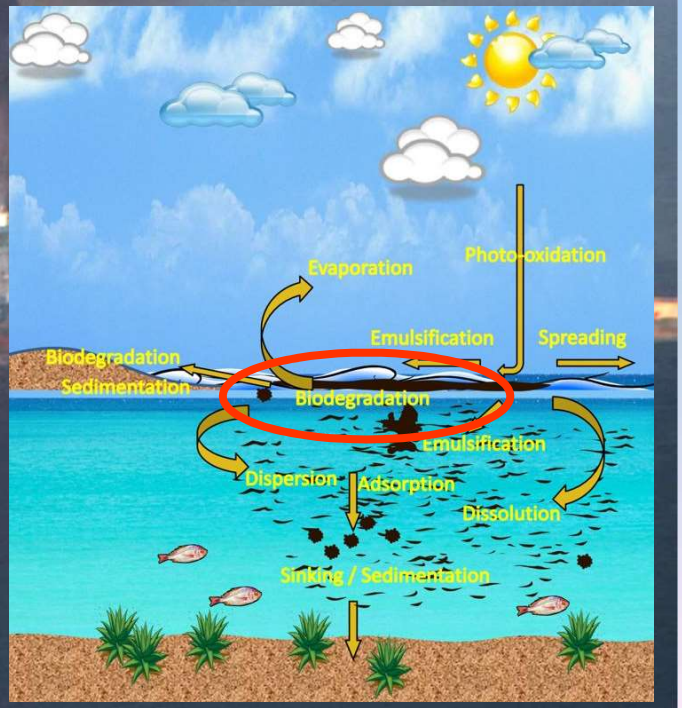
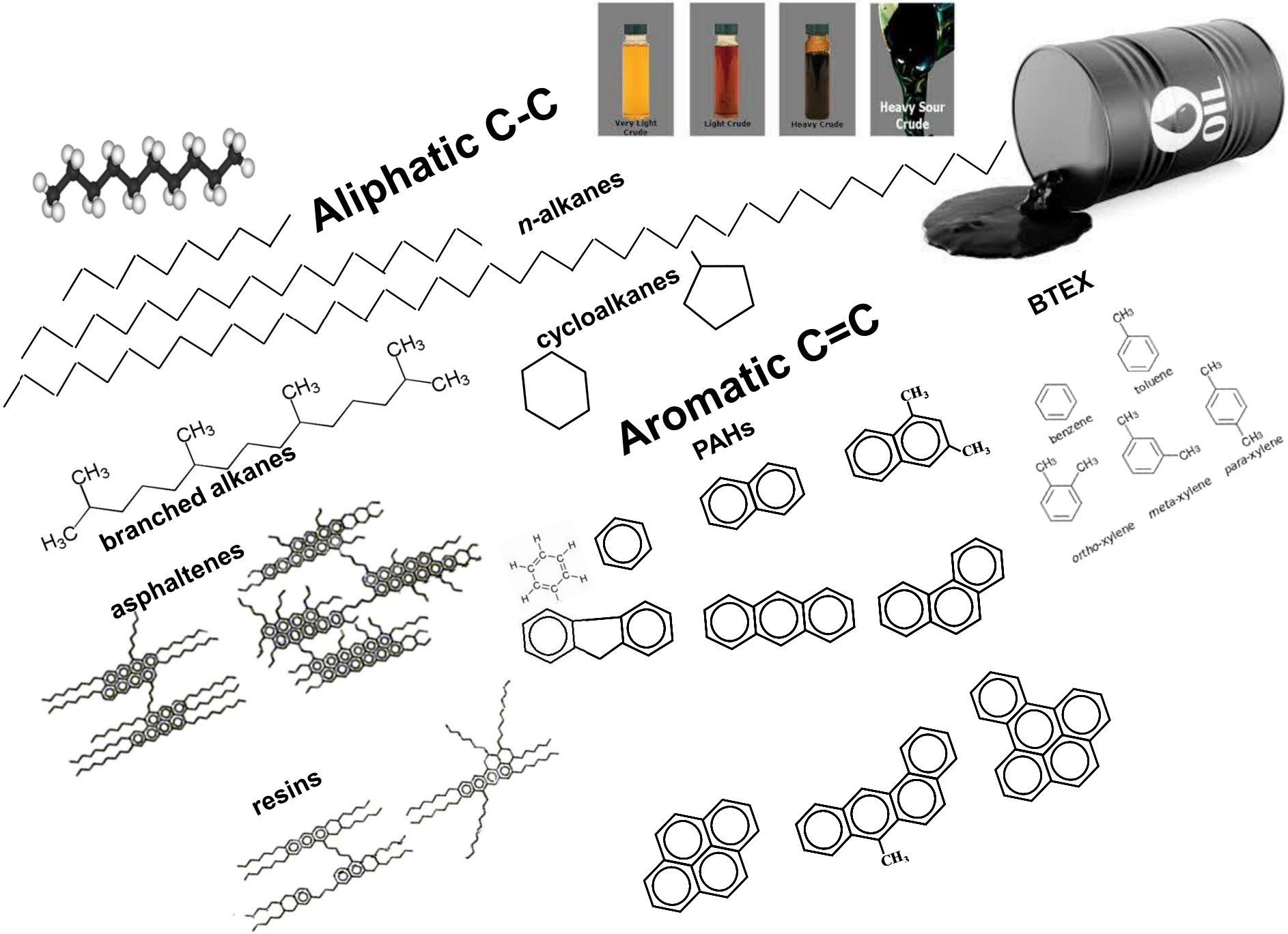
Biodegradation of Oil by Marine Hydrocarbon-Degrading Bacteria



