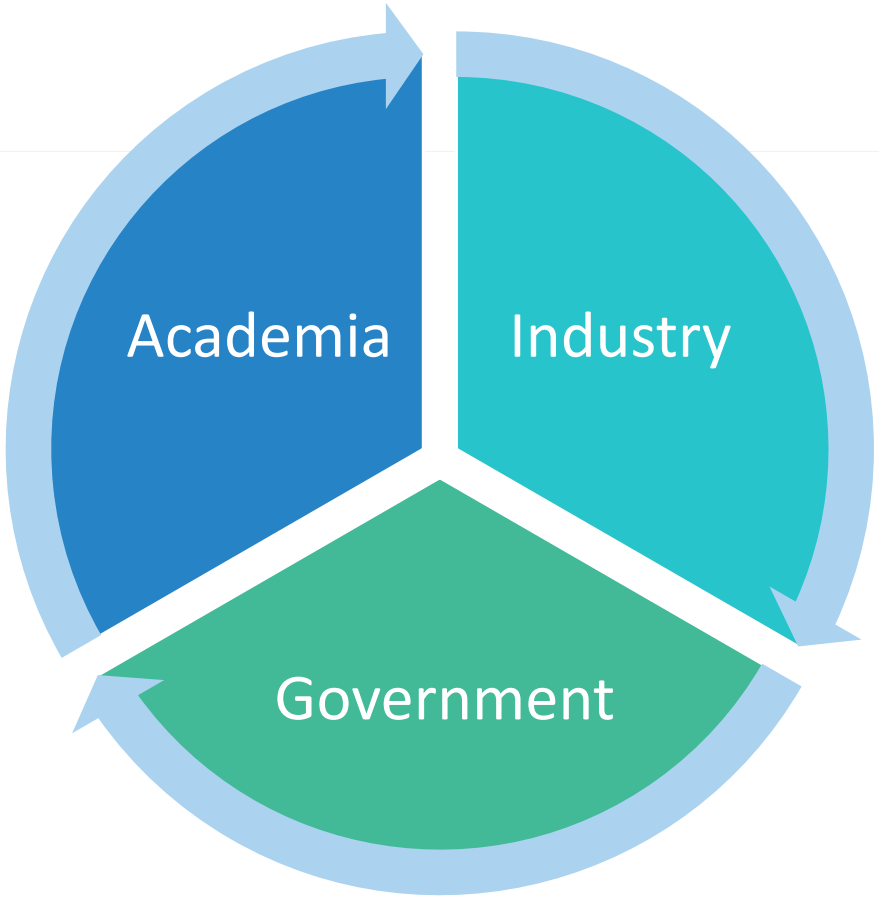
From zooplankton to ecosystem effects: is rapid oil spill assessment possible?

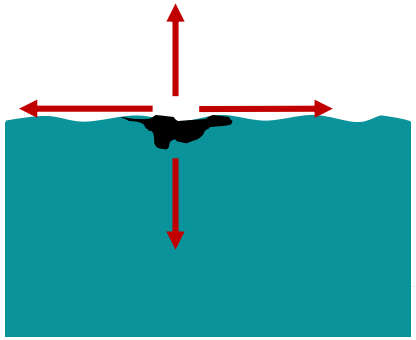
KATHERINE COLVIN

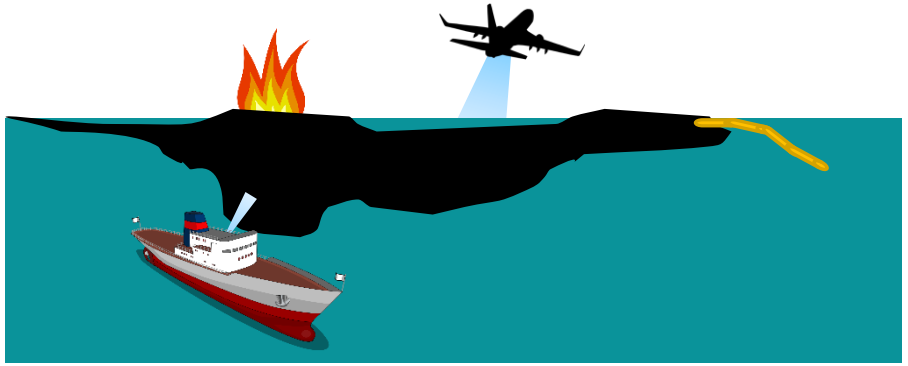
UNIVERSITY OF EXETER

A rapid assessment toolkit to monitor the ecotoxicological impact of oil spills


Academia
Industry
Government

Why rapidly?



