
Industry Technical Advisory Committee

Analytical and toxicological studies of oil

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Torrey Canyon Oil Company, founded in 1889, merged with Hardison & Stewart Oil Company and Sespe Oil Company in 1890 to form Union Oil (Unocal). Nearly 50 wells drilled in the Torrey Canyon field 1889-1890 and 42 still pumping by 1917. (Source: *Geology and Oil Resources of a Part of Los Angeles and ...*, Issues 753-755 by William Stephen & Webster Kew, Washington, Government Publishing Office, 1924).



Where is Torrey Canyon oil now?

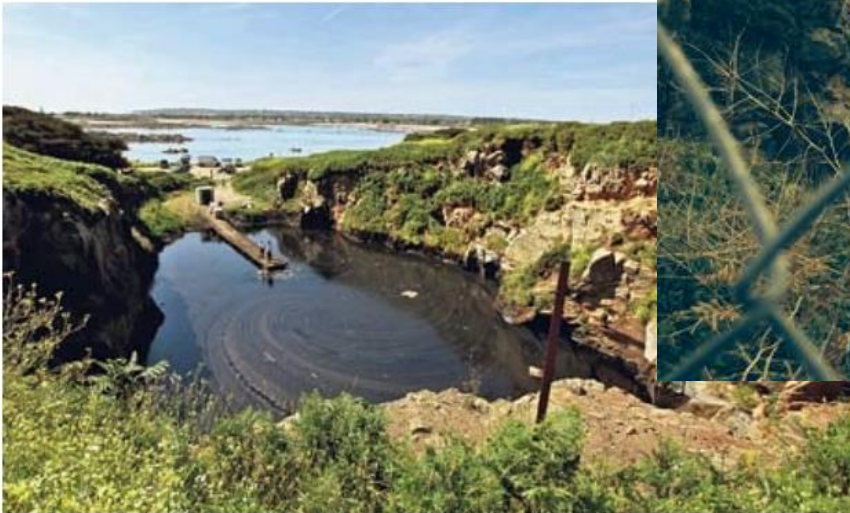


Photo: Graeme Robertson for The Guardian



September 2016

Photo: @julian_may



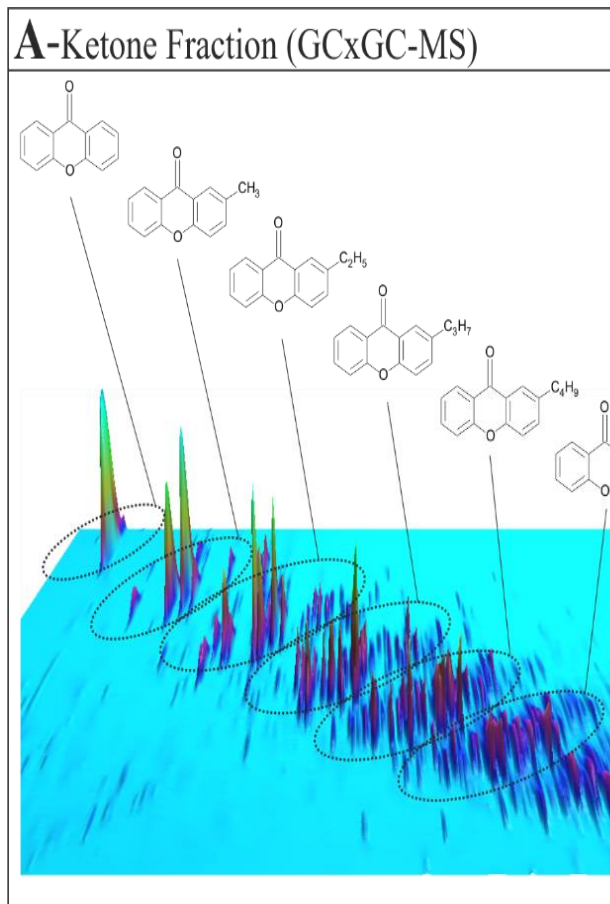
Cornwall April 2017

Photos: Prof. M. Attrill

Toxic oil residues: a needle in a haystack?



Compositional Investigation of Fractions



analytical
chemistry

Article

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Class Type Separation of the Polar and Apolar Components of Petroleum

