Eutrophication and Hypoxia: Problems and Scientific Challenges

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ABSTRACT

During the last few decades, anthroppgenic input of nutrients into the coastal environment has increased several times. Such an increase has already caused large scale hypoxia over large coastal areas in many areas all over the world. Currently, there are more than 400 dead zones worldwide, and the number of "dead zones" has doubled every ten years since the 60's.

On a global scale, hypoxia has lead to major changes in the structure and function of marine communities and trophic relationship of marine food chains. In hypoxic coastal waters, a shift from demersal to pelagic fish, a decrease in dominance of predators, and an increase in dominance of smaller size predators and preys with a short life cycle are generally found.

Recent scientific evidence showed that hypoxia is an endocrine disruptor, and can alter the balance of sex hormones, leading to reproductive impairment and a male biased F1 population in fish and may threaten the sustainability of natural populations. Hypoxia is also a teratogen, leading to malformation in fish through disrupting hormonal balance and/or apoptosis during development. The above new findings make hypoxia probably the most pressing global problem in marine environments.

The problems of eutrophication and hypoxia are difficult to deal with. Furthermore, climate change will further exacerbate the problem in the coming years. There is an urgent need to develop cost-effective control and monitoring technologies and measures to reduce the ecological risk of hypoxia.

優養化與缺氧：問題與科學上的挑戰

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摘 要

在過去的十年裡，流入沿海地區的人造養分以倍數成長。這個情況在全世界許多地區的沿海中造成了大規模的缺氧現象。目前，全世界有超過四百處的死亡海域，而這個數目自六十年代起每十年增加一倍。

缺氧現象已經引發全球海洋結構、功能以及海中食物鏈營養關係的改變。在缺氧的沿海中，底棲魚被遠洋魚類取代，獵食者的數量減少，取而代之的是小型獵食者以及生命週期短暫的獵物。

最近的科學研究發現缺氧是一種內分泌干擾物，會改變荷爾蒙的平衡，造成不育以及雄魚數目的增加，並威脅自然族群的永續性。缺氧也是一種畸形原，透過干擾荷爾蒙以及/或細胞凋亡讓魚類產生畸形。以上的發現使得缺氧現象成了全球海洋最迫切的問題。

優養化與缺氧是非常棘手的問題。氣候變遷將近一步惡化這個問題。當務之急便是發展符合成本效益的管控機制、監控技術和措施以減低缺氧所造成的生態危機。