



GESAMP

Joint Group of Experts on the
Scientific Aspects of Marine
Environmental Protection

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Agenda item 5.7

**PLANNING OF GESAMP ACTIVITIES:
ATMOSPHERIC INPUT OF POLLUTANTS TO THE OCEANS**

Report of the Chairman of Working Group 38

1 WMO has continued its support of GESAMP WG 38 (Atmospheric Input of Chemicals to the Ocean). During and following GESAMP 39 additional terms of reference for continued work of GESAMP WG 38 were approved to address issues related to the impact of the atmospheric deposition of anthropogenic nitrogen to the ocean. These additional tasks were added as follows:

- .1 Update the geographical estimates of anthropogenic nitrogen deposition to the global ocean made in the 2008 paper in *Science* (Duce, R.A., et al., "Impacts of atmospheric anthropogenic nitrogen on the open ocean", *Science*, 320, 893-897 (2008), which were based on data from 2005 or earlier. This would utilize newer and more geographically distributed data on anthropogenic atmospheric nitrogen concentrations and deposition over the global ocean as well as improved models of these processes and impacts;
- .2 Considering issues related to Task 1 above, re-evaluate the impact of atmospheric nitrogen deposition on marine biogeochemistry, including re-estimating the amount of CO₂ that could be drawn down from the atmosphere into the ocean as a result of the increased productivity in the ocean derived from the additional anthropogenic nutrient nitrogen deposited. This would allow an update on the impact of the atmospheric nitrogen deposition on atmospheric radiative properties outlined in the 2008 *Science* paper;
- .3 Provide a more reliable estimate of the impact of atmospheric anthropogenic nitrogen deposition on the production of additional nitrous oxide in the ocean and its subsequent emission to the atmosphere. This was one of the greatest uncertainties in the 2008 *Science* paper;
- .4 Evaluate the extent to which anthropogenic nitrogen delivered to the coastal zone via rivers, atmospheric deposition, etc. is transported to the open ocean, in which regions this may happen, and what its impact is there. In the 2008 *Science* paper it was assumed that all nitrogen delivered to the coastal zone was sequestered there and did not reach the open ocean, but this may not be true in all locations; and
- .5 Make a more detailed estimate of the input and impact of anthropogenic nitrogen in the area of the Northern Indian Ocean (Arabian Sea, Bay of Bengal) and the South China Sea - the areas that are expected to show the greatest increase of anthropogenic nitrogen deposition over the next few decades.

2 To address these terms of reference, a highly successful workshop on The Atmospheric Deposition of Nitrogen and Its Impact on Marine Biogeochemistry was held at the University of East Anglia in Norwich, United Kingdom, from 11 to 14 February 2013. The first day of the workshop was devoted to discussions of the five tasks identified above as the foci of the

workshop. Two participants were asked to summarize the issues in each of these task areas and to lead the discussions that followed. On the basis of the task area discussions above, the workshop participants broke up into sub-groups on the second through fourth days of the workshop. These sub-groups began the development of eight different scientific papers, covering the task areas above, which will be submitted to peer-reviewed journals. Twenty-three scientists participated in the workshop, one participating by Skype.

The approximate titles of these eight papers are as follows:

- .1 Impact of atmospheric nitrogen deposition on the oceans;
- .2 Atmospheric nitrogen deposition to the oceans: observations vs model-based estimates;
- .3 Atmospheric nitrogen deposition to the South China Sea;
- .4 Modeling the ocean biogeochemical response to increasing nitrogen deposition;
- .5 Riverine delivery of nutrients and carbon to the oceans;
- .6 Marine nitrogen cycle - overview and update;
- .7 Future changes in N₂O emissions from the Arabian Sea and Bay of Bengal: the role of increasing atmospheric and riverine inputs; and
- .8 Sensitivity of the marine nitrogen inventory to regional nitrogen deposition

3 These papers are now in the process of being developed and most should be completed within the coming months, with all being submitted for publication between the fall of 2013 and the summer of 2014.

4 As far as future activities of WG 38 in 2014 are concerned, we believe that the WG should simply focus on getting all of these papers completed and submitted, and hopefully published over the next year. Therefore, at this time we are suggesting that there be no additional tasks undertaken in 2014. We would like to use the time over the next year to consider if there are any additional issues related to the input of chemicals to the ocean that WMO and other sponsors might be interested in the working group addressing, and if so to bring these to GESAMP 41 in 2014.

5 In addition to WMO, support for the Norwich workshop was received from the US National Science Foundation, the ICSU Scientific Committee for Oceanic Research (SCOR), the International Maritime Organization and the University of East Anglia.