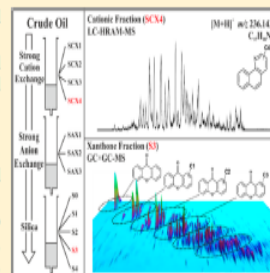
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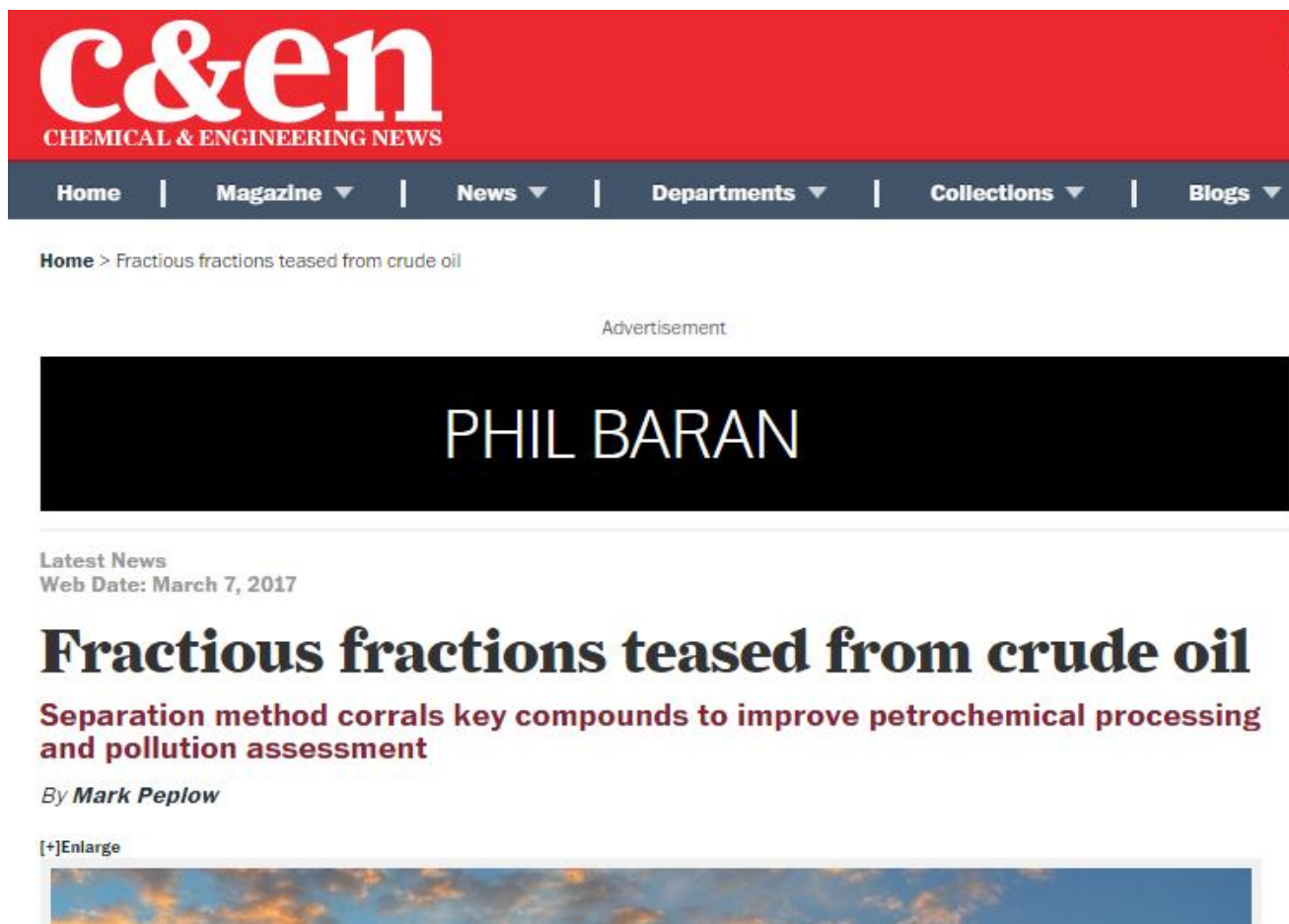
Supporting Information

ABSTRACT: Identification of the heteroatom (nitrogen, sulfur, and oxygen)-containing compounds of petroleum is of key importance when considering industrial and environmental issues associated with crude oil production. The more commonly performed methods of crude oil fractionation are often insufficient in the extent to which they separate oils, not allowing defined "molecular" fractions to be obtained. Methods capable of performing a class type separation are uncommon and are often extensive and resource and time intensive. Here we report a method for the separation of crude oils into discrete compound classes. The method utilizes both ion exchange and normal phase chromatography to generate fractions of saturated hydrocarbons, aromatic hydrocarbons, basic compounds, naphthenic acids, and other oxygen-containing species, carbazoles, sulfoxes, and thiophenes from small crude oil samples (~0.5



g). Assessment of method selectivity with a suite of model compounds has shown the fractions to be well-defined, with classes of model compounds isolated within discrete fractions. Application of the method to five crude oils of varying API gravity (12.1–38.3°) demonstrates a potential for wide-ranging use. Sample recoveries were high (77–98%) with simple evaporative losses correlating closely with total sample loss. Repeatability was also high, demonstrated by triplicate analyses of model compound mixtures, oils spiked with model compounds and oils alone. Separation selectivity was further demonstrated by application of the scheme to the Alaska North Slope (ANS) crude oil and analysis of fractions by comprehensive two-dimensional gas-chromatography mass-spectrometry (GC × GC/MS) and/or liquid-chromatography high-resolution accurate-mass spectrometry methods (LC-HRAM-MS). Isolation of discrete fractions then allowed excellent separation (by LC and GC methods) of carbazole, dibenzothiophene, fluorenones, xanthenes, and quinoline fractions. Individual parent and C_{1–5} alkyl homologues were easily separated (GC × GC/MS), allowing high-quality mass spectra (EI) to be obtained for the individual compounds in many cases. Analysis of fractions by GC × GC/MS also allowed a series of thioxanones to be identified.

Our research in the news!



The screenshot shows the top portion of a news article on the Chemical & Engineering News (C&EN) website. At the top is the C&EN logo in white on a red background, with the text 'CHEMICAL & ENGINEERING NEWS' below it. A dark blue navigation bar contains links for 'Home', 'Magazine', 'News', 'Departments', 'Collections', and 'Blogs'. Below the navigation bar, a breadcrumb trail reads 'Home > Fractious fractions teased from crude oil'. An advertisement placeholder is shown with the text 'Advertisement' and a large black box containing the name 'PHIL BARAN' in white. Below the ad, the article's metadata is displayed: 'Latest News' and 'Web Date: March 7, 2017'. The main headline is 'Fractious fractions teased from crude oil' in a large, bold, black font. Below the headline is a sub-headline in a smaller, bold, black font: 'Separation method corrals key compounds to improve petrochemical processing and pollution assessment'. The author's name is listed as 'By Mark Peplow'. At the bottom of the article preview, there is a small image of a sunset over a body of water and a link that says '[+]Enlarge'.

