文章摘要

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胶州湾贝类养殖区氮、磷污染现状及动态变化

Nitrogen and phosphorous pollution in shellfish culture areas of Jiaozhou Bay

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中文摘要：

依据2011年3、5、8、10月和1997～2010年5、8、10月水环境调查资料，对胶州湾贝类养殖区氮、磷污染现状及动态变化进行了分析与评价，并分析了海水富营养化的成因，可为赤潮的预测预警提供基础资料。结果表明，1）2011年胶州湾贝类养殖区氮、磷污染较为严重，除3月其含量符合标准要求外，5、8、10月均存在氮、磷污染，其中无机氮超标率为11.11%～100%，活性磷酸盐超标率为33.33%～66.67%，无机氮超标率均值高于活性磷酸盐。2）氮、磷污染程度具有明显的季节变化，以10月最重，8月次之，3月最轻。无机氮和活性磷酸盐污染指数均值分别为1.35和0.93，氮污染重于磷污染。3）氮、磷营养盐空间分布不均，贝类养殖区西部和东部海域氮、磷含量高于中部海域，空间分异程度为8月＞3月＞5月＞10月。4）海水富营养化程度较为严重，2011年3、5、8、10月富营养化站位所占比例为44.44%～100%，营养指数均值为1.09～6.99，海水富营养化严重程度依次为8月＞10月＞5月＞3月。5）2011年各调查月份养殖区海水中N/P比值为20.96～43.22，除5月部分测站N/P比值小于Redfield比值，其他3个月份N/P比值均大于Redfield比值，活性磷酸盐可能成为浮游植物生长的主要限制因子之一。6）氮、磷污染指数具有明显的年际变化，其中无机氮污染指数2008年最高，1997和2000年最低；活性磷酸盐污染指数1997年最高，2011年最低。7）海水富营养化成因复杂，径流携带大量氮、磷等营养物质入海和贝类养殖自身污染是造成胶州湾贝类养殖区海水富营养化的主因。近年胶州湾贝类养殖区氮、磷污染状况并无明显改善，海水富营养化依然严重，存在发生赤潮的可能性。

英文摘要：

Based on environmental survey in March, May, August, October, 2011 and May, August, October from 1997 to 2010, the status of nitrogen and phosphorous pollution and its variations in shellfish culture areas of Jiaozhou Bay were analyzed and assessed. It was found that: (1) Nitrogen and phosphorus pollution in shellfish culture areas of Jiaozhou Bay was more serious in 2011. Concentrations of these nutrients met the national standard in March only, but were above the limit in all other months, when DIN concentrations were 11.11% to 100% and phosphate (PO4-P) concentrations were 33.33% to 66.67% higher above the limit. (2) DIN and PO4-P in summer areas showed obvious seasonal variations. The maximum and minimum values appeared in October

66.61% higher above the limit. (2) DIN and PO4-P in survey areas showed obvious seasonal variations. The maximum and minimum values appeared in October and March, respectively. The mean pollution index (Pi) of DIN and PO4-P were 1.35 and 0.93 respectively, indicating more serious pollution by nitrogen. (3) Spatial variation was also found for DIN and PO4-P in Jiaozhou Bay, with much higher concentrations of nutrients in the western and eastern regions of shellfish culture area but lower in the central region. The ranking of monthly DIN and PO4-P eutrophication was August>March>May>October. (4) Relatively serious eutrophication was found in the survey areas, with 44.44%~100% sampling stations were in eutrophication. The ranking of average monthly eutrophication index values was August>October>May>March. (5) In the four months in 2011, the N/P ratio of most seawater samples was between 20.96 and 43.22, which was above the Redfield ratio, with only few exceptions in May, indicating that PO4-P may be the main limiting factor for phytoplankton growth. (6) Pollution index of nitrogen and phosphorus showed obvious interannual variation. Pi of DIN was the highest in 2008 and the lowest in 1997 and 2000, and Pi of PO4-P was the highest in 1997 and the lowest in 2011. (7) The causes of seawater eutrophication were very complex, but two main factors were identified in the aquaculture areas of Jiaozhou Bay. One was the large amounts of nitrogen, phosphorus and other nutrient inputs from the rivers, and the other was the shellfish aquaculture self pollution. In recent years, although the nitrogen and phosphorus pollution in shellfish culture areas of Jiaozhou Bay showed no obvious deterioration, eutrophication is still serious, which may contribute to more frequent algal blooms.

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