Boyd McKew

boyd.mckew@essex.ac.uk

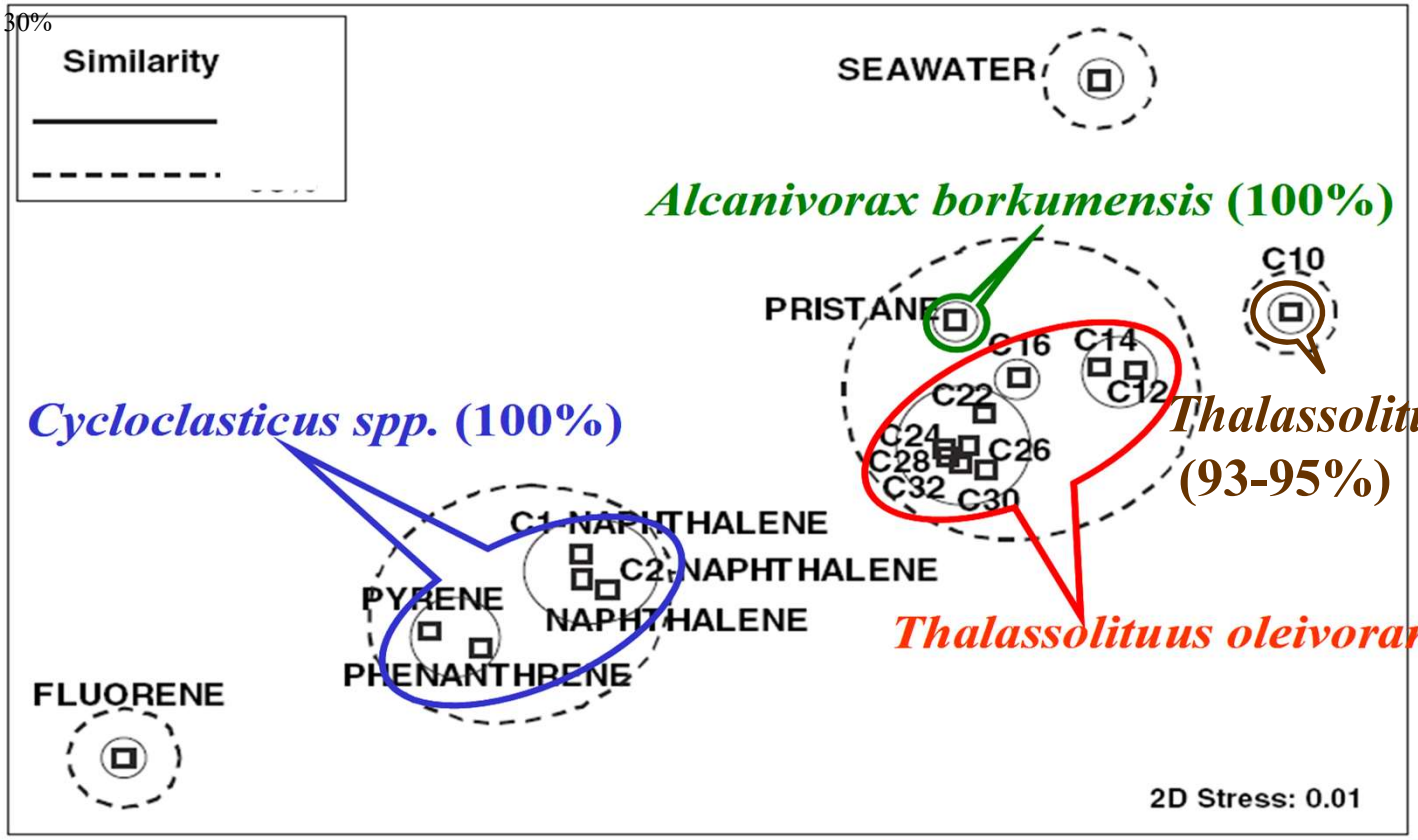

Very Light Crude
Light Crude
Heavy Crude
Heavy Sour Crude
OIL
Aliphatic C-C
n-alkanes
cycloalkanes
branched alkanes
CH3
H3C
Aromatic C=C
PAHs
BTEX
benzene
toluene
ortho-xylene
meta-xylene
para-xylene
asphaltenes
resins

Environmental Microbiology (2007) 9(1), 165–176 doi:10.1111/j.1462-2920.2006.01125.x

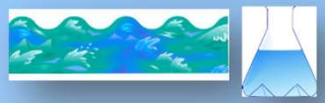
Determining the identity and roles of oil-metabolizing marine bacteria from the Thames estuary, UK

Boyd A. McKew,[1*] Frédéric Coulon,[1]
A. Mark Osborn,[2] Kenneth N. Timmis[3] and
Terry J. McGenity[1]