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Fractious fractions teased from crude oil

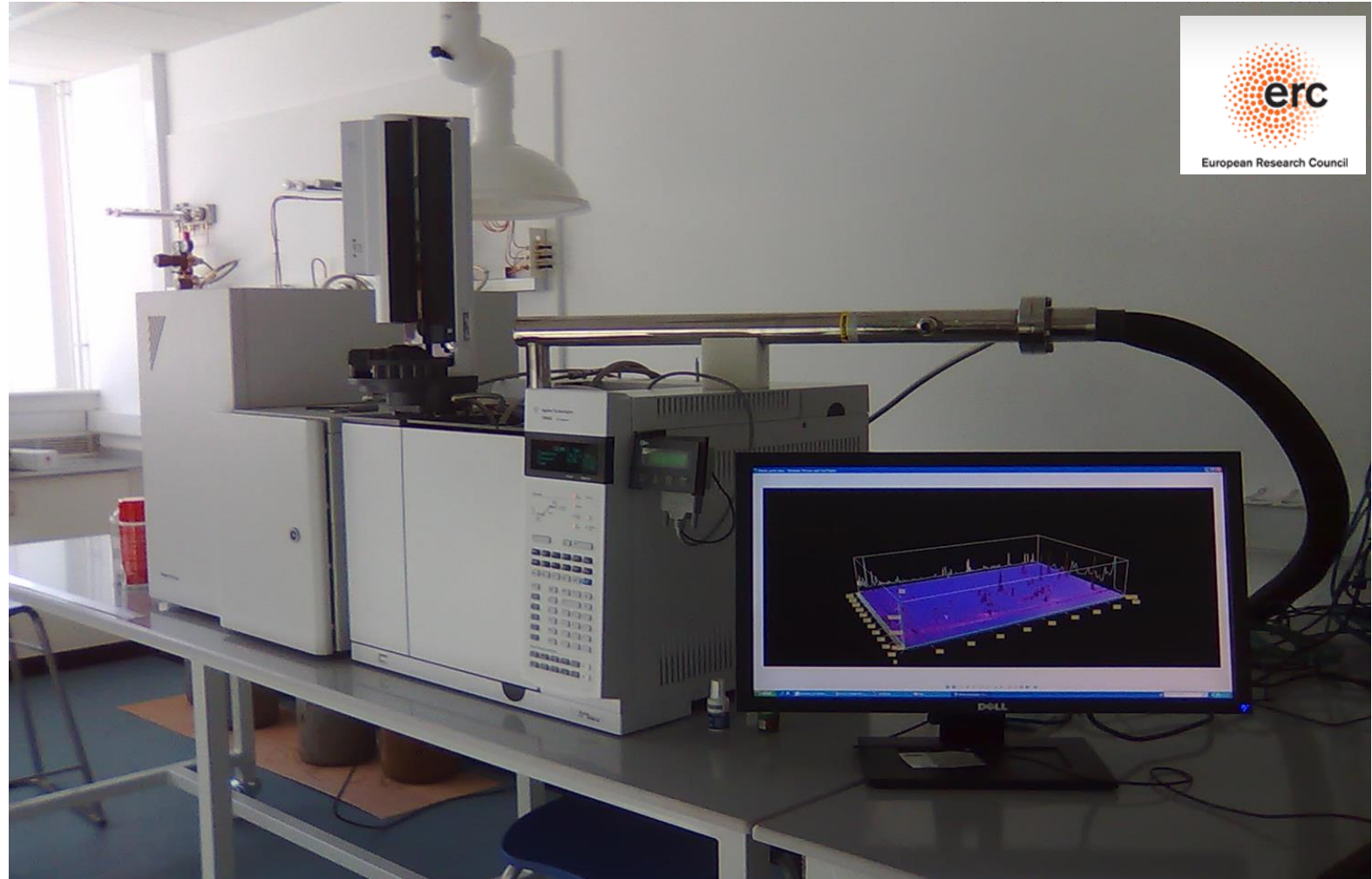
Separation method corrals key compounds to improve petrochemical processing and pollution assessment

By *Mark Peplow*

[+]Enlarge

Analytical Approach-GCxGC-MS

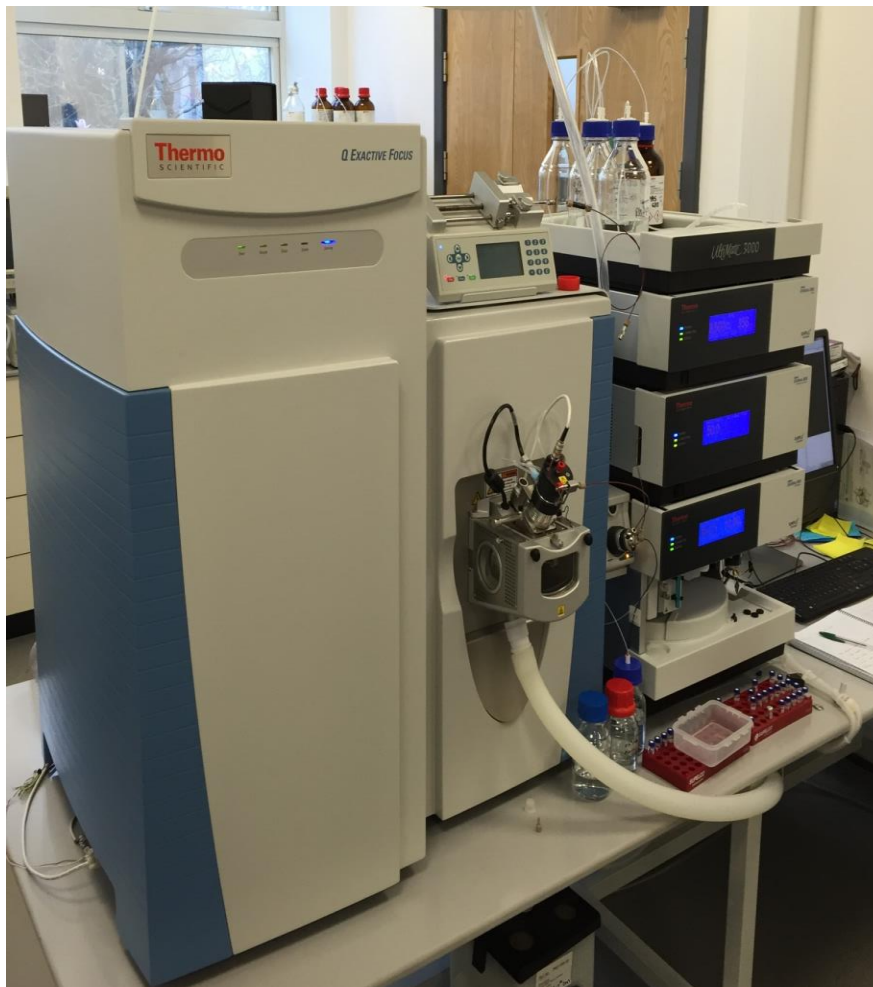
Markes Bench TOF™ GCxGC-Mass Spectrometer (ERC)