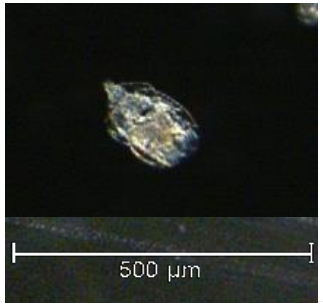


Why assess?

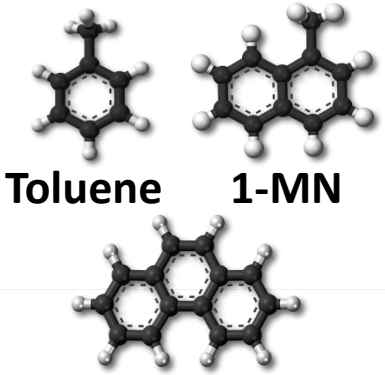
Are commercially available toxkits effective indicators of oil spill toxicity?

Methodology

Brine Shrimp
Artemia franciscana



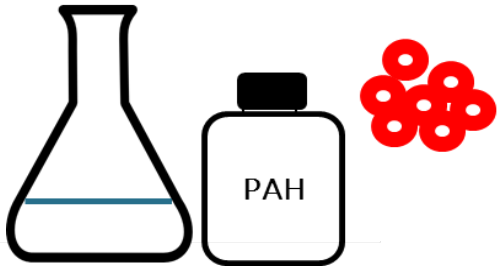
Rotifer
Branchionus plicatilis



Toluene **1-MN**

Phenanthrene

1



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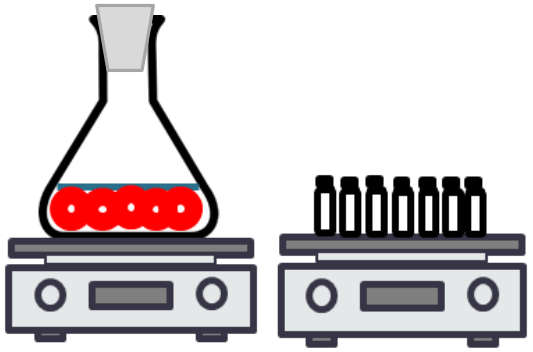

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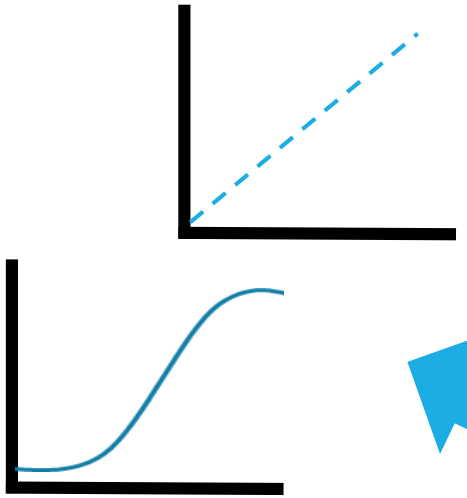
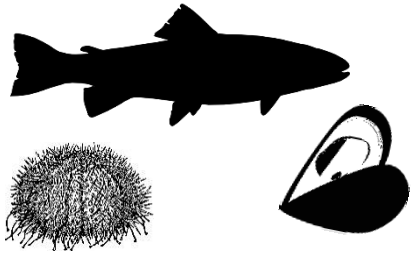
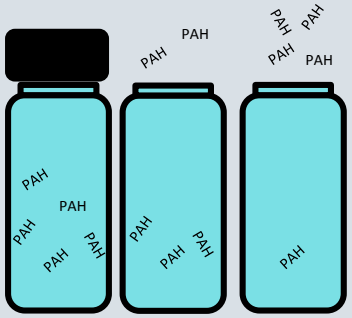
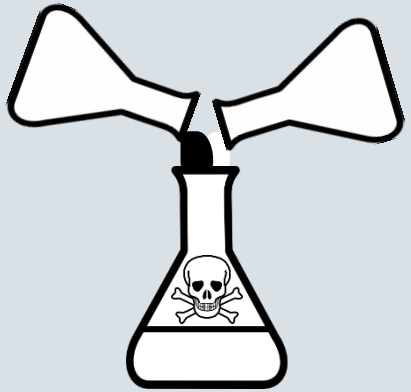