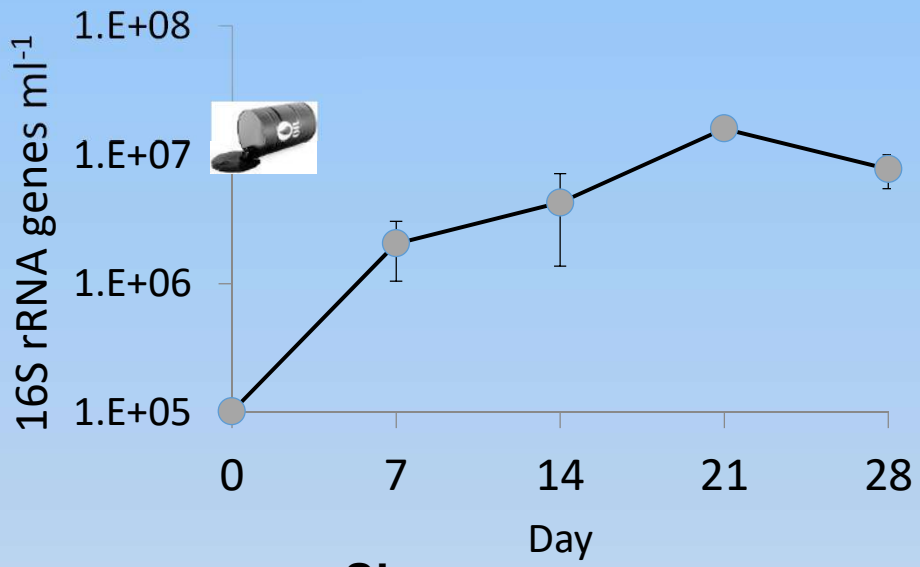
enriched microcosms. The communities in *n*-decane microcosms differed from those in microcosms supplemented with less volatile alkanes, with a phy-



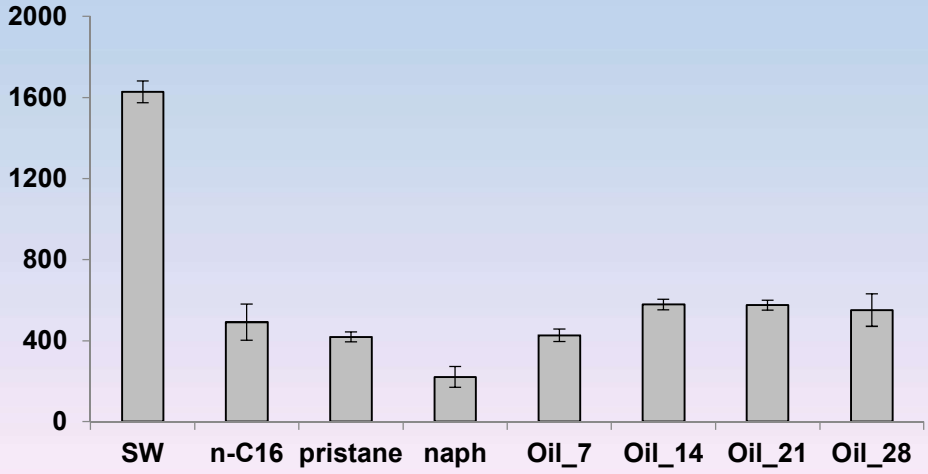
Succession of an oil degrading community?