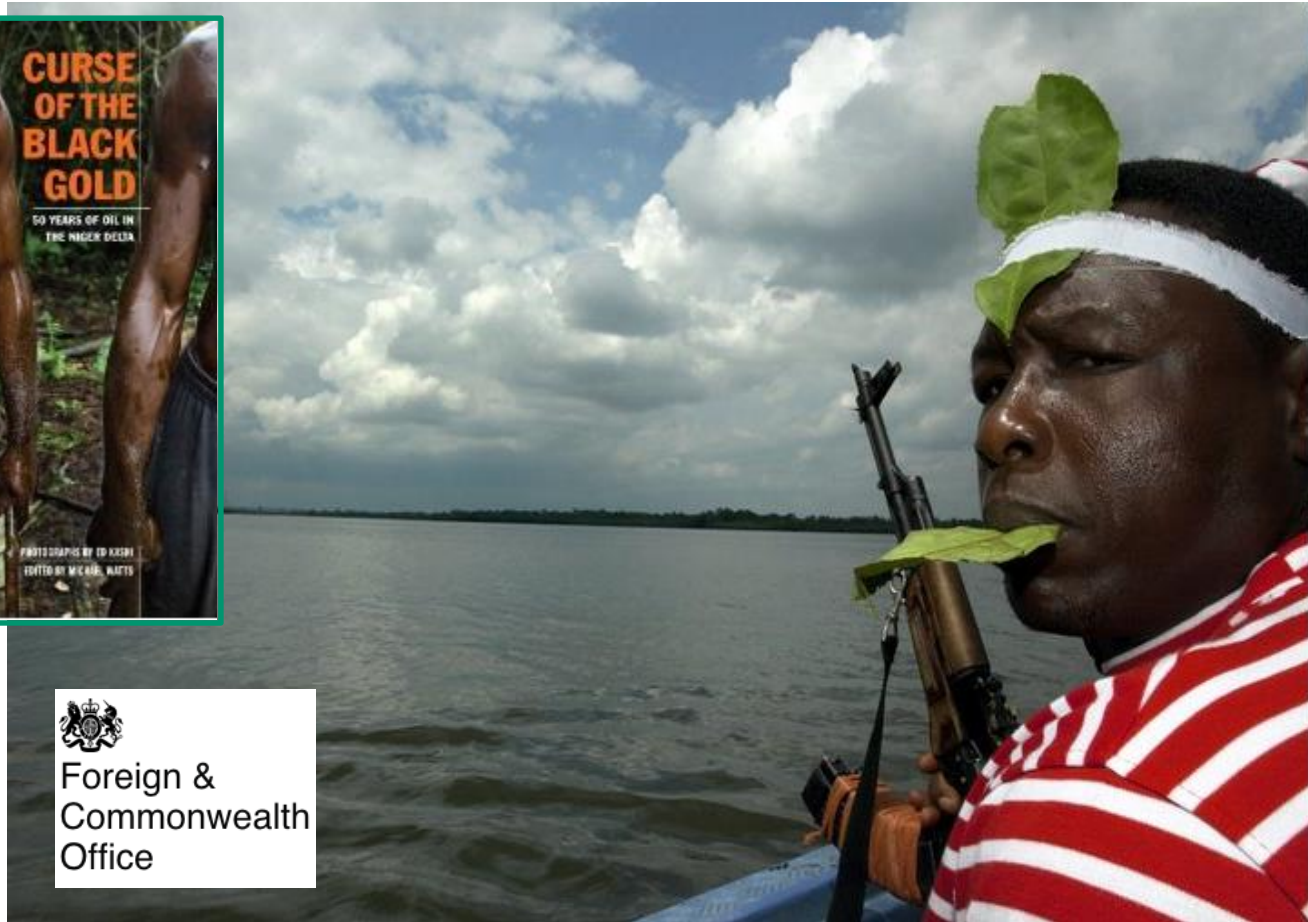
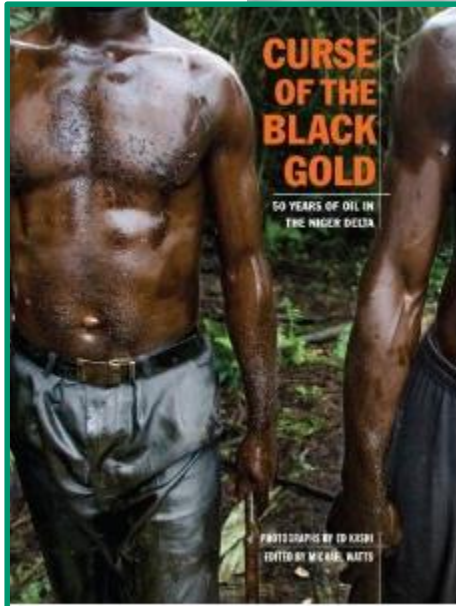
Analytical Approach-LC-HRAM-MS

Q Exactive™ Focus Hybrid Quadrupole-Orbitrap™ Mass Spectrometer
(NERC & UoP)