Typical issues with PAH toxicity studies





Chemical Concentrations

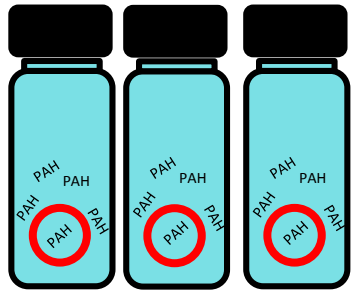
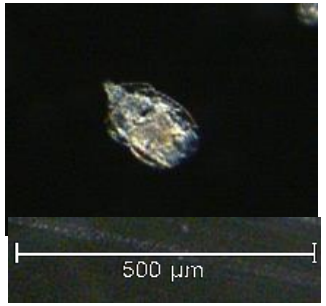


Figure 2: Measured compared to nominal exposure concentrations of 1-methylnaphthalene (A and B), toluene (C) and phenanthrene (D) at 0 and 24 hours (±2) after dosing Brine Shrimp (*Artemia franciscana*)(A), Marine Rotifer (*Branchionus plicatilis*)(B) or, both (C and D) ± SD. The 1:1 predicted line shows the agreement between the nominal and observed concentrations (N=3).

Organism Sensitivity

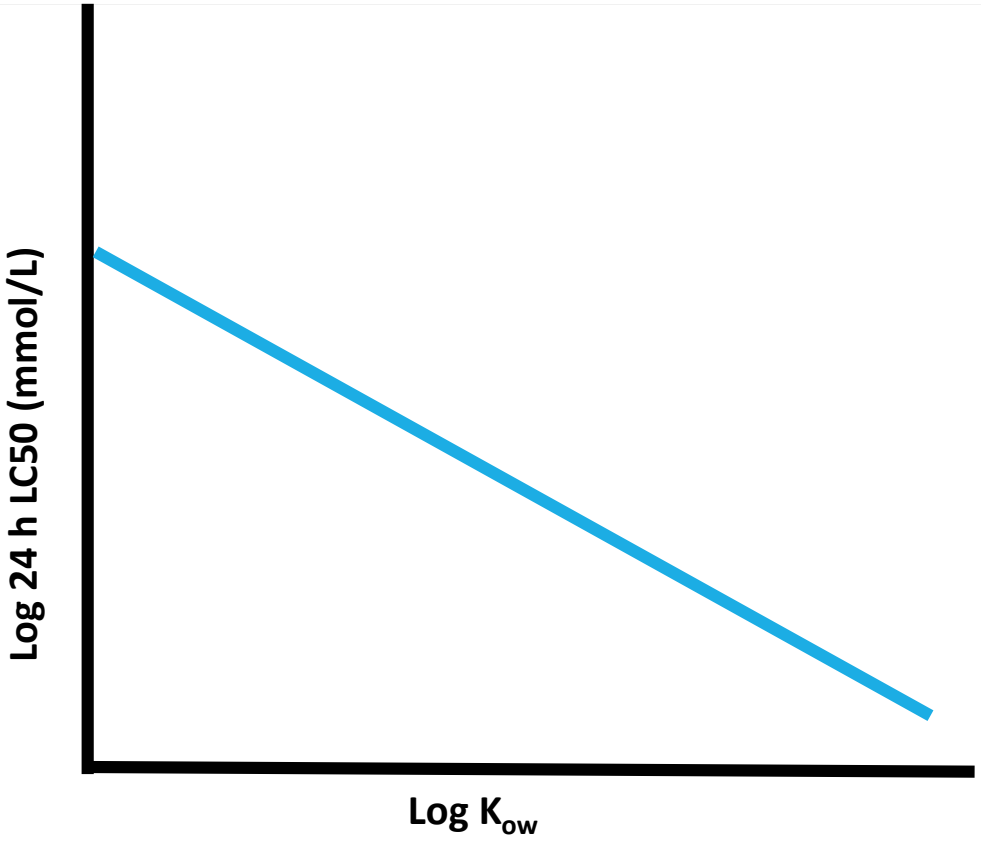
Brine Shrimp
Artemia franciscana



Rotifer
Branchionus plicatilis

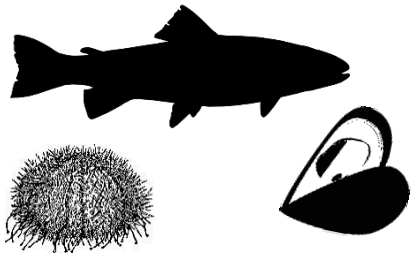
Figure 3: Effect of A) toluene, B) 1-methylnaphthalene and C) phenanthrene on Brine Shrimp (*Artemia* franciscana) and D) toluene and E) 1-methylnaphthalene on Marine Rotifer (*Branchionus plictalis*) survival rate after 24 h exposure ± SE (Artemia n=10, Rotifer n=5).

