國 立 臺 灣 海 洋 大 學

海洋環境與生態研究所 專題討論

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中文題目：#2012-1016 年在緬因灣 *Pseudo-nitzschia* 藻華爆發的動態#

英文題目：#*Pseudo-nitzschia* bloom dynamics in the Gulf of Maine: 2012–2016#

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英文摘要

The toxic diatom genus *Pseudo-nitzschia* is a growing presence in the Gulf of Maine (GOM), where regionally unprecedented levels of domoic acid (DA) in 2016 led to the first Amnesic Shellfish Poisoning closures in the region. However, factors driving GOM *Pseudo-nitzschia* dynamics, DA concentrations, and the 2016 event are unclear. Water samples were collected at the surface and at depth in offshore transects in summer 2012, 2014, and 2015, and fall 2016, and a weekly time series of surface water samples was collected in 2013. Temperature and salinity data were obtained from NERACOOS buoys and measurements during sample collection. Samples were processed for particulate DA (pDA), dissolved nutrients (nitrate, ammonium, silicic acid, and phosphate), and cellular abundance. Species composition was estimated via Automated Ribosomal Intergenic Spacer Analysis (ARISA), a semi-quantitative DNA finger-printing tool. *Pseudo-nitzschia* biogeography was consistent in the years 2012, 2014, and 2015, with greater *Pseudo-nitzschia* cell abundance and *P. plurisecta* dominance in low-salinity inshore samples, and lower *Pseudo-nitzschia* cell abundance and *P. delicatissima* and *P. seriata* dominance in high salinity offshore samples. During the 2016 event, pDA concentrations were an order of magnitude higher than in previous years, and inshore-offshore contrasts in biogeography were weak, with *P. australis* present in every sample. Patterns in temporal and spatial variability confirm that pDA increases with the abundance and the cellular DA of *Pseudo-nitzschia* species, but was not correlated with any one environmental factor. The greater pDA in 2016 was caused by *P. australis* – the observation of which is unprecedented in the region – and may have been exacerbated by low residual silicic acid. The novel presence of *P. australis* may be due to local growth conditions, the introduction of a population with an anomalous water mass, or both factors. A definitive cause of the 2016 bloom remains unknown, and continued DA monitoring in the GOM is warranted.

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中文摘要

　　有毒矽藻屬 *Pseudo-nitzschia* 在緬因灣越來越常見，2016 年該地區首次觀察到超高濃度失憶性貝類毒素軟骨藻酸(Domoic acid, DA)，因為超高濃度 DA 使該區域成為首度關閉之貝類養殖區。然而，目前並不清楚是什麼因子控制緬因灣 *Pseudo-nitzschia* 的數量變動、DA 濃度與 2016 年藻華事件發生原因。本研究在 2012 年、2014 年和 2015 年夏季和 2016 年秋季在離岸測線進行表水和不同深度採集水樣，另外 2013 年也進行每週表水集樣。溫度和鹽度數據來自於 NERACOOS 浮標和採樣過程中直接量測。樣本採集包括顆粒性 DA (pDA)、溶解性的營養鹽(硝酸鹽、氨、矽酸和磷酸鹽)和細胞數量。種類組成是透過自動核醣體基因間隔分析(ARISA)，是一種半定量 DNA 指紋工具。*Pseudo-nitzschia* 生物地理學顯示在 2012、2014 和 2015 年的數量變動是一致的，*Pseudo-nitzschia* 細胞數量在低鹽度的近岸較多，以 *P. plurisecta* 為優勢種。在高鹽度的離岸水中 *Pseudo-nitzschia* 數量較低，種類則是以 *P. delicatissima* 和 *P. staeria* 為優勢種。在 2016 年的藻華事件中，顆粒性 DA 濃度比前幾年高了約 10 倍，*Pseudo-nitzschia* 種類組成在近岸與離岸的差異較不明顯，並且每個樣本中都可發現 *P. australis*。在顆粒性 DA 濃度時空變化上，會隨著 *Pseudo-nitzschia* 數量與不同種類所含的 DA 而增加，但相關分析中無法歸咎於單一環境因子。2016 年高濃度的顆粒性 DA 是由 *P. australis* 所造成的，此種類在該地區是首度發現，低矽酸的環境下使藻毒情況更為惡化。*P. australis* 的出現可能與當地環境適合成長、或是異常水團入侵所帶入，或兩者同時影響所致。造成 2016 年藻華的確切原因目前並不清楚，未來在緬因灣進行軟骨藻酸監測是必須的。

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