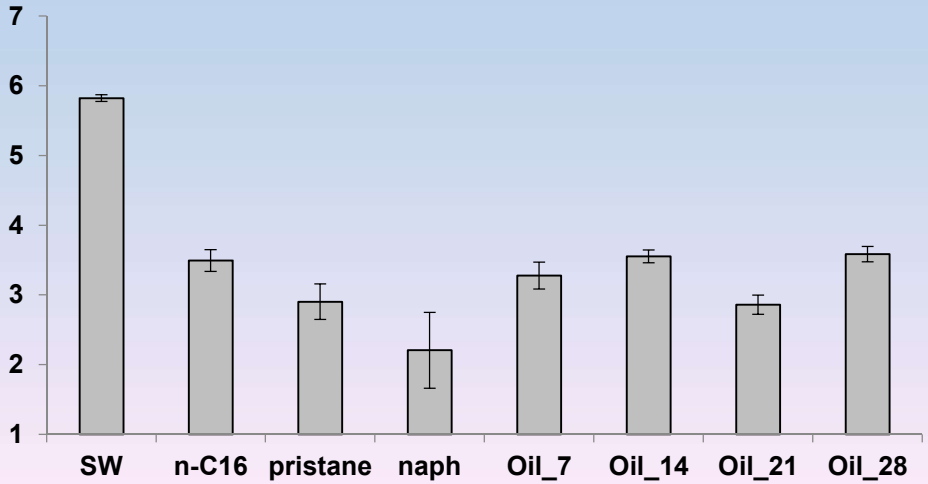
Time

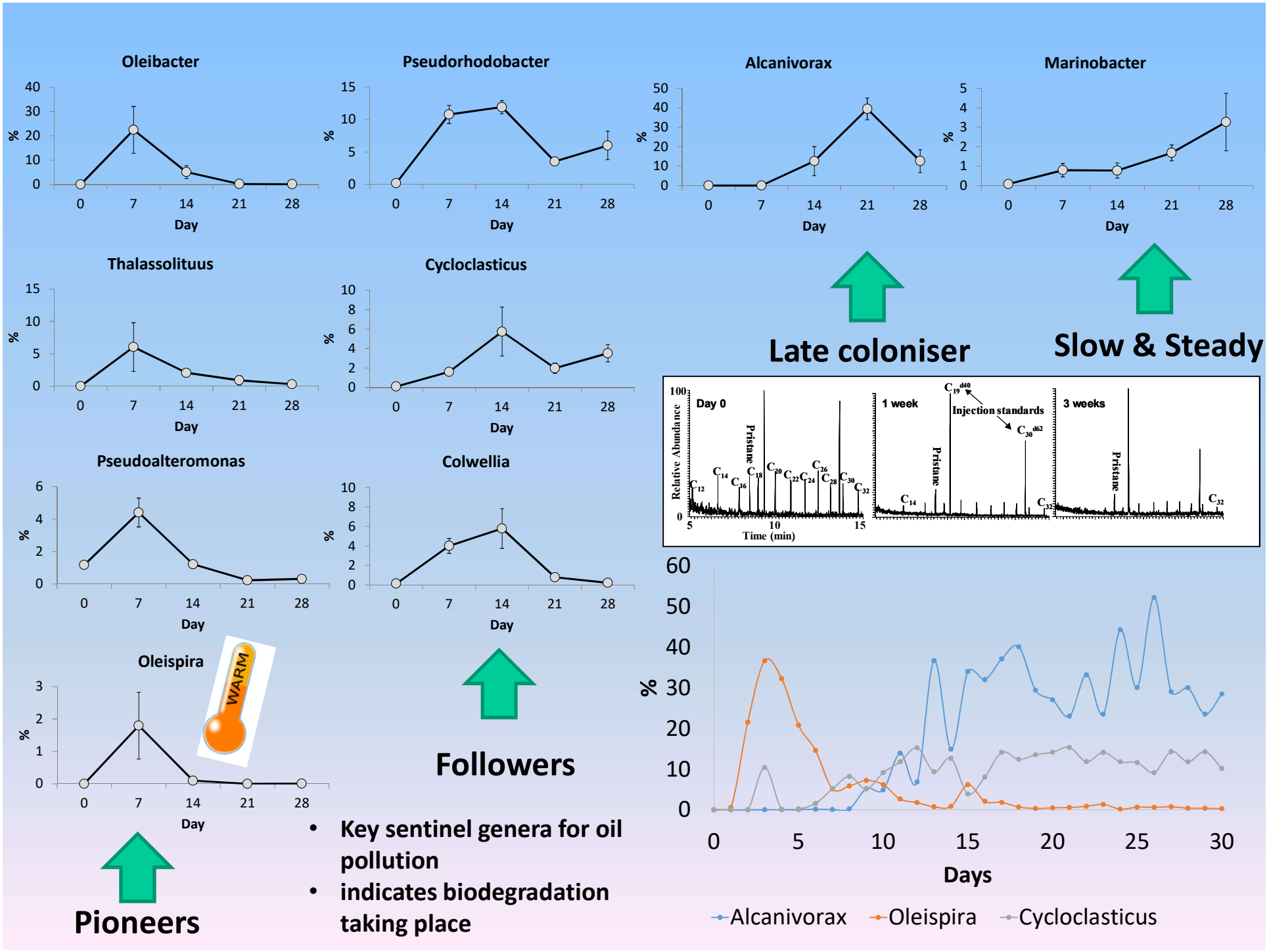


otuRichness

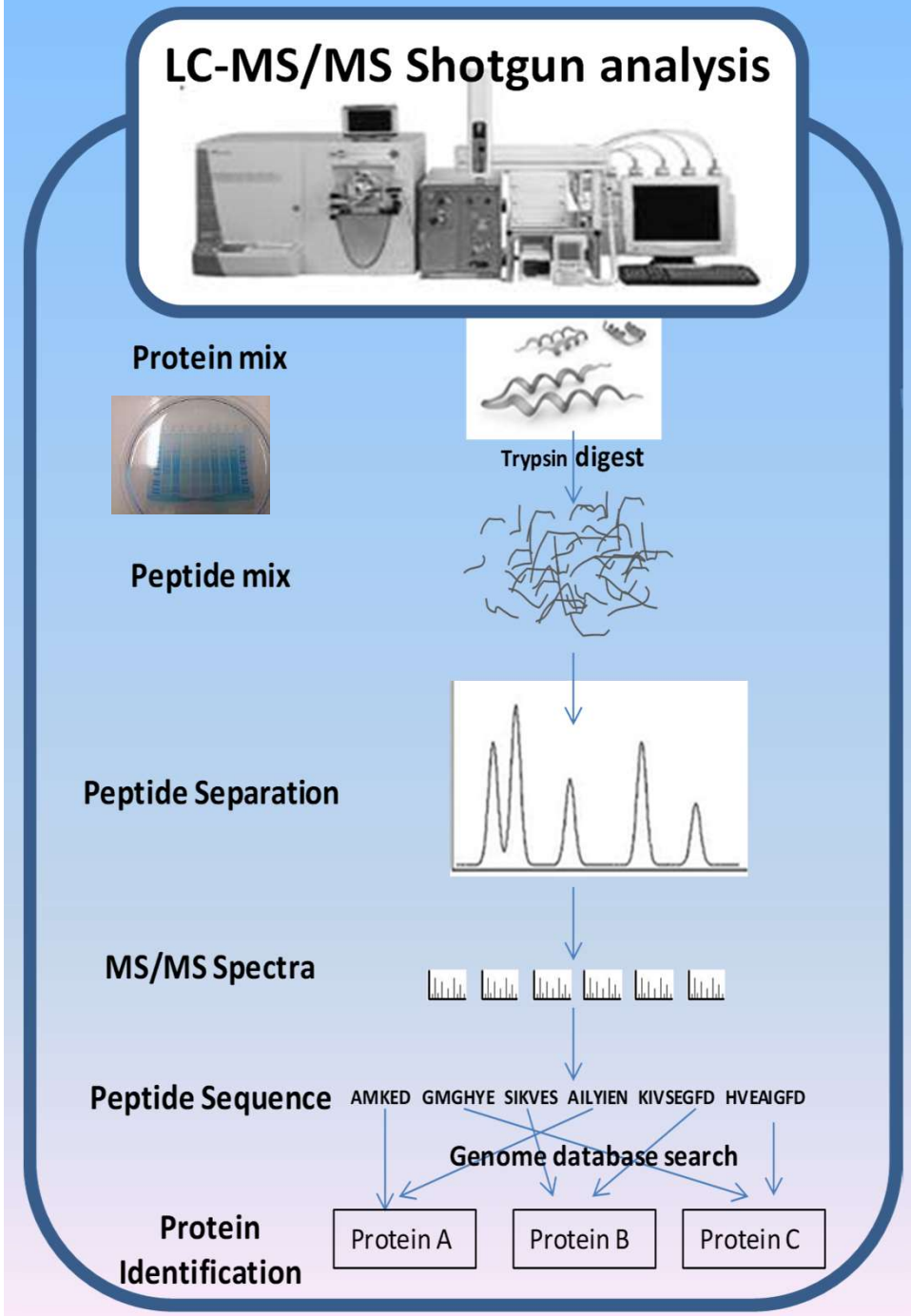


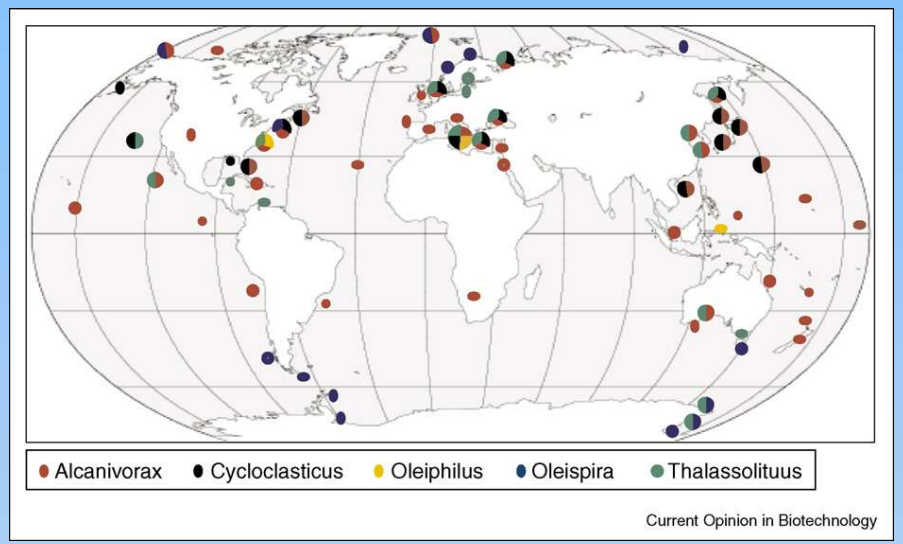
Shannon





- Key sentinel genera for oil pollution
- indicates biodegradation taking place





Genome sequenced

