THE JOINT IOC-ICES STUDY GROUP ON NUTRIENT STANDARDS (SGONS)

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An activity report of the joint IOC-ICES Study Group on Nutrient Standards (SGONS)
“Towards developing an International Nutrients Scale System (INSS) using Reference Materials for nutrients in Seawater (RMNS) solutions”
Talk outline

● Objective and ToRs of SGONS
● Present status of comparability of measurements of nutrients in seawater
● International collaborations, inter-comparison studies and stability tests in 2006-2009
● Work towards International Nutrients Scale System
● Action items in 2010-2011
● Conclusions
Objective and ToRs of SGONS
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 a need to establish a strategy for obtaining high-quality oceanic nutrients data, based on the use of CRMs and well-characterized methodologies.
Objective

Global comparability and traceability for measurements of nutrient in the ocean through the development of certified reference materials (CRMs).
Specific Terms of Reference of Study Group on Nutrient Standards

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.
How to obtain comparability?

In the past: adjust by offset

Inter-laboratory comparisons – give idea of differences between labs.

Synthesis using mathematics methods and experience. Get apparent global comparability but does not have a firm foundation – accuracy is unknown.
How to obtain comparability?

Can now do scaling based on the RM
Theoretically correct way
Tested on cruises using RMs on CLIVAR lines
and SIO on CLIVAR - P6 in 2009.
How to obtain comparability?

In the past: adjust by offset

Present: scaling based on the RM

Future: International Nutrients Scale System
- Comparability with RM.
- Traceability and accuracy with CRM traceable to SI.
Present status of comparability of measurements nutrients in seawater
WOCE/CLIVAR cruises in 1990s and 2000s

Green: with RMNS by M. Aoyama
Yellow: without RMNS
Red: future cruise with RMNS
120 crossovers in the world ocean during WOCE and CLIVAR periods
Present status of comparability of nutrient data at P-03 and P-14 crossover point in the Pacific in 1980s-2000s
Present comparability of WOCE/CLIVAR data based on RM

Nitrate “0.83±0.06” – “1.10±0.32”

Phosphate “0.82±0.06” – “1.11±0.17”

Silicate “0.83±0.09” – “1.20±0.04”
International collaborations, inter-comparison studies and stability tests in 2006-2009
Inter-laboratory comparison studies

Organised by MRI, Japan

2006 and 2008 RMNS I/C studies

55 laboratories in 15 countries
2006 and 2008 Inter-laboratory Comparison Studies: participating laboratories

Many laboratories have good internal comparability

Figure 7. Comparability of nitrate concentrations measured at the same laboratory in 2006 and 2008 I/C studies.

Figure 9. Comparability of phosphate concentrations measured at the same laboratory in 2006 and 2008 I/C studies.

Inter-laboratory comparison studies

MRI 2006 and 2008 RMNS I/C study
55 laboratories in 15 countries

- Significant discrepancies between results from different laboratories (poor external comparability).
- Many laboratories have good internal comparability.
Work towards International Nutrients Scale System
2009 INSS workshop participants
10-12 Feb. 2009, UNESCO, Paris, France
42 participants, 11 countries
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.
International Nutrients Scale System

Establish global comparability and traceability of sea water nutrient data from the world's oceans through the development of appropriate certified reference materials (CRMs).
Coverage of International Nutrients Scale System, INSS, in sea water

The concentration ranges of determinands:
Nitrate (or Nitrate + Nitrite): 0 – 50 µmol kg\(^{-1}\)
Nitrite: 0 – 3 µmol kg\(^{-1}\)
Phosphate: 0 – 4 µmol kg\(^{-1}\)
Silicate: 0 – 250 µmol kg\(^{-1}\)
Ammonia:
DOM:

Uncertainties should be stated with each concentrations of nutrients:
Illustrating the effect of an International Nutrients Scale System
Illustrating the effect of an International Nutrients Scale System

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<tr>
<td>Max</td>
<td>66.1</td>
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<td>Min</td>
<td>65.7</td>
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<td>Mean</td>
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<td>Median</td>
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<td>%stdev</td>
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How do we improve the comparability of nutrient measurements?

Use an agreed on internationally-distributed reference material with assigned nutrient values to:

(1) determine a laboratory’s precision (internal comparability)
(2) adjust data from multiple laboratories to a common calibration scale (external comparability).
2010 Paris meeting of SGONS

23-24 March 2010, UNESCO, Paris, France
32 participants, 11 countries
Results of global stability test

Lot. AX Nitrate

Nominal: 21.0

ANALDATE

10 core laboratories for RM stability test
Recent Progresses

• Publish a book of INSS and 2009 workshop until June 2010: see a draft
Action items in 2010-2011
Action items 2010-2011

8. Development of non-toxic RM of the carbonate systems will be continued. These are needed to support the growth in demand for such solutions for work on ocean acidification. Quality control of seawater pH is indispensible for the evaluation of ocean acidification, therefore we intend to develop reference material for pH. ToR(viii)
Conclusions
Conclusions-1

• Use of RMNS provides measures of precision and accuracy so we can proceed to studies of change in deep water related to climate changes.
Conclusions-2

The comparability and traceability of nutrients data in the world’s oceans are of primary importance to Marine Science, and to the studies of Global Change. The work of SGONS is enabling (1) better comparability between data sets (2) study of change in nutrients distributions (3) study of coupling between the nitrogen, phosphorus and carbon cycles
Thank you for your attention