A JOINT ICES-IOC STUDY GROUP ON NUTRIENT STANDARDS

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10 core laboratories for RM stability test

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Summary. This document proposes a joint ICES-IOC study group to develop international standards for nutrients to establish comparability and traceability of nutrient data in the world oceans.
Objectives

Establish **global comparability and traceability** of sea water nutrient data from the world’s oceans through the development of appropriate certified reference materials (CRMs).
5.4.4 Nutrients

Uncertainties in deep ocean nutrient observations may be responsible for the lack of coherence in the nutrient changes. Sources of inaccuracy include the limited number of observations, and the lack of compatibility between measurements from different laboratories at different times.

This strongly suggests that we need to establish a strategy for obtaining high-quality oceanic nutrients data, based on the use of CRMs and well-characterized methodology.
Present status of comparability of nutrient data at P-03 and P-14 crossover point in the Pacific in 1980s-2000s

P3_P14_crossing stations in 1985, 1993, 2005 and 2007 (24N, 180E, r=250km)

Nitrate vs. phosphate ratio

Depth / dbar

1000 2000 3000 4000 5000 6000

13 13.5 14 14.5 15 15.5 16

Nitrate vs. phosphate ratio

1985 without RMNS
1993 without RMNS
2005 with RMNS
2007 with RMNS
Inter-laboratory comparison studies

1 Previous inter-laboratory comparison studies
- ICES NUTS I/C five times I/C studies (1965–1995)
- QUASIMEME - international Laboratory testing scheme 1990s-
- NOAA/NRC (to certify MOOS-1) 2001 & 2003
- MRI 2003 & 2006 RMNS I/C study

2 Latest inter-laboratory comparison study
MRI 2008 RMNS I/C study by 55 laboratories in 15 countries confirmed below.
- Confirmed that many laboratories had good precision (repeatability).
- Confirmed that non-linearities in the calibration of nutrients measurements are a problem needing to be addressed.
- Confirmed that significant discrepancies exist between the results reported by different laboratories.
2006 and 2008 Inter-laboratory Comparison Studies: participating laboratories
Illustrating the effect of an International Nutrients Scale System

Si results for 25 core labs and 3 samples (2 Si, 5 Si en 3 Si)

- Count: 25
- Max: 67.2
- Min: 64.6
- Mean: 65.9
- Median: 66.0
- %stdev 1.24

Sample ordered by reported value

Graph showing the distribution of Si results for 25 core labs and 3 samples, illustrating the effect of an International Nutrients Scale System.
Corrected Si results for 25 core labs and samples 2 Si and 5 Si

Illustrating the effect of an International Nutrients Scale System
How do we improve the comparability of nutrient measurements?

By the use of agreed on internationally-distributed reference materials with assigned values for the nutrient composition that can be used both to confirm a laboratory’s precision (internal comparability) and to adjust data from multiple laboratories to a common calibration scale (external comparability).
Specific Terms of Reference of Study Group on Nutrient Standards

i. Develop and establish reference materials for nutrients in seawater (RMNS) collaborating with producers of currently available RMNS. Primary determinants are nitrate, nitrite, phosphate and silicate.

ii. Collaborate and encourage National Metrology Institute of Japan to complete certification of RMNS for nitrate, nitrite, phosphate and silicate.

iii. Develop new sampling and measurement protocols using the RMNS.

iv. Carry out an international collaboration exercise to verify the stability of the reference materials and test the proficiency of the new protocols.

v. Complete and publish a revised nutrients analysis manual.
Specific Terms of Reference of Study Group on Nutrient Standards

vi. Distribute 10,000 bottles of RMNS to laboratories measuring nutrients as part of the CLIVAR Repeat Hydrography Program to construct a global nutrient dataset referenced to the new RMNS.

vii. Promote the use of RMNS to aim for global acceptance in order to enable reliable comparability between global nutrient data sets. Investigate the feasibility of expanding RMNS to include ammonium and dissolved organic matter.

viii. Encourage the collaborations with communities of chemical reference materials for ocean sciences such as carbonate system RMs for DIC, TA and pH, and also for dissolved oxygen in seawater.
Conclusions

The comparability and traceability of nutrients data in the world’s oceans are one of primary importance to Marine Science, and to the studies of Global Change. The work of the proposed Study Group on Nutrient Standards would enable better comparability between data sets measured at different times, and by different laboratories, so it would be possible to investigate, reliably, the change of nutrients distributions in the ocean, and the tight coupling between the nitrogen and phosphorus cycles in the ocean with that of carbon.