- Proteins – functional units of the cell – most closely related to an organisms phenotype
- Simultaneous expression data for 1000s of proteins

frontiers in Microbiology

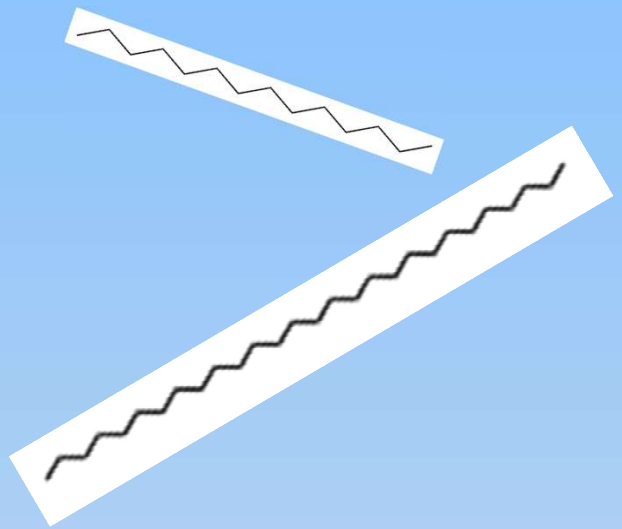
ORIGINAL RESEARCH
published: 1/ December 2018
doi: 10.3389/fmicb.2018.00130

