

Palabras clave: Apostomatidae, Vertical migration oxidative stress, Minimum Oxygen Zone

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