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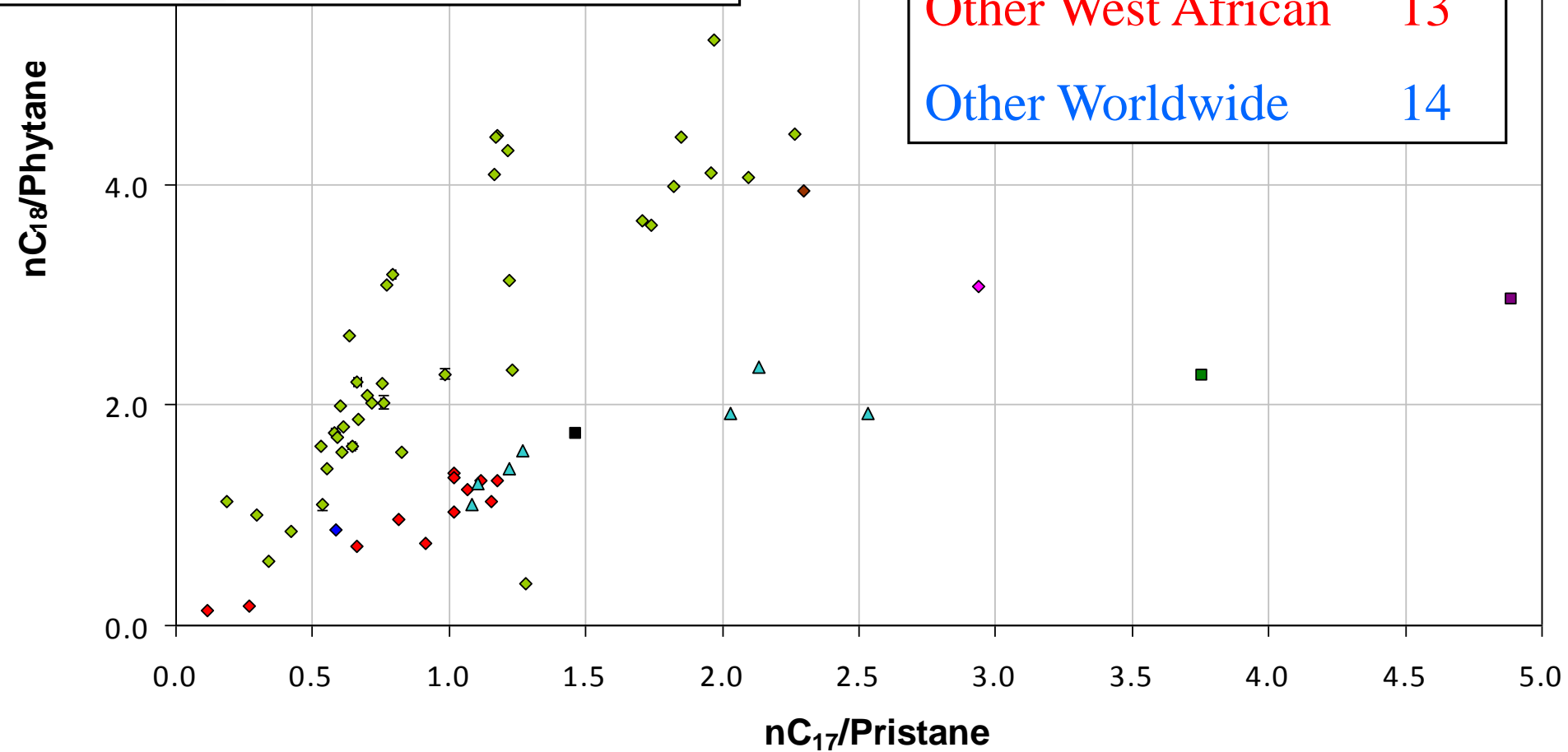
Fingerprinting stolen oil in Nigeria




Foreign &
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itac: Industry Technical Advisory Committee
for oil spill response



Oil sands operations, Alberta



Current case study : Effects of oil toxicity to Haddock



Upstart meeting of the new RCN project: EGGTOC, Bergen 25-26 Januar.

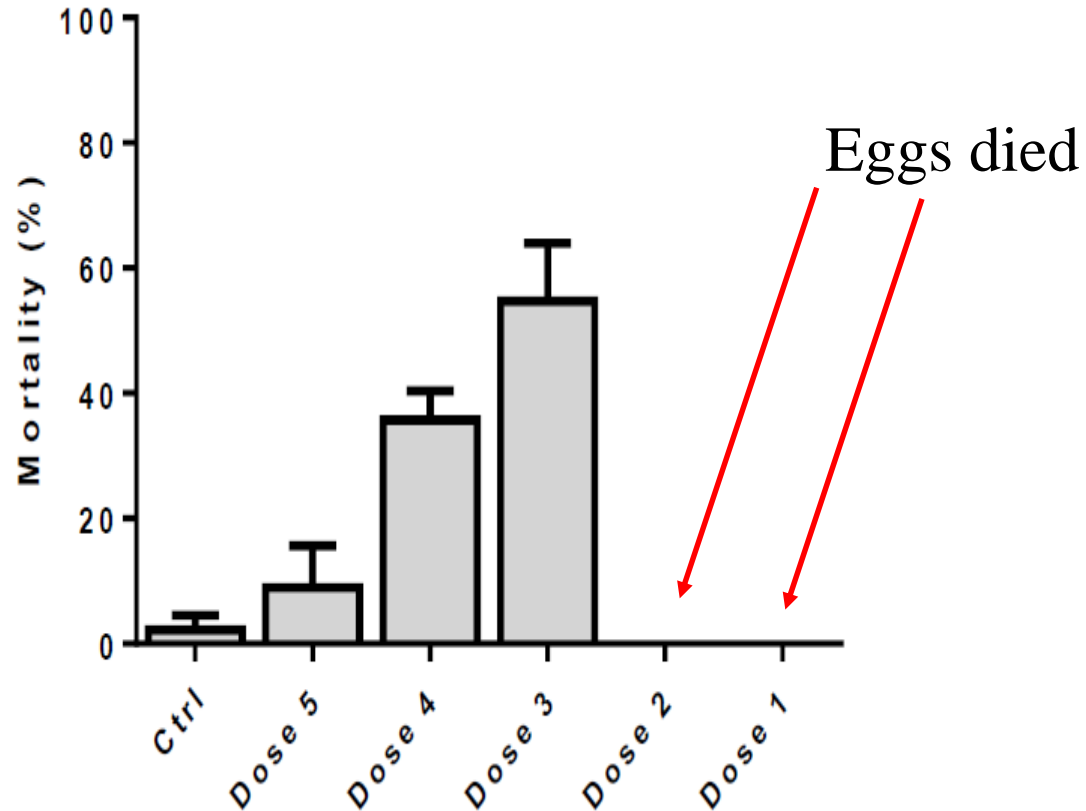
People from the left back road:

Bjørn Henrik Hansen (SINTEF, Trondheim), Trond Nordtug (SINTEF, Trondheim), John Incardona (NOAA, USA), Terje van der Meeren (IMR, Austevoll), Nat Scholz (NOAA, USA), Elin Sørhus (IMR, Bergen), Birgitta Norberg (IMR, Austevoll), Anders Goksøyr (UiB), Denis Da Silva (NOAA, USA), Frode Vikebø (IMR, Bergen), Ørjan Karlsen (IMR, Austevoll).