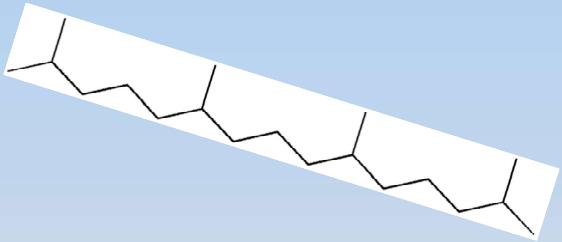
Differential Protein Expression During Growth on Medium Versus Long-Chain Alkanes in the Obligate Marine Hydrocarbon-Degrading Bacterium *Thalassolituus oleivorans* MIL-1

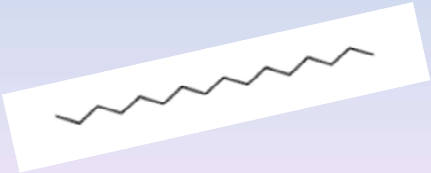
OPEN ACCESS

Edited by:
Jean Armengaud

Benjamin H. Gregson[1], Gergana Metodieva[1], Metodi V. Metodiev[1], Peter N. Golyshin[2,3] and Boyd A. McKew[1]**







environmental microbiology

sfam

Environmental Microbiology (2019) **00**(00), 00–00

doi:10.1111/1462-2920.14620

Differential protein expression during growth on linear versus branched alkanes in the obligate marine hydrocarbon-degrading bacterium *Alcanivorax borkumensis* SK2^T

Benjamin H. Gregson, Gergana Metodieva, Metodi V. Metodiev and Boyd A. McKew*
School of Biological Sciences, University of Essex, Colchester, Essex, CO4 3SQ, UK.

Introduction

A. borkumensis SK2^T is a model strain of a group of organisms known as obligate hydrocarbonoclastic bacteria (OHCB) which grow on a highly restricted spectrum of

CASE PhD (Gareth Thomas)

- Experimental & in situ oil spills
- Efficacy & effects of Dispersants on…
  - Hydrocarbon degradation
  - Succession of oil-degrading community

Biosurfactants (rhamnolipid, sophorolipid, trehaloselipid) & chemical surfactants (Superdispersant 25, Slickgone NS, Finasol OSR52)

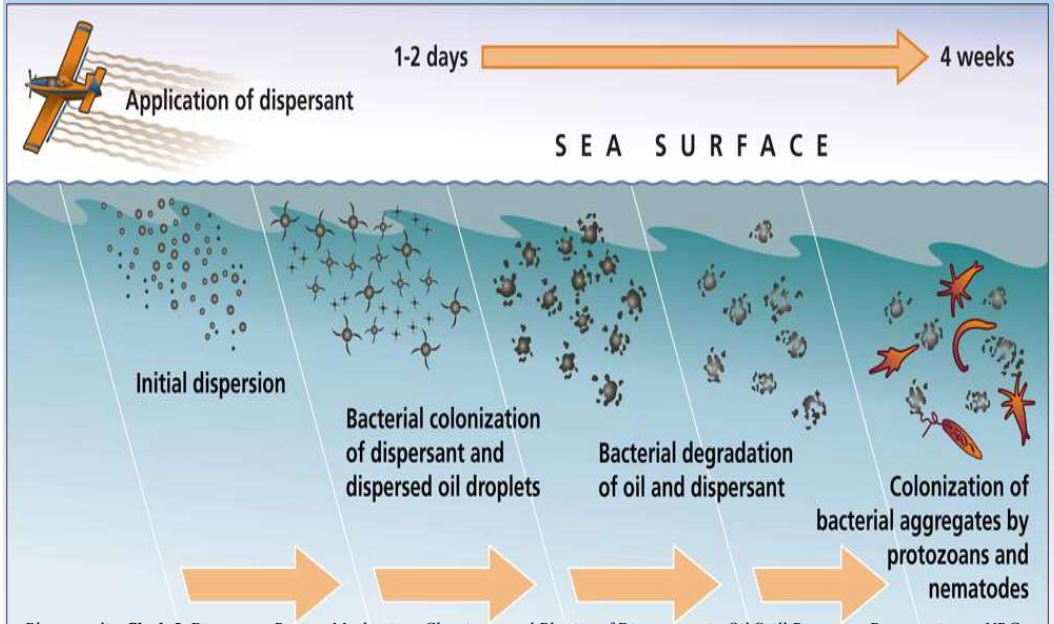
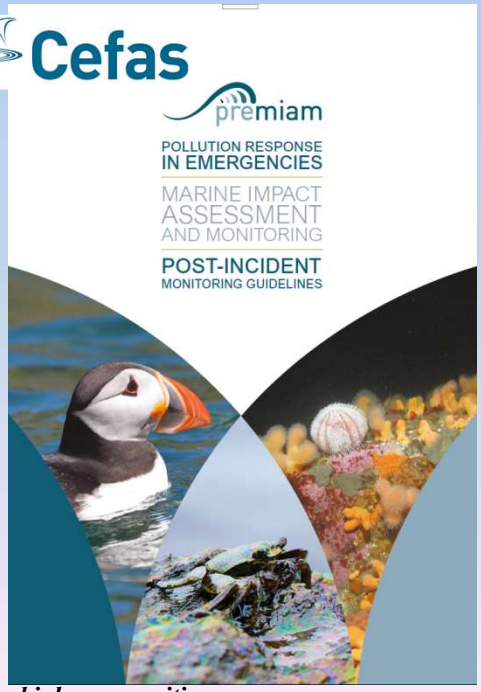


