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REPORTS AND STUDIES



**GESAMP**

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

# REPORT OF THE THIRTY-SIXTH SESSION OF GESAMP

Geneva, 28<sup>th</sup> April-1<sup>st</sup> May 2009



IMO



FAO



UNESCO



IOC



WMO



UNIDO



IAEA



UN



UNEP

## Notes

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**80**



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Environmental Protection

**IMO FAO UNESCO-IOC WMO UNIDO IAEA UN UNEP**

# **REPORT OF THE THIRTY-SIXTH SESSION OF THE GESAMP**

**Held at the headquarters of the World Meteorological  
Organization, Geneva, 28 April to 1 May 2009**

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# CONTENTS

EXECUTIVE SUMMARY .....	5
RÉSUMÉ ANALATIQUE .....	8
RESUMEN EJECUTIVO .....	11
УСТАНОВОЧНОЕ РЕЗЮМЕ .....	14
执行摘要.....	17
19 .....	ملخص تنفيذي
<b>1 INTRODUCTION .....</b>	<b>23</b>
<b>2 REPORT OF THE CHAIRPERSON OF GESAMP .....</b>	<b>23</b>
<b>3 REPORT OF THE ADMINISTRATIVE SECRETARY OF GESAMP .....</b>	<b>25</b>
<b>4 GESAMP POOL OF EXPERTS AND WEB-SITE .....</b>	<b>27</b>
<b>5 GESAMP ACTIVITIES .....</b>	<b>28</b>
5.1 Evaluation of the hazards of harmful substances carried by ships (WG 1) .....	28
5.2 Review of applications for 'active substances' to be used in ballast water management systems (WG 34) .....	30
5.3 Development of activities in relation to deepwater fisheries, fisheries habitat and related ecosystem concerns (WG 35) .....	32
5.4 Development of an ecosystem approach to mariculture (WG 36) .....	32
5.5 Expanded scientific review of mercury and its compounds and threats to the marine environment (WG37) .....	32
5.6 Atmospheric input of chemicals to the ocean (WG38) .....	33
5.7 Global trends in pollution of coastal ecosystems: retrospective ecosystem assessment (WG 39, under consideration) .....	34
<b>6 CONTRIBUTION TO THE ASSESSMENT OF ASSESSMENTS (AOA) UNDER THE 'UN REGULAR PROCESS' .....</b>	<b>35</b>
<b>7 SIDE-EVENT ON "GLOBAL ATMOSPHERIC INPUT OF CHEMICALS TO THE OCEANS" .....</b>	<b>35</b>
<b>8 IDENTIFICATION OF NEW AND EMERGING ISSUES REGARDING THE DEGRADATION OF THE MARINE ENVIRONMENT OF RELEVANCE TO GOVERNMENTS AND SPONSORING ORGANIZATIONS .....</b>	<b>36</b>
<b>9 SCOPING ACTIVITIES FOR GESAMP 37 .....</b>	<b>37</b>
<b>10 FUTURE WORK PROGRAMME .....</b>	<b>38</b>
10.1 Evaluation of the hazards of harmful substances carried by ships .....	38
10.2 Review of proposals for approval of ballast water management systems that make use of 'active substances' .....	38
10.3 Development of an ecosystem approach to mariculture with emphasis on off-shore farming .....	38
10.4 Expanded scientific review of mercury and its compounds and threats to the marine environment .....	38
10.5 Atmospheric input of chemicals to the ocean .....	38
10.6 Global trends in pollution of coastal ecosystems: retrospective ecosystem assessment .....	39
10.7 Other activities .....	39
<b>11 ANY OTHER BUSINESS .....</b>	<b>39</b>

<b>12 DATE AND PLACE OF GESAMP 37</b> .....	<b>40</b>
<b>13 ELECTION OF CHAIRPERSONS</b> .....	<b>40</b>
<b>14 CONSIDERATION AND ADOPTION OF THE REPORT OF GESAMP 36</b> .....	<b>40</b>
<b>15 CLOSURE OF THE SESSION</b> .....	<b>40</b>
 <b>ANNEXES</b>	
Annex I: Agenda.....	41
Annex II: List of documents.....	42
Annex III: List of participants.....	43
Annex IV: Possible Roles for GESAMP in the United Nations Regular Process.....	46
Annex V: Activities and achievements by the Sponsoring Organizations of GESAMP during the intersessional period.....	48
Annex VI: Terms of References for current GESAMP Working Groups.....	58
Annex VII: Template for new GESAMP Working Groups.....	61
Annex VIII: Report from Working Group 36 on “Ecosystem Approach to Offshore Mariculture”.....	62
Annex IX: Report from Working Group 38 on “Global Atmospheric Input of Chemicals to the Oceans”.....	69
Annex X: Scoping paper, Microplastics and associated contaminants – occurrence and potential impact in the oceans.....	74
Annex XI: GESAMP Reports and Studies.....	81