Front left road:

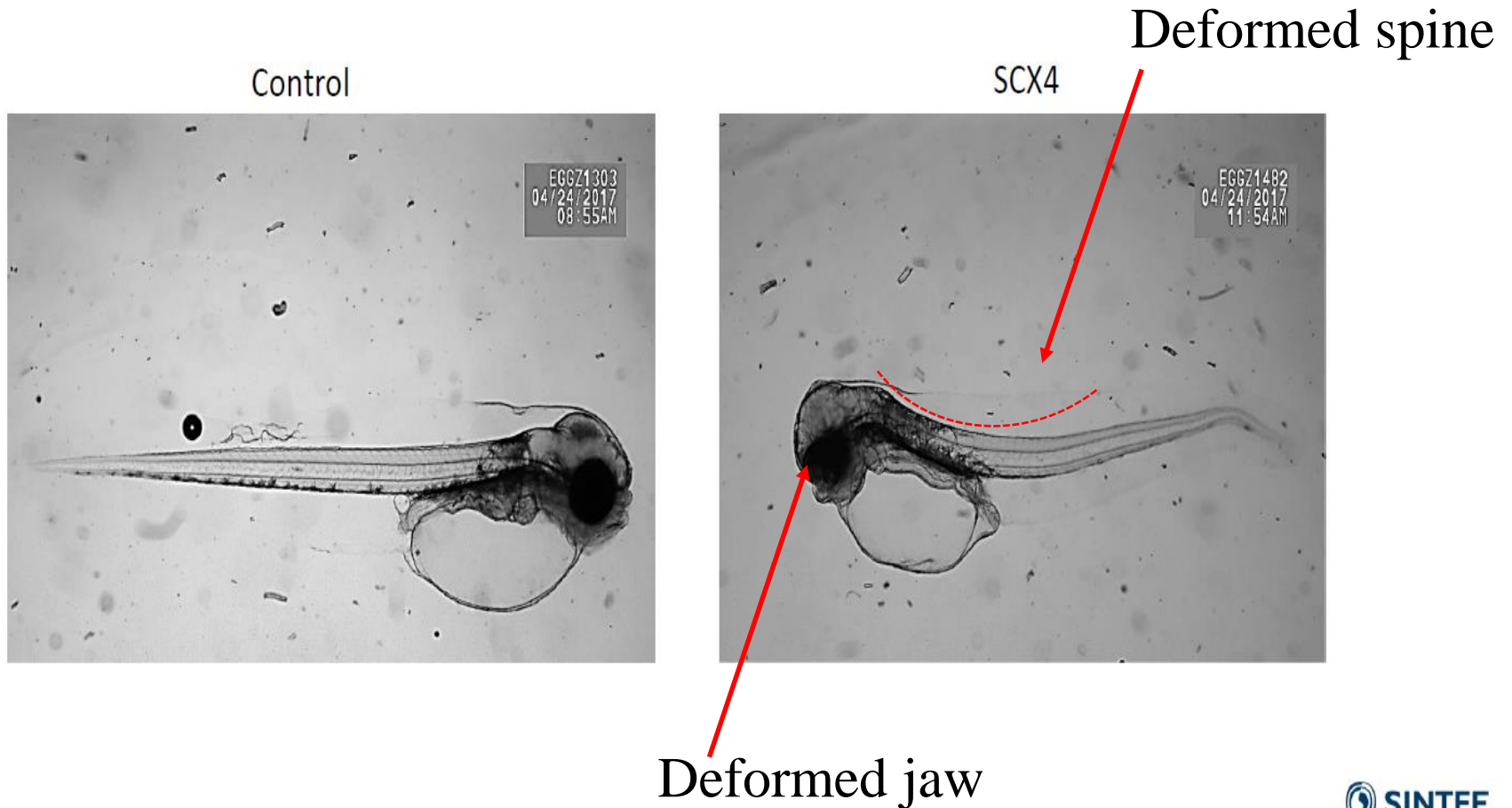
Lisbet Sørensen (IMR, Bergen), Steven Rowland (University of Plymouth, UK), Sonnich Meier (IMR, Bergen), Kåre Jørgensen (UiS), Torstein Harboe (IMR, Austevoll), Raphael Delepée (Université of Caen, France), Jérémie Le Goff (ADn'tox, France)

Effects of 'polar' compounds on haddock larvae



Unpublished preliminary data: Bjørn Henrik Hansen, Julia Farkas, Trond R. Størseth, Dag Altin, Steve Rowland, Will Robson, Philipp Mayer and Sonnich Meier