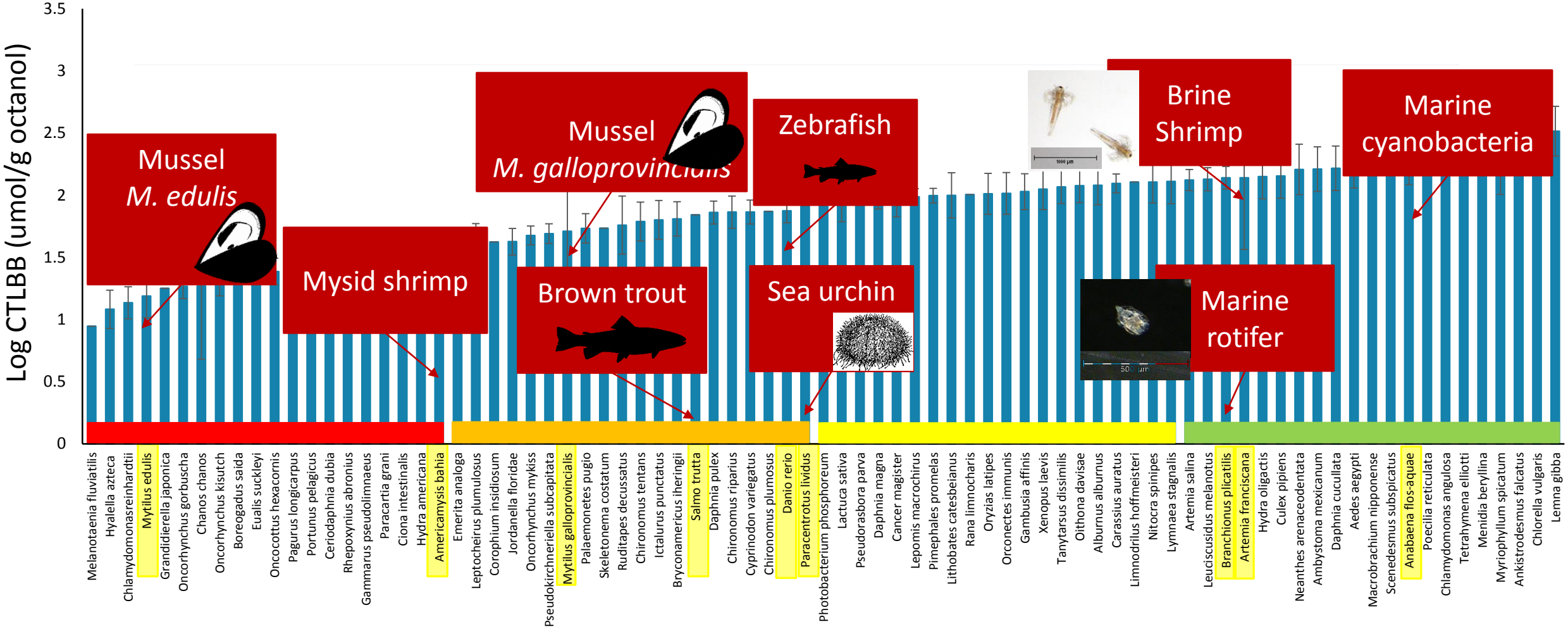
Target Lipid Model



McGrath et al., 2018

Comparative Sensitivity



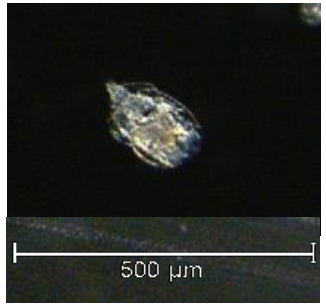


Most Sensitive

Least Sensitive

Predicted oil toxicity

Brine Shrimp
Artemia franciscana



Rotifer
Branchionus plicatilis

+

Alaska North Slope

+

PETROTOX

=

50 % mortality of Brine Shrimp

