Biological effects in mussels (*Mytilus sp.*) growing on depth charges in the Gulf of Finland

Aino Ahvo[1], Anu Lastumäki[1], Raisa Turja[1], Jennifer Strehse[2], Edmund Maser[2], Kari K. Lehtonen[1]

[1]Finnish Environment Institute, Marine Research Centre

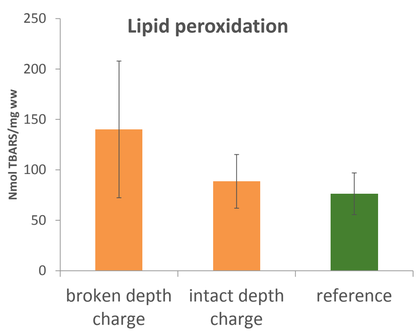
[2]Institute of Toxicology and Pharmacology for Natural Scientists, University Medical School, Schleswig-Holstein, Germany

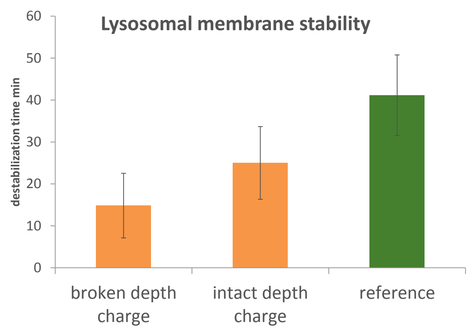
Sample collection was done with help from the Finnish Navy

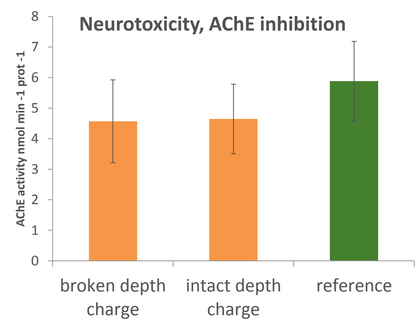
After the world wars, hundreds of tons of conventional munitions (mines, charges and shots) were dumped or left into the Baltic Sea. After 70 years in the sea, the fate of the corroded munitions and explosive chemicals in the marine environment is unknown. In the present study the possible biological effects of deteriorated conventional munitions were evaluated in the Baltic Sea blue mussels (*Mytilus sp.*) living on depth charges on a WW2 wreck in the Gulf of Finland.

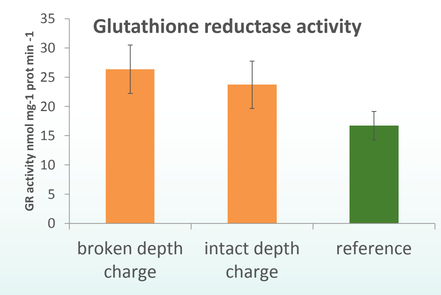
Biomarkers studied	Measure of
Lipid peroxidation	Oxidative damage
Lysosomal membrane stability	General stress
Acetylcholinesterase inhibition	Neurotoxicity
Glutathione reductase activity	Oxidative stress
Catalase activity	Oxidative stress
Glutathione –S-transferase activity	Xenobiotic biotransformation
Integrated Biomarker Response	Calculated combined stress from the above biomarkers

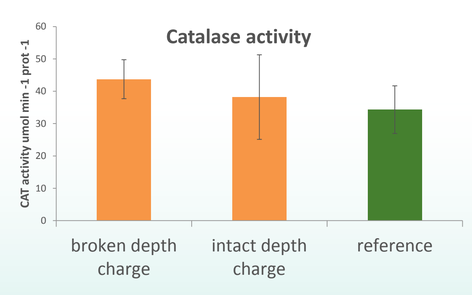
Mussels sampled from the depth charges showed significant differences in acetylcholinesterase, glutathione reductase and catalase activity as well as lysosomal membrane stability and lipid peroxidation compared to the reference mussels.

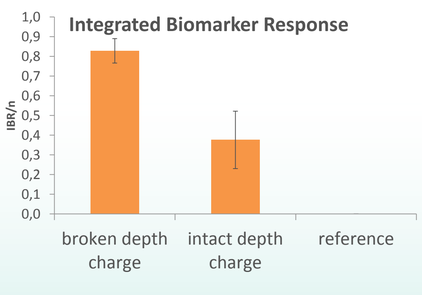












Key observations

- The results of the biomarker analyses show that mussels sampled close to depth charges seem to be experiencing some oxidative stress.
- However, no TNT was found in any of the whole mussel chemical samples.
- Other contaminants, such as iron or polyaromatic hydrocarbons (PAHs), may account for the elevated stress levels seen in the mussels living on top of the depth charges.

Sample	TNT µg/kg	Fe mg/kg	Ni mg/kg	Cu mg/kg	Pb mg/kg	Σ22PAH µg/kg
mussels near depth charges	n.d.	64	0,41	1,8	0,06	77,51
reference mussels	n.d.	30	0,29	1,4	0,06	31,72

Results of chemical analysis of mussel tissue of the concentration of TNT and derivatives, selected metals and PAHs per fresh weight of mussel tissue. N.d. = not detected.

Metals and PAHs were measured in the Finnish Environment Institute Laboratory Centre. The PAHs measured: 1-methylnaphtalene, 2-methylnaphtalene, anthracene, acenaphthene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(e)pyrene, benzo(ghi)perylene, benzo(k)fluoranthene, dibenzo(ah)anthracene, dibenzotiophene, phenanthrene, fluoranthene, fluorene, indeno(123cd)pyrene, chrysene, naphthalene, perylene, pyrene, triphenylene