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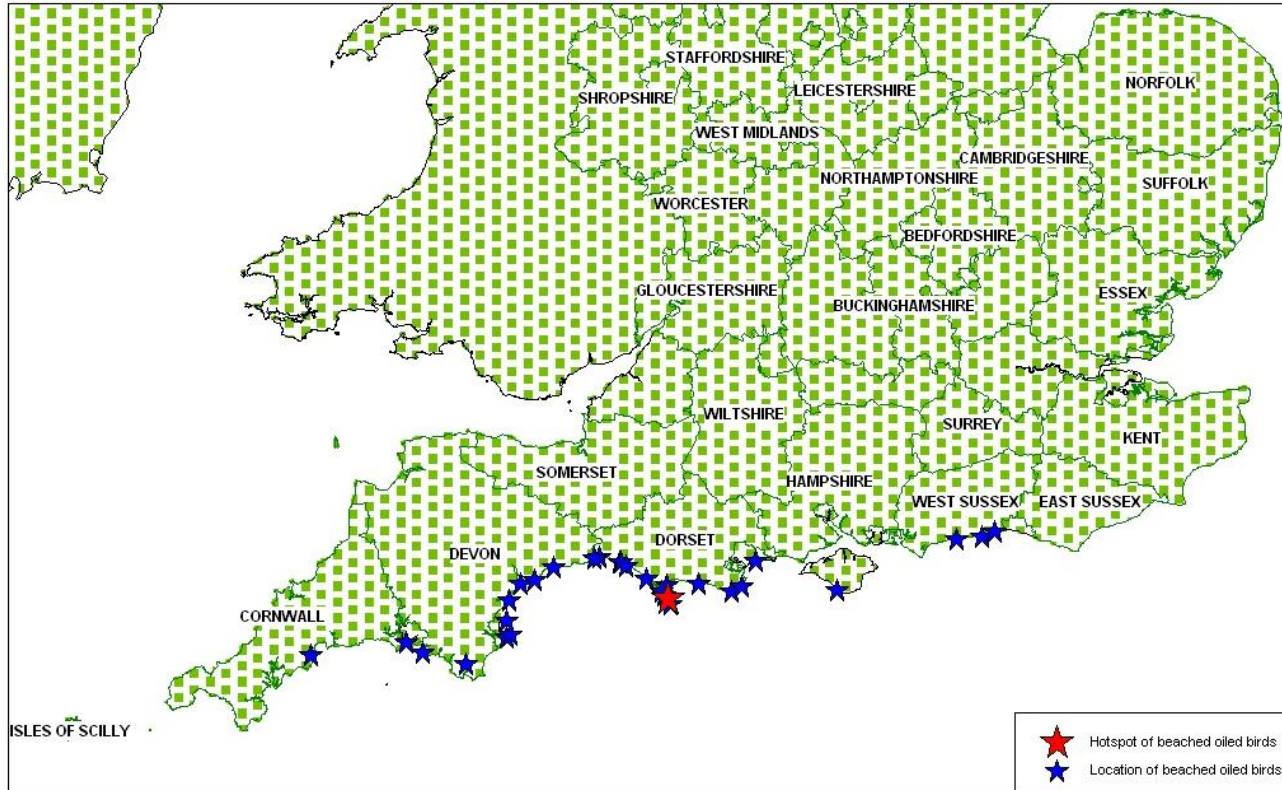


Not all spills are crude!



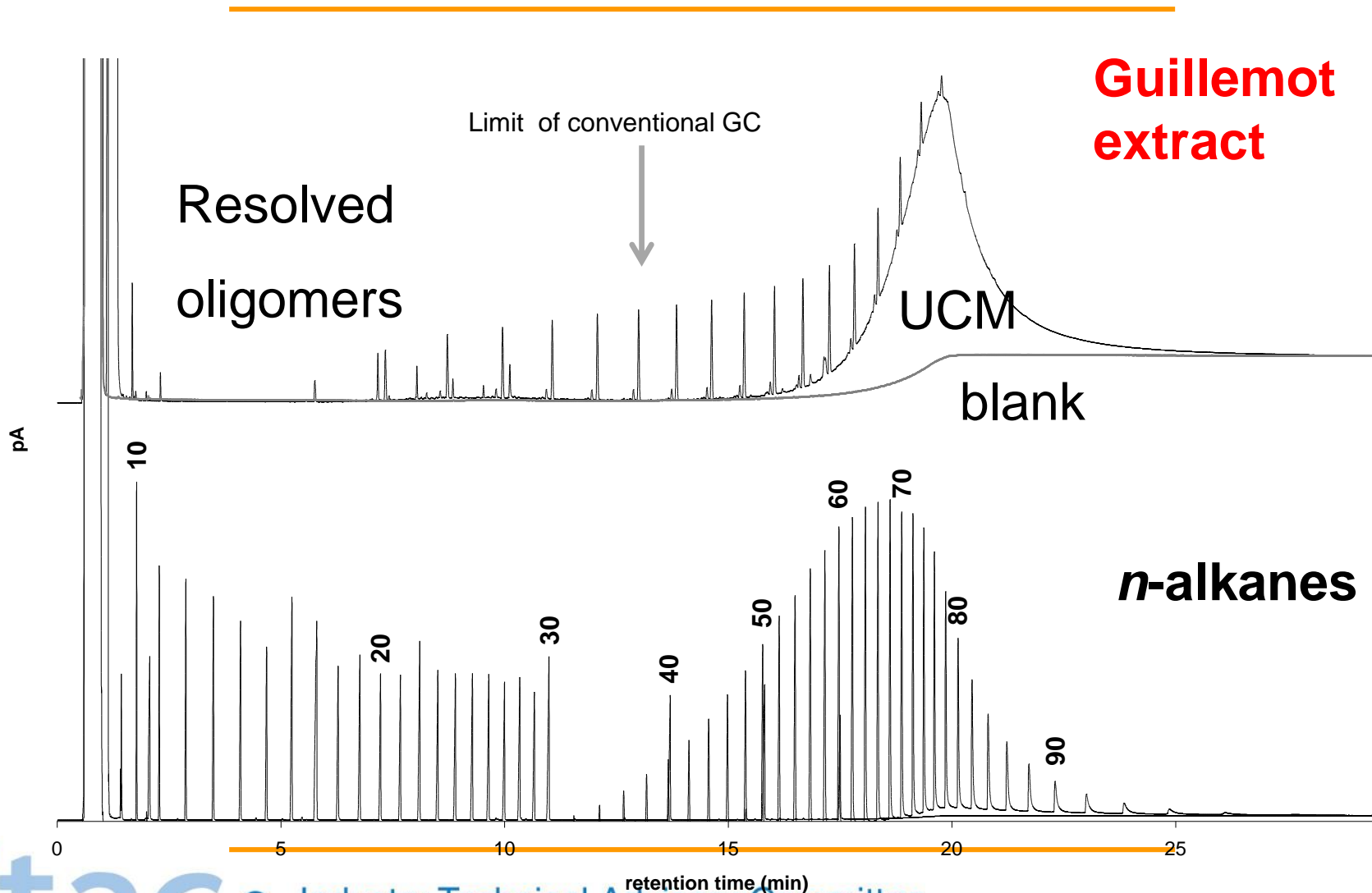


Oiled birds incident end January/beginning February 2013 - locations of reported beached birds