…µg/L

50 % mortality of Rotifer

…µg/L

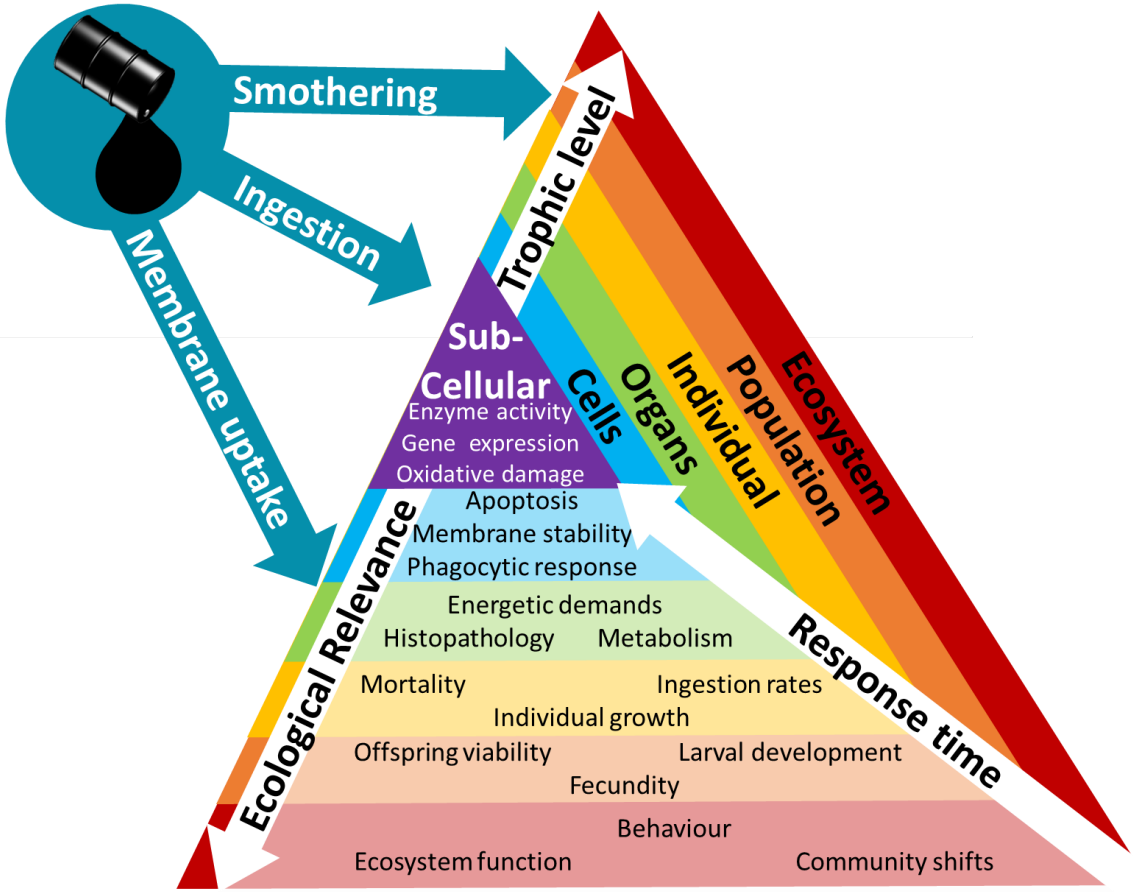
Conclusions

Accurate dosing is possible in 5 mL vials

More sensitive species should be tested

Unlikely to detect toxicity at environmentally relevant concentrations

Niehus et al., 2018



Future Perspectives

Does PETROTOX accurately predict oil toxicity?