*Photo credit: **Clark J**. Dispersant Basics: Mechanism, Chemistry, and Physics of Dispersants in Oil Spill Response. Presentation to NRC Committee on Understanding Oil Spill Dispersants: Efficacy and Effects, 15 March 2004.*

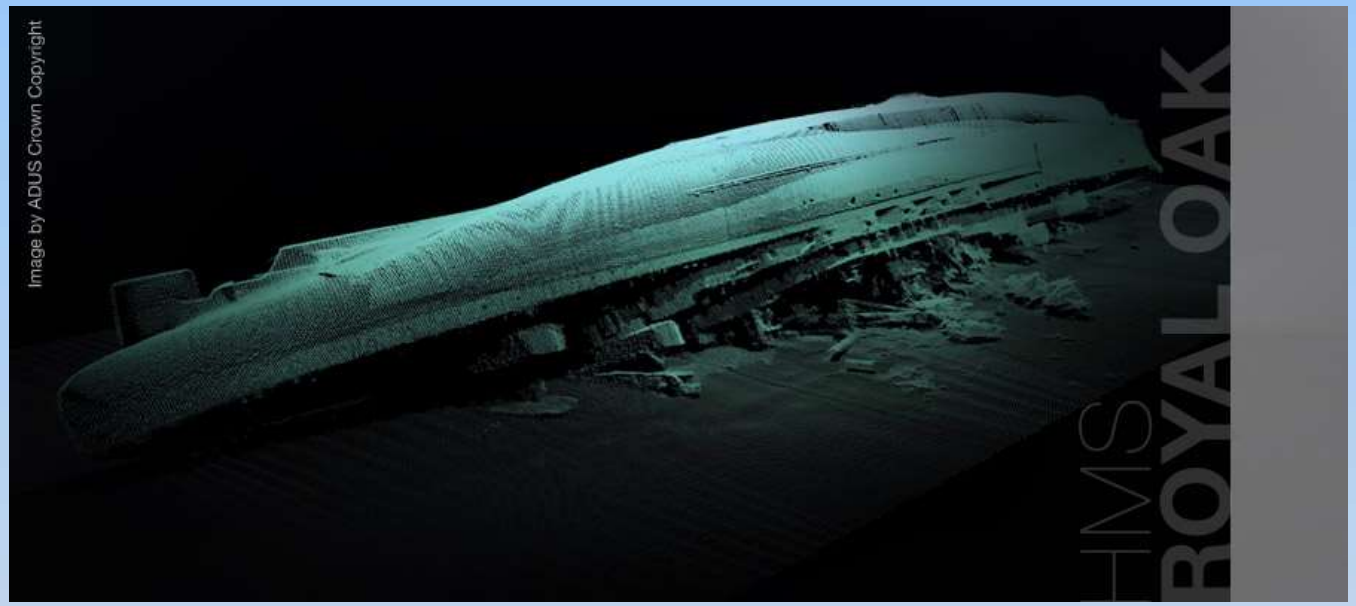
Agia Zoni II Spill (Sept 2017)

- Post spill monitoring of sediment bacterial communities
- See Talk by Gareth Thomas !



Microbial communities:
Monitoring microbes affected by marine oil spills

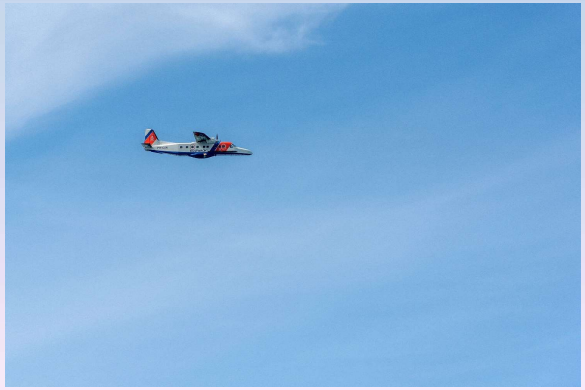
Oil from sunken wrecks ?

