Svensson, Susanne. 2003. Effects, dynamics and management of okadaic acid in blue mussel, *Mytilus edulis*. Department of Zoology/Zoophysiology, Göteborg University, Tjärnö Marine Biological Laboratory, 452 96 Strömstad, Sweden

Abstract: Accumulation of algal toxins in mussels constitutes a serious threat to consumers and the industry. In Sweden, the annual occurrence of the diarrhetic shellfish toxin okadaic acid (OA) in blue mussels, *Mytilus edulis*, is the largest impediment to a further development of the mussel industry. OA is a potent protein phosphatase inhibitor and causes harmful effects at different levels within an organism. The effects of OA on mussels have previously not been investigated.

The inhibitory effects of OA on protein phosphatase (PP) and glycogen synthase (GS) activities in mussels and rainbow trout (*Oncorhynchus mykiss*) were studied. OA inhibited PP activity *in vitro* in both species. However, GS activity was inhibited by OA in rainbow trout but not in mussels. It was suggested that mussels may have mechanisms which prevent OA from binding to PP *in vivo*. Studies on the cytotoxic effects of OA in mussel blood cells showed that these cells are highly resistant to OA and it was hypothesized that this was due to p-glycoprotein activity (multixenobiotic resistance) in the cell membrane. However, the main site of p-glycoprotein activity was observed within lysosomal membranes. Preliminary results suggest that the lysosomes are involved in protecting the cells from the cytotoxic effects of OA.

Depuration of toxic mussels is a potential management option to increase the availability of marketable mussels. Various aspects regarding the physiological processes and the influence of environmental factors on depuration of OA were evaluated in manipulative experiments. Tests of the effects of food conditions showed that depuration rate was unaffected by feeding and digestive activities. In addition, the importance of lipid turnover for depuration of OA was evaluated. Although a positive correlation between lipid content and concentration of OA was observed in the field, depuration was not faster in mussels with reduced levels of lipids in the laboratory. Exposure to different temperatures and feeding conditions did not influence depuration rates. In a large-scale experiment, where toxic mussels were relocated to a fjord for depuration, a fast reduction of OA was obtained at the new location. However, these mussels accumulated DTX-1 which correlated to the presence of *Dinophysis acuta* in the fjord. A comparison between four different depuration experiments suggested that (1): depuration is equally effective in the lab as in the field (2): short-term manipulation of external conditions does not affect depuration rates (3): depuration is faster during summer compared to winter conditions. It was proposed that seasonal changes in the physiological status of the mussel regulate depuration of OA.

A field study comparing levels of OA among mussels, oysters (*Ostrea edulis*) and cockles (*Cerastoderma edule*) provided strong evidence for species-specific accumulation of this toxin and suggested that oysters and cockles can be marketed for human consumption during periods when harvest of mussels is banned.

Keywords: blue mussel, cockle, cytotoxic, depuration, diarrhetic shellfish poisoning, dinoflagellates, Dinophysis, environmental conditions, lipid, lysosome, management, multixenobiotic resistance, okadaic acid, oyster, p-glycoprotein, protein phosphatase