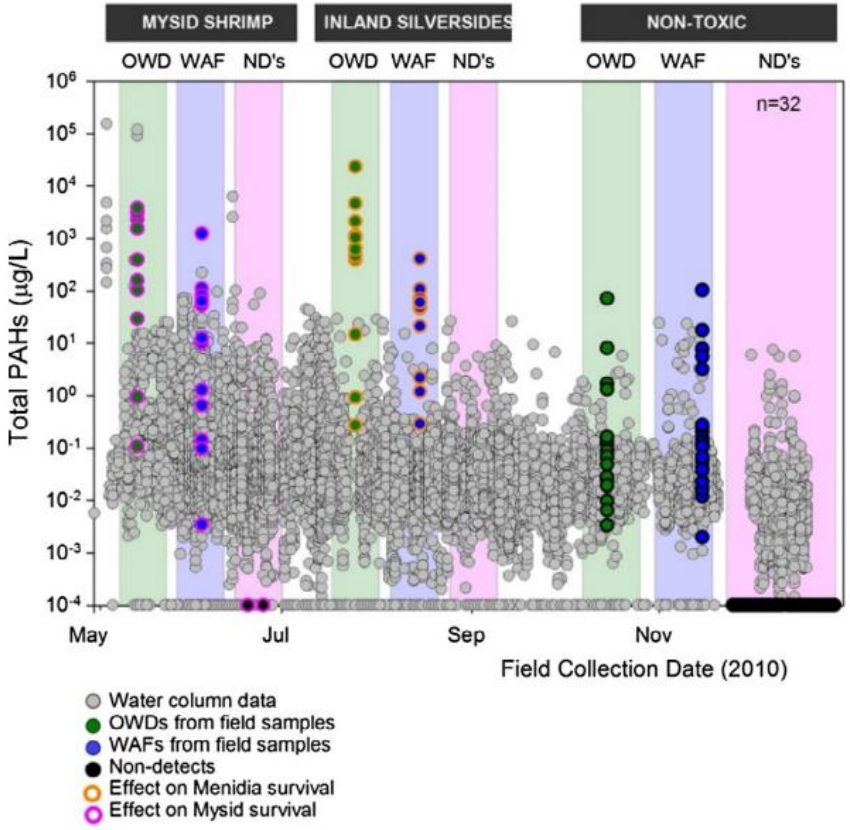
Can sublethal indicators accurately predict toxicity?

Conclusions

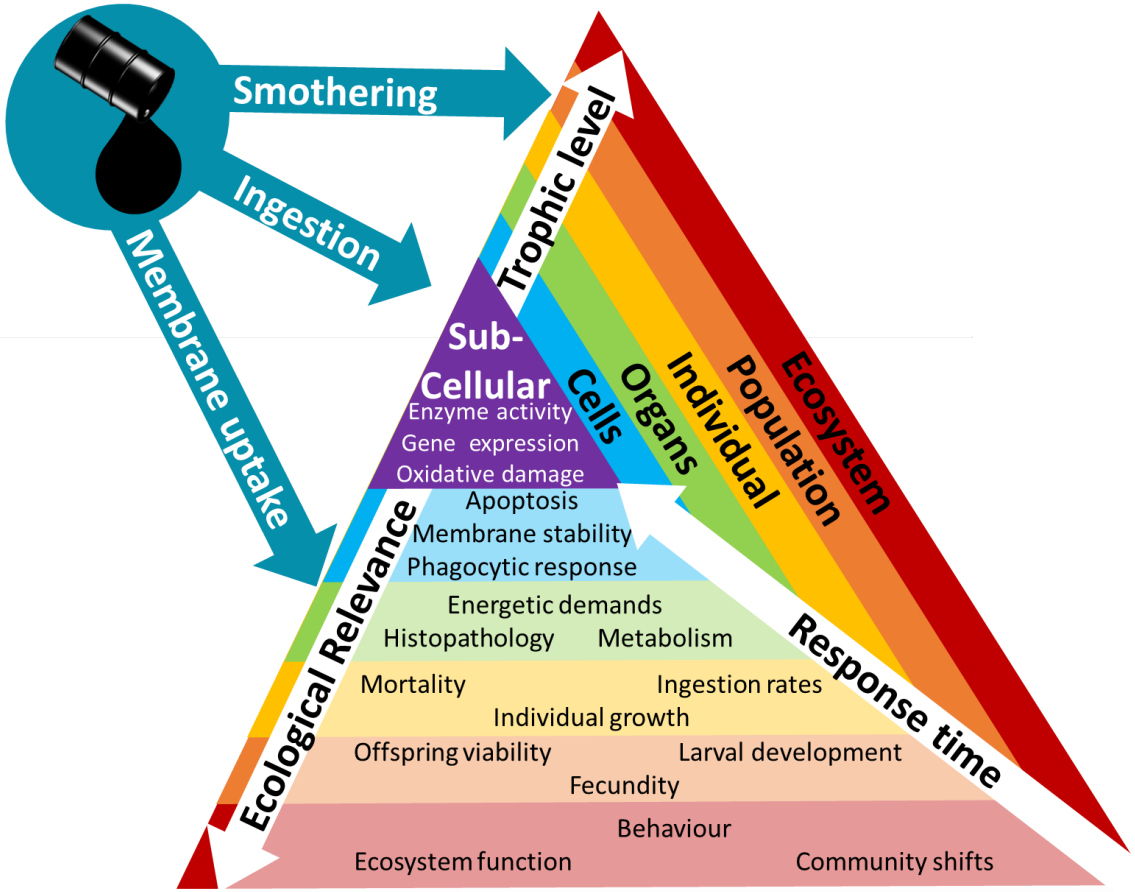
Accurate dosing is possible in 5 mL vials

