GESAMP WORKING GROUP 38

THE ATMOSPHERIC INPUT OF CHEMICALS TO THE OCEANS

Annual Report to SCOR by the Co-Chairmen of GESAMP Working Group 38

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During the past year GESAMP WG 38 has focused its attention in three areas: 1) Development of a workshop on the ocean management and policy implications of the air/sea exchange of chemicals; 2) Development of a workshop on the atmospheric transport of microplastics to the ocean; and 3) Completion of the peer-reviewed publications arising from the 2017 workshop "The impact of the changing acidity of the ocean and atmosphere on the air/sea exchange of chemicals", as well as from other WG 38 activities.

Development of a workshop on the ocean management and policy implications of the air/sea exchange of chemicals

Plans have been developed, funds have been obtained from several UN agencies and from SOLAS, and individuals have been invited for a workshop which was to be held in October, 2020 at Nelson Mandela University, Port Elizabeth, South Africa, entitled **"What is the potential role of atmospheric deposition in driving ocean productivity in the Madagascar Channel and Southwest Indian Ocean – an adaptive-dynamic management approach within Large Marine Ecosystems".** Unfortunately, due to COVID-19, this in-person workshop has now been postponed, likely until October, 2021. This workshop, which would include international scientists, managers, and policymakers, would evaluate the atmospheric inputs and impacts of nutrients from biomass burning and industrial emissions, with the following objectives:

- To evaluate the current knowledge of the atmospheric inputs into the southwest Indian Ocean and scientific evidence for the factors that control algal blooms in this region, including the potential role of atmospheric deposition, and the confidence in our understanding of these factors.
- To debate the associated potential impacts and management implications with a broader group of stakeholders/experts (including social scientists and economists)
- To present this information to decision-makers at the senior management and policy level for their response and advice on adaptive management steps
- To identify the feasibility of institutionalising such an adaptive/dynamic management process at the regional level and linking it into national management processes.

- In parallel with this process, to introduce young and emerging scientists to the debate and the science involved and to build capacity for this dialogue within the region.

The workshop will bring together leading scientists who are recognized experts in their field (atmospheric chemists, oceanographers, etc.) to confirm the status of knowledge and its 'confidence' and to identify any emerging trends that may need further resolution. We had already invited a group of senior scientists who had responded very enthusiastically to this workshop plan. This group have also understood the need for a postponement and indicated they still wish to be involved when the workshop is rescheduled. The workshop will also bring in other expertise from the fisheries sector (private and public) as well as socio-economists and environmental managers to elaborate on the implications and discuss potential 'next steps'.

It will also include senior managers and decision-makers (i.e., Permanent Secretaries, Directors-General, Ministers) for their consideration of the management implications and the reality of being able to respond in an adaptive and dynamic manner within their national and/or regional needs and priorities. At the Capacity Building level, the audience will be young undergraduates with science or management majors, graduate students, and early career scientists from Africa with a focus on those having interest/expertise in marine systems and who will hopefully go on to work in this field of science or become managers themselves.

The Workshop has a set of expected Outputs to be delivered both within and beyond the attendees:

- A clearer understanding of the role of atmospheric nutrient input within the southwest Indian Ocean and its possible role as a 'driving' mechanisms for phytoplanktonic blooms and associated food chains
- Positive demonstration to scientists, managers and policy-makers of how a Trends Analysis and 'weight-of-evidence' approach can be used for the furtherance of adaptive/dynamic management to their mutual advantage
- Identification of a process whereby such an adaptive/dynamic management approach could be adopted and used at both the national and regional level.
- Furthermore, if we have sufficient information and an effective 4-day process, we are also considering a 'Special Issue' of papers covering the workshop's results. This special edition would include the relevant new scientific knowledge as presented during the workshop and would lead into a final paper or papers describing the dynamic ecosystem management process.

Development of a workshop on the atmospheric transport of microplastics to and from the ocean

WG 38 has been developing, in cooperation with GESAMP WG 40 (Plastics and Microplastics in the Ocean), a virtual workshop entitled **"The Atmospheric Transport of Microplastics to and from the Ocean"**. We believe that atmospheric transport of microplastics to the ocean may be

a quantitatively important and under-studied aspect of the broader issue of oceanic microplastic pollution. Thus WG 38 and WG 40 are proposing a joint activity - a virtual workshop, with two main goals:

1. Identification of our current understanding and quantitative estimations of the major sources and types of atmospheric microplastics, their atmospheric transport paths, and their inputs to and from the global ocean; and

2. Identification of an appropriate future atmospheric (and marine) sampling and measurement strategy to enable more accurate estimations of the above to be made.

We hope this workshop can help set the research agenda and provide advice to relevant national and international agencies. We are currently identifying a group of approximately 20 individuals to invite to this virtual workshop. Included would be individuals with expertise in the formation and physical form of atmospheric microplastics; atmospheric measurement of microplastics; long range atmospheric transport modelling; dry and wet deposition processes, calculations, and modelling; sea-to-air transport processes of substances (recycling); and possible atmospheric global and regional monitoring sites.

WMO strongly supports this proposed virtual workshop, and we expect it to take place sometime before the end of 2020 and report in early 2021.

Recent publications of WG 38

Smith, S.R., G. Alory, A. Andersson, W. Asher, A. Baker, et al. 2019, "Ship-based contributions to global ocean, weather, and climate observing systems, Frontiers in Marine Science, 6, 434, 10.3389/fmars.2019.00434..

Ito, A., S. Myriokefalalitakis, M. Kanakidou, et al., 2019, "Pyrogenic iron: The missing link to high iron solubility in aerosols", Science Advances, **5**: eaau7671.

Hopkins, F.E., P. Suntharalingam, M. Gehlen, O. Andrews, *et al*., 2020, "The impacts of ocean acidification on marine trace gases and the implications for atmospheric chemistry and climate. Proceeding of the Royal Society A, **476**: 20190769. http://dx.doi.org/10.1098/rspa.2019.0769.

Liss, P.S.,2020, "Microplastics: All up in the air?", Marine Pollution Bulletin, **153,** https://doi.org/10.1016/j.marpolbul.2020.110952.