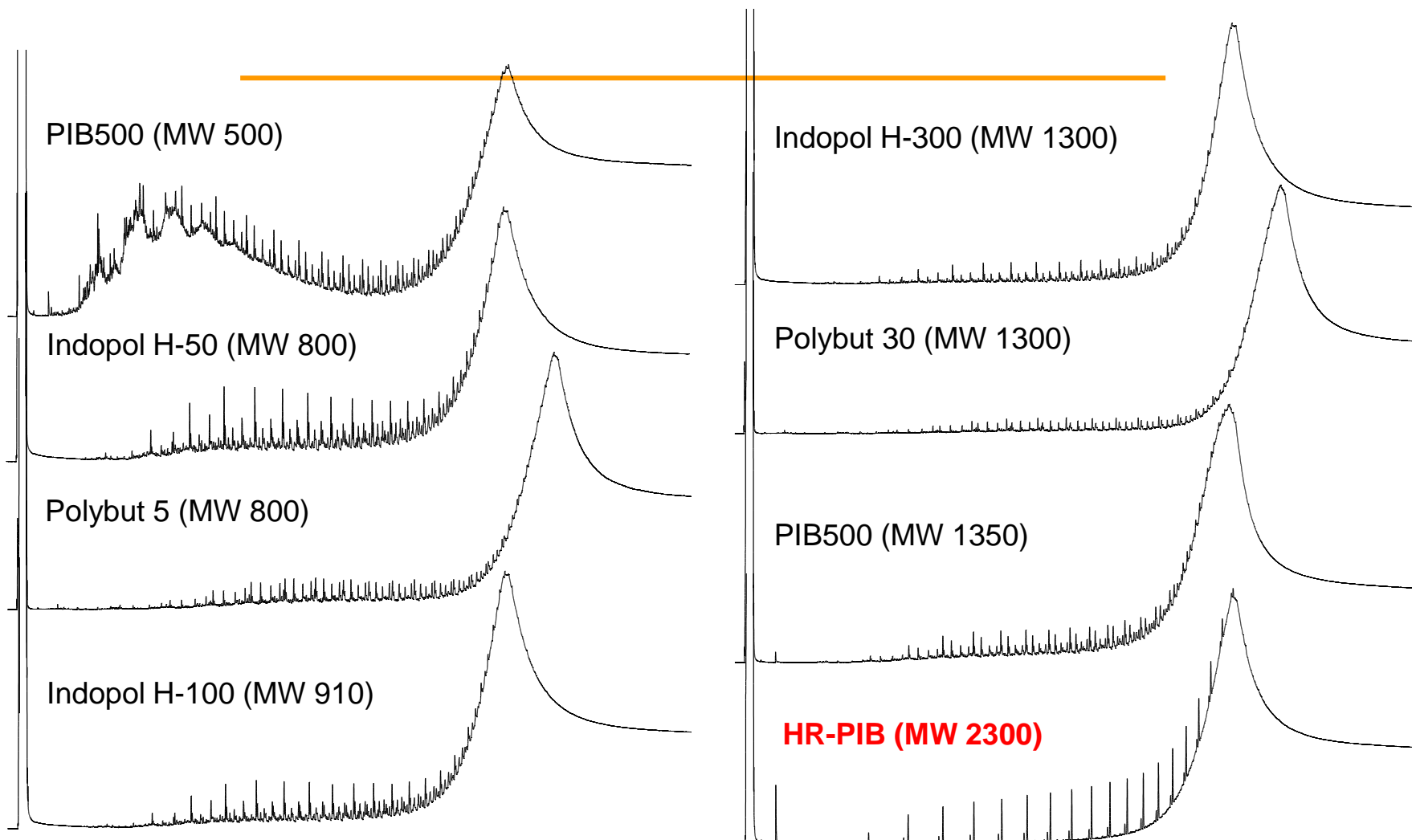
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HTGC-FID: PIBs



**Guillemot
extract**

HTGC-FID: PIBs



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Ships banned from discharging seabird pollutant PIB



Guillemots, augs and razorbills were among the bird species found dead

A pollutant that killed thousands of birds off the coast of Britain earlier this year will no longer be dumped at sea after a worldwide ban was agreed.

More than 4,000 birds were killed or injured by the chemical polyisobutene (PIB) between Cornwall and Sussex, and on the Channel Islands.

The International Maritime Organisation (IMO) has reclassified PIBs from 2014.

It means ships will only be able to wash their tanks and dispose of all PIB residues while in port.

Until now it has been legal for discharges to be made when vessels wash out their tanks, as long as they are further than 12 nautical miles from the nearest point of land.

Related Stories

[Call for bird pollutant review](#)

[Coast pollution investigation closed](#)

[Bird clean-up operation cost £10,000](#)

Summary

- 💧 Complex mixtures of oil compounds can be better identified by modern methods.
- 💧 Combination of chemistry & toxicology allows active components to be better identified.
- 💧 Challenge has been/is, to maintain funding for staff & equipment so that skills & equipment are available when spills occur!

Acknowledgements

- 💧 NERC funding for LCMS 2014-2019
- 💧 ERC funding Advanced Investigators Award to SJR 2009-2014 (GCxGC-MS)
- 💧 Present and former colleagues at UoP, Env Canada, Norway etc
- 💧 Norwegian Research Council for funding past 'HADDOCK' & present EGGTOX and RESOLVE projects
- 💧 FCO for funding Nigerian studies