# EXECUTIVE SUMMARY

**1 Introduction:** The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) held its thirty-sixth session at the Headquarters of the World Meteorological Organization (WMO) in Geneva, Switzerland, from 28 April to 1 May 2009. GESAMP was established in 1969 by a number of United Nations Organizations as a Joint Group to encourage the independent, interdisciplinary consideration of marine pollution and environmental protection problems with a view to avoiding duplication of efforts within the United Nations system. The main topics considered at this session are described below.

**2 The revitalization of GESAMP:** Since late 2005, GESAMP has received welcome support from the Swedish International Development Co-operation Agency with the main aim of increasing the participation of developing country experts in the activities of GESAMP. In addition, the Swedish Maritime Administration has seconded, since late 2006, a staff member to act as the GESAMP Officer. This support, together with the establishment of the GESAMP Office at IMO, in October 2007, as a co-sponsoring arrangement between the Sponsoring Organizations of GESAMP, has enabled GESAMP to revitalize itself by reconnecting with the international marine science community and by expanding its advisory activities.

**3 Evaluation of the hazards of harmful substances carried by ships (WG 1):** This Working Group evaluates, at the request of IMO, the hazards to the environment and human health of bulk liquid chemicals carried by ships. Initiated in 1971, the GESAMP hazard evaluation procedure was revised in 1998 and by 2007 all 800 hazard profiles had been revised according to the new GHS compatible procedure (GESAMP Reports and Studies No.64, 2002). The hazard profile contains a unique fingerprint of each substance, providing information on 14 separate, human health, environmental and physico-chemical, hazard criteria. WG 1 decided to prepare a paper for publication focused on the methodology developed for the estimation of inhalation toxicity. Data on inhalation toxicity are often absent, particularly for non-volatile materials and the concern arose that, at elevated temperature and pressure, such products may form an additional hazard by inhalation. GESAMP recommended that WG 1, being almost 40 years in existence, should consider its visibility and means of communication including renaming of the group and the development of outreach products.

**4 Review of applications for 'active substances' to be used in ballast water management systems (WG 34):** WG 34 met on four occasions in the intersessional period to evaluate the risks for the environment, the crew, and the public at large as well as the ships' safety of 14 proposed ballast water management systems. It also held a first 'Stock-taking' Workshop in January 2009

focusing solely on the methodology used for assessments. Several topics were discussed with the aid of external experts, such as the development of a Human Exposure Scenario (HES), the application and parameterisation of an environmental exposure model (MAM-PEC) and the consistency in the application of assessment factors to acute and chronic eco-toxicity tests. WG 34 plans to incorporate the results of the Workshop into the methodology.

**5 Development of activities in relation to deepwater fisheries, fisheries habitat and related ecosystem concerns (WG 35):** GESAMP noted with regret the decision of FAO's Fisheries and Aquaculture Department to discontinue its lead role and technical support for WG 35, due to severe budgetary restrictions. The current development warranted a renewed discussion on a future GESAMP trust fund, to make sure that changing focuses in lead agencies do not have an immediate negative impact on Working Groups and allowing them to finish their intended work.

**6 Development of an ecosystem approach to offshore mariculture (WG 36):** WG 36 has not been able to hold planned meetings in 2008, and would not be able to do so in the current year. Future activities of the WG were therefore only aimed to finalize the WG 36 session report as a general report of the WG activities, which was welcomed by GESAMP.

**7 Expanded scientific review of mercury and its compounds and threats to the marine environment (WG 37):** After UNIDO's announcement in 2008 that it would discontinue its role as the lead agency of WG 37 due to changing policy priorities, GESAMP considered that this WG was very important. After all, WG 37 had already met twice, despite logistical problems, the work was advancing well and it was anticipated that only one more meeting of the 11 experts was needed to produce a report to GESAMP. GESAMP inventorized the currently available support from other Sponsoring Organizations and noted with pleasure UNEP's potential interest in taking over the lead for this WG, in particular by its Global Programme of Action and the Division of Technology, Industry and Economics (DTIE) (the latter is responsible for preparing the Mercury Convention planned for completion in 