

DAIMON Toolbox Fact Sheets:

Methods to Study the Impact of Dumped Munitions on Marine Biota

Assessment category 3: Biological effects

Toolbox component: Disease/Pathology

Fact Sheet 3.20: Lipidosis – pathological accumulation of neutral lipids in bivalves (NL)

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What is it?

Lipidosis is a pathological accumulation of neutral lipids in molluscan cells of the digestive gland or fish liver cells.

What does it tell you?

An enhanced occurrence of neutral lipids, either within the lysosomes or in the cytoplasm, indicates a lipid storage disorder (lipidosis). Cytoplasmic lipid accumulation may as well be a sign of induced apoptosis (Boren & Brindle, 2012). In contrast to an increased lipofuscin content, which constitutes a more general stress response, neutral lipid accumulation appears to be more strictly linked to the pollution with organic chemicals (Moore et al., 1988; Livingstone & Pipe, 1992).

Type of Indicator (tick box)

- non-specific stress indicator
- specific for groups of contaminants incl. CWA or explosives
- CWA-specific indicator
- specific for substances related to explosives (e.g. TNT)

How to measure it?

Species: Neutral lipids can be measured in mussel and fish

Matrix: Fish liver tissue, mussel digestive gland tissue

Equipment: cryostat; equipment for the preparation of cryo-histological slides and stainings; microscope equipped with camera (for details refer to Brenner et al. 2014).

Measurements and units: Cryo-sections of the target tissue are prepared and treated according to a protocol leading to the visualization of a defined staining reaction within the measured tissue. Slides are photographed through a microscope and evaluated according to maximum staining reaction. Neutral lipid accumulation is displayed in relation to the area investigated [area %].

Sample size: Measurements are made from at least 15-20 individual specimens from each study site/treatment.

How to analyse and assess the data?

Tissue sections with high staining intensity covering better parts of the investigated cell volumes are regarded as more effected and might have been more in contact with organic pollutants than tissues of individuals with lower concentrations of neutral lipids in their tissues. Assessment criteria for neutral lipid accumulations have not been developed yet. Results of the neutral lipid assessment in mussels should be used for internal comparison of the study results only.

References

- Boren, J., & Brindle, K. M. (2012). Apoptosis-induced mitochondrial dysfunction causes cytoplasmic lipid droplet formation. *Cell death and differentiation*, 19(9), 1561–1570
- Brenner, M., Broeg, K., Frickenhaus, S., Buck, B.H. and Koehler, A. (2014). Multi-Biomarker approach using the blue mussel (*Mytilus edulis* L.) to assess the quality of marine environments: Impacts of habitat structure and season, *Marine Environmental Research*, 95, pp. 13-27
- Livingstone, David R., & Pipe, Richard K. (1992). Mussels and environmental contaminants: molecular and cellular aspects. Pages 425–464 of: Gosling, Elizabeth (ed), *The Mussel Mytilus: Ecology, Physiology, Genetics and Culture*. Development in Aquaculture and Fisheries Science. Amsterdam, London, New York, Tokyo: Elsevier
- Moore, M. N., Pipe, R. K., & Farrar, S. V. (1988). Induction of lysosomal lipid accumulation and fatty degeneration by polycyclic aromatic hydrocarbons in molluscan digestive cells. *Marine Environmental Research*, 252–253