More sensitive species should be tested

Unlikely to detect toxicity at environmentally relevant concentrations



Echols et al., 2015



Future Perspectives

Does PETROTOX accurately predict oil toxicity?

Can sublethal indicators accurately predict toxicity?

Thank you!
Any Questions?

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Concawe
Environmental Science for European Refining

Oil Spill Response

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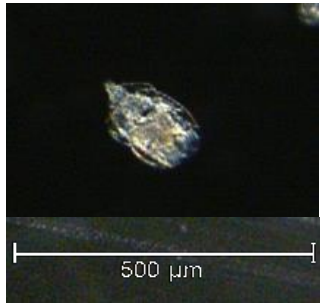
Sensitivity to WAF, CEWAF, Dispersant and PD oil

Brine Shrimp
Artemia franciscana



Rotifer
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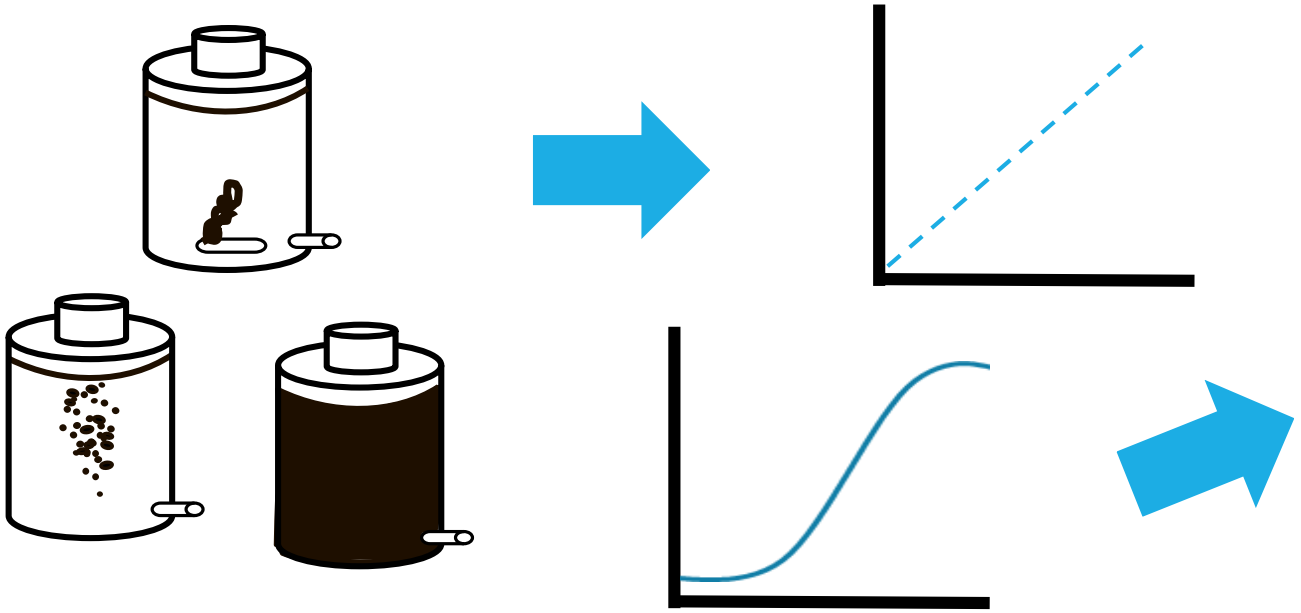
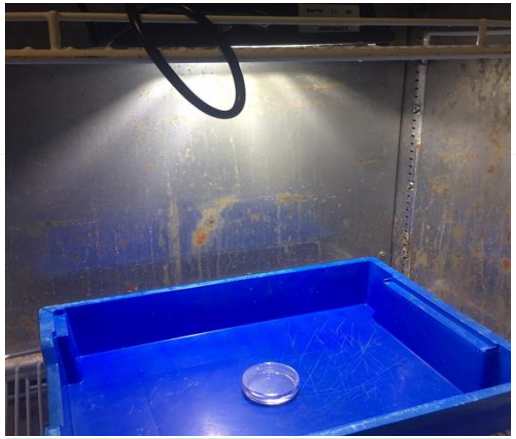


PETROTOX

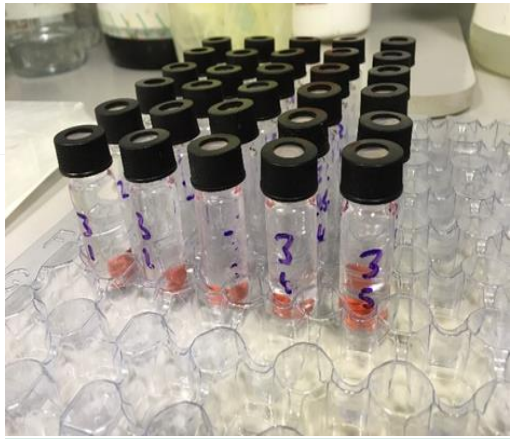
Ecotoxicological tests

Dosing

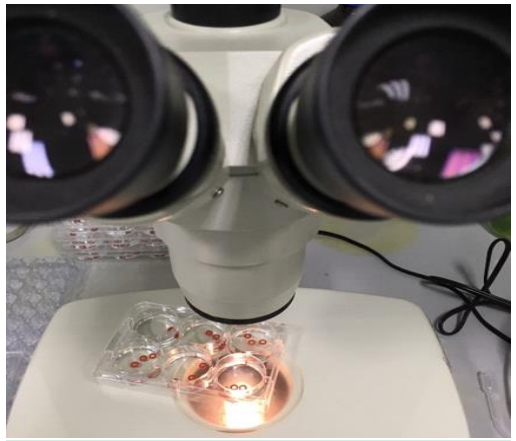
Equilibration



Hatching



Exposure

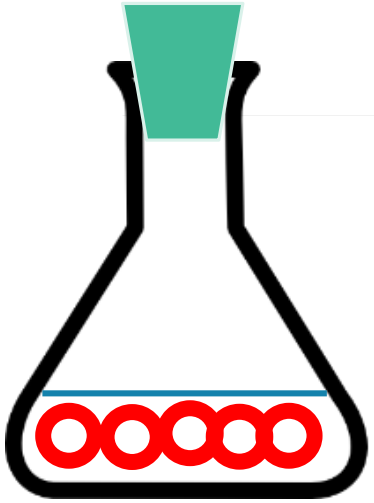


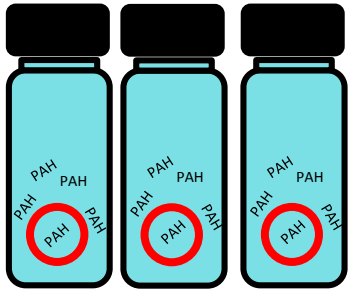
Counting

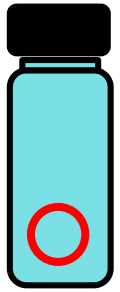
Sample Preparation

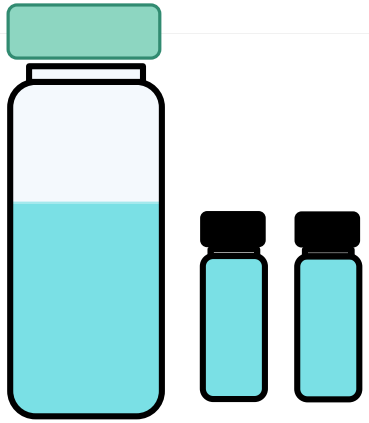
Chemical Analysis

Overcoming Loss









Systems sealed: with Teflon lined cap or foil covered bung

More O-rings: compensate for some loss during exposure

No headspace: to prevent volatilisation within the system

Samples prepared for chemistry immediately