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Distribution, occurrence and biotoxin composition of the main shellfish toxin producing microalgae within European waters: A comparison of methods of analysis

Sara E. McNamee [a], Linda K. Medlin [b], Jessica Kegel [b], Gary R. McCoy [c], Robin Raine [c], Lucia Barra [d], Maria Valeria Ruggiero [d], Wiebe H.C.F. Kooistra [d], Marina Montresor [d], Johannes Hagstrom [e], Eva Perez Blanco [e], Edna Graneli [e], Francisco Rodríguez [f], Laura Escalera [f], Beatriz Reguera [f], Simon Dittami [g], Bente Edvardsen [g], Joe Taylor [h], Jane M. Lewis [h], Yolanda Pazos [i], Christopher T. Elliott [a], Katrina Campbell [a,*]

[a] Institute for Global Food Security, School of Biological Sciences, Queen's University, Stranmillis Road, Belfast BT9 5AG, UK
[b] Marine Biological Association of UK, The Laboratory, Citadel Hill, Plymouth, UK
[c] Martin Ryan Institute, National University of Ireland, Galway, Ireland
[d] Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Napoli, Italy
[e] Linnaeus University, Marine Ecology Department, SE-39182 Kalmar, Sweden
[f] Instituto Español de Oceanografía, Subida a Radio Faro 50, 36390 Vigo, Spain
[g] University of Oslo, Department of Biosciences, 0316 Oslo, Norway
[h] Faculty of Science and Technology, University of Westminster, London W1W 6UW, UK
[i] INTECMAR, Peirao de Vilaxoán, Villagarcía de Arosa 36611, Spain

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ABSTRACT

Harmful algal blooms (HABs) are a natural global phenomena emerging in severity and extent. Incidents have many economic, ecological and human health impacts. Monitoring and providing early warning of toxic HABs are critical for protecting public health. Current monitoring programmes include measuring the number of toxic phytoplankton cells in the water and biotoxin levels in shellfish tissue. As these efforts are demanding and labour intensive, methods which improve the efficiency are essential. This study compares the utilisation of a multitoxin surface plasmon resonance (multitoxin SPR) biosensor with enzyme-linked immunosorbent assay (ELISA) and analytical methods such as high performance liquid chromatography with fluorescence detection (HPLC-FLD) and liquid chromatography–tandem mass spectrometry (LC–MS/MS) for toxic HAB monitoring efforts in Europe. Seawater samples ($n = 256$) from European waters, collected 2009–2011, were analysed for biotoxins: saxitoxin and analogues, okadaic acid and dinophysistoxins 1/2 (DTX1/DTX2) and domoic acid responsible for paralytic shellfish poisoning (PSP), diarrheic shellfish poisoning (DSP) and amnesic shellfish poisoning (ASP), respectively. Biotoxins were detected mainly in samples from Spain and Ireland. France and Norway appeared to have the lowest number of toxic samples. Both the multitoxin SPR biosensor and the RNA microarray were more sensitive at detecting toxic HABs than standard light microscopy phytoplankton monitoring. Correlations between each of the detection methods were performed with the overall agreement, based on statistical 2×2 comparison tables, between each testing platform ranging between 32% and 74% for all three toxin families illustrating that one individual testing method may not be an ideal solution. An efficient early warning monitoring system for the detection of toxic HABs could therefore be achieved by combining both the multitoxin SPR biosensor and RNA microarray.

1. Introduction

Monitoring programmes in coastal waters have become a necessity because of the potential dangers to human health and the significant economic impacts of contaminated seafood from harmful microalgae. Monitoring of phytoplankton and their toxins

* Corresponding author at: Institute for Global Food Security, School of Biological Sciences, Queen's University, David Keir Building, Stranmillis Road, Belfast BT9 5AG, UK. Tel.: +44 02890976535; fax: +44 02890976513.
E-mail address: katrina.campbell@qub.ac.uk (K. Campbell).

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