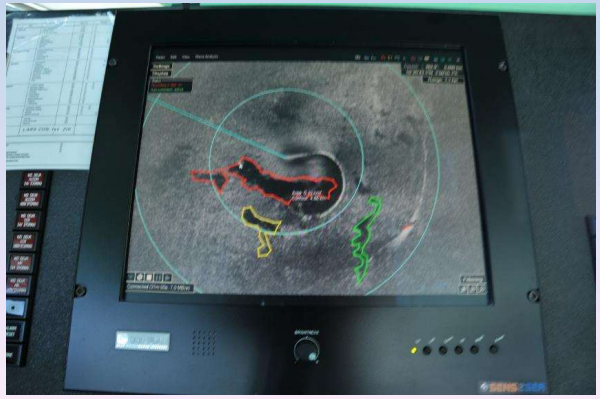


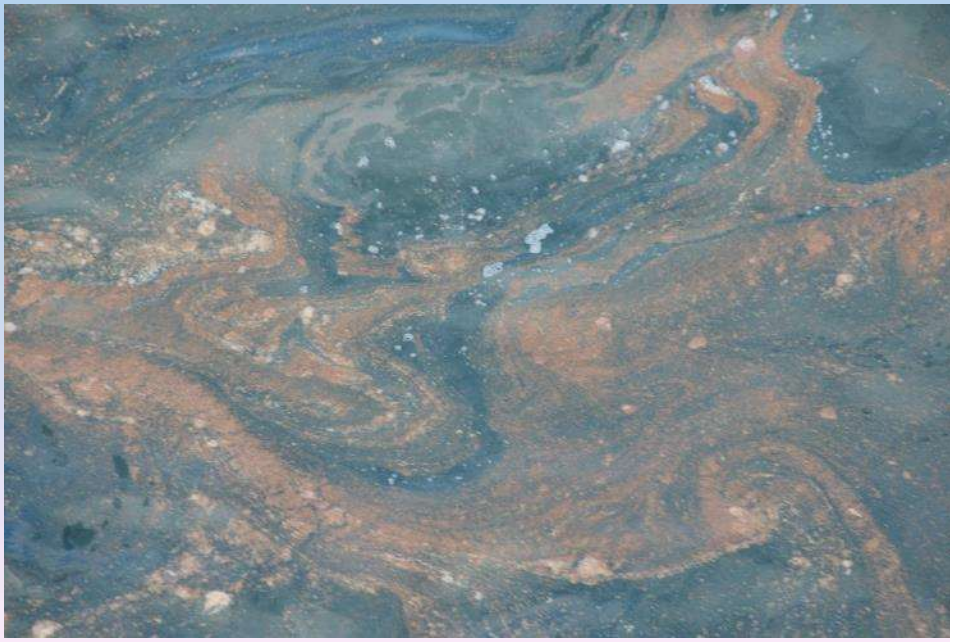
- ❑Torpedoed 80 years ago
- ❑Still leaks fuel oil today

ExpOS'D (ITOPF 2018 R&D Award)

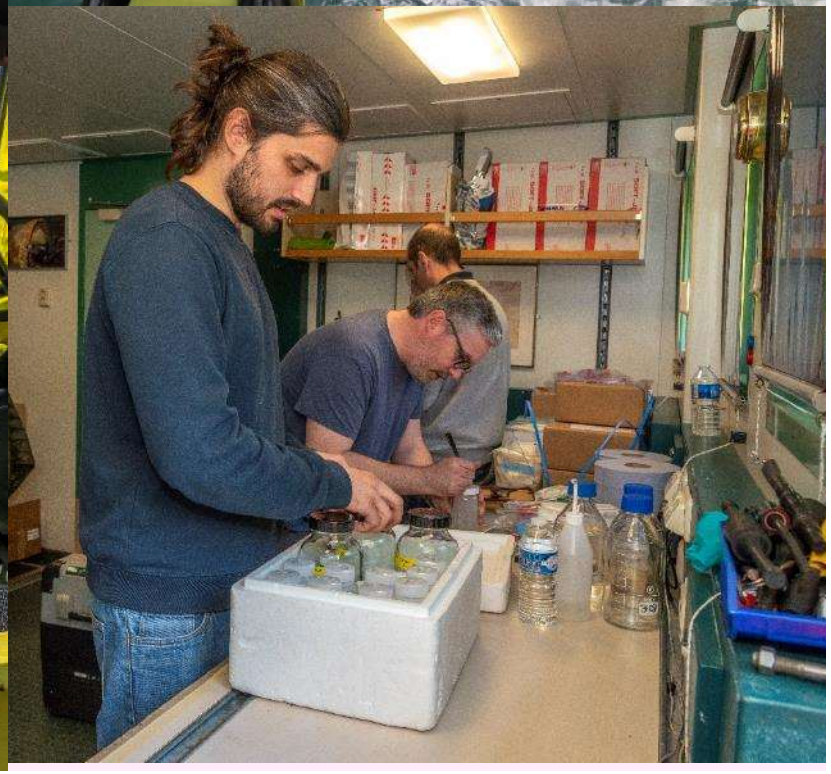
- Light/Medium Arabian Crude
- 5.3 tonnes (3 slicks)
- Dasic Slickgone NS dispersant
- April 2019







ARCA



New PhD (Oct 2020)

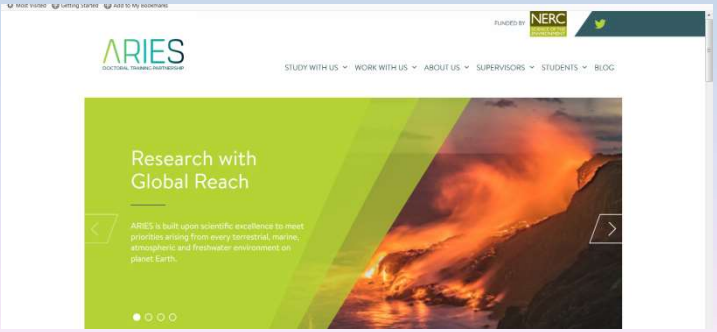
University Essex (Boyd McKew & Terry McGenity) and OSRL (Rob Holland)

University of Essex

Oil Spill Response

Effects of dispersants on mitigating environmental impacts of marine oil pollution: insights from microbiological, chemical and field investigations

NERC SCIENCE OF THE ENVIRONMENT



www.aries-dtp.ac.uk

Marine Oil Snow

Acknowledgments

Gareth Thomas, Ben Gregson, Peter Golyshin, Marieke Zeinstra, Corinne Whitby, Terry McGenity

University of Essex

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