Dr Rob Holland, Technical Lead

Oil Spill Response

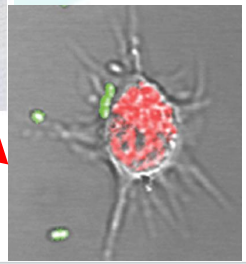
Bridging research to response
Impact assessment research

Why and how are we doing this?

- Building new and growing existing links to research groups
- Using our scientific credibility and networks
- Common interests and overlap
  - Autonomous systems & sensor development
  - **Environmental impacts / ecotoxicology**
  - Dispersant chemistry
  - Spill modelling / metocean datasets
- OSRL Members undertaking similar activity – sharing knowledge
- Disseminating and sharing
  - ITAC, Interspill….
- **Success stories**
  - MSc internships (various)
  - NERC funded NOC-OSRL AUV research
  - University of Exeter PhD studentship……

University of Exeter

- Ecotoxicology research group with internationally recognised expertise and facilities
- Scoped using oil industry expertise through Concawe's Biological Effects Measures group (STF-32)
- Shell, ExxonMobil, BP, Chevron…..
- OSRL providing spill response application and context
- CEFAS also providing expertise support – detection and quantification of contaminants
- Funded via Concawe, Exeter & OSRL for 4 years from September 2017-2021



A rapid assessment toolkit for predicting the ecological impacts of spilled oil

To combine for the first time critical evaluation of state of the art diagnostic tools of expected environmentally relevant exposure concentration with sublethal toxicity assessment, with a view to developing a toolkit that can support an integrative framework for guiding oil spill monitoring and response.

Research objectives

- Evaluate the performance of state-of-the-art diagnostic toxicology tools for hydrocarbons to evaluate their use assessing hazard of oil contaminated samples
- Evaluate the relative sensitivity of standard marine toxicity tests (e.g. OSPAR guidelines) and additional commercially available *in-vivo* and *in-vitro* portable kits (including bacterial and mammalian luciferase reporter assays for specific oil components), using representative oil-derived hydrocarbons and dispersants.
- Laboratory studies to evaluate the performance of novel, passive sampling technologies
- Exposure to dissolved and/or bioavailable hydrocarbons will be modelled according to the OSCAR model along with methods for calculating critical body burdens (e.g. TLM; Target Lipid Model), and extraction methods designed to provide surrogate measures of the bioavailable fraction of the oil.

Further information

- Two page summary document available
- Conferences
  - Interspill 2018 - submitted
  - IOSC, ITAC, GOMRI etc
  - SETAC, PRIMO
- University of Exeter = Kat Colvin (attending)
- Concawe = Markus Hjort (attending)

PhD project outline: A rapid assessment toolkit for assessing the ecological impacts of spilled oil

UNIVERSITY OF EXETER

Supervisors: Professor Tamara Galloway and Dr Ceri Lewis, University of Exeter, Dr Rob Holland, Oil Spill Response Limited (https://www.oilspillresponse.com/)

Project partners: Concawe (industry technical governance; https://www.concawe.eu/)

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Start date September 2017, duration 4 years.

Background: Multiple accidental oil releases occur each year, each presenting a unique challenge on a global/regional scale for marine life and ecosystem services[1]. Regulatory and management decisions following a spill need to be made rapidly, combining multi-agency co-ordination and emergency planning with powerful diagnostic tools of exposure, bioavailability and biological effects to guide rapid response and inform remediation[2].

Not all oil spills are the same. Oil spill response may be hampered by a lack of basin-specific knowledge of how a particular diagnostic toolkit can be used to predict ecological impact. Oil is a complex and dynamically changing mixture of chemicals and spilled oil can, depending on its category, rapidly contaminate vast water bodies. The use of dispersants, when appropriate, can increase the temporary bioavailability of oil components, i.e the fraction taken up into tissues and able to interact with biological targets. Even when dispersants cannot be used oil will undergo transformations on composition (weathering), and will still be subjected to the surrounding conditions that affect how and where it is transported, as well as how it mobilizes in the water column and/or other environmental compartments[3]. The interactions of all these will determine how the resulting oil will behave. The sensitivity of exposed animals is further influenced by variations in uptake, detoxification and response[4]. Addressing these issues requires enhanced knowledge of the sensitivity and performance of individual diagnostic tests, combined with a deeper fundamental understanding of the factors influencing bioavailability and biological effects.

Aim: To combine for the first time critical evaluation of state of the art diagnostic tools of expected environmentally relevant exposure concentration with sublethal toxicity assessment, with a view to devloping a toolkit that can support an integrative framework for guiding oil spill monitoring and response (and complementary to Net Environmental Benefit Analysis (NEBA) and Spill Impact Mitigation Analysis (SIMA)).

Hypothesis: *The toxicity of spilled oil on target species can impact populations due to the potential effects on survival, growth and reproduction. This impact may be predicted from the measured concentration and bioavailability of key hydrocarbon components in the water column using a toolkit of state of the art diagnostic toxicity tools.*

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