ABSTRACT

Marine sediment systems were chosen as model ecosystems in this thesis since they function as major sinks for organic contaminants introduced in the marine environment. Shallow-water sediment systems are ecologically very important for a wide range of organisms, and they have a high biological activity. These marine sediments are often found in close proximity to humans and are influenced by several anthropogenic activities like increased contaminant and nutrient loadings.
Contaminants are continuously introduced into the environment and this may seriously impact the marine environment, in particular the benthic sediment communities. Eutrophication with inorganic nutrients is another major problem for these areas, and may eventually result in oxygen depletion, increased loading of organic matter and changes in species diversity. Incident of UV-light is also a relevant issue in relation to shallow-water sediment systems, since UV-light directly can affect the benthic sediment organisms, and also enhance the toxicity of compounds by a phenomenon called phototoxicity. As these stressors may occur at the same time, they may also interact with each other and with the marine environment.

The overall aim of this thesis was to use ecologically relevant experiments with natural sediments to study contaminant effects on marine benthic organisms and communities. The use of natural sediment communities with indigenous species ensured that both direct effects on specific organisms and indirect effects on food webs would be described. The more specific aims were to investigate effects of an antifouling compound (copper pyrithione) and a polycyclic aromatic hydrocarbon (PAH) (pyrene) in combination with increased nutrient loading or presence of UV-light.

The studies in this thesis show that interactions definitely occurred, and that the effects of contaminants depended on presence of nutrients and UV-light.
The contaminant/nutrient interactions were rather complex. In general, sediment function was mainly affected in high nutrient treatments, whereas sediment structure was affected in both high and low treatments. The contaminants caused both direct and indirect effects on the sediment community and in some cases these effects were significant several weeks after the initial contaminant application. All groups of benthic organisms, i.e. algae, bacteria, meio- and macrofauna, were affected even though the contaminants only were added once in the beginning of the experiments.
Presence of UV-light increased the toxicity of pyrene to the sediment organisms, and particularly the benthic microalgae were susceptible to phototoxicity. On the other hand, bacteria were insensitive to pyrene and increased their activity in presence of pyrene.
The results from this thesis certainly emphasise the need to consider natural communities and interactions between stressors in future contaminant evaluation and toxicity testing.

Keywords: Ecotoxicology, shallow-water sediments, contaminants, nutrient status, UV-light, ecologically relevant interactions, bacteria, benthic microalgae, meiofauna, macrofauna, nutrient cycling, oxygen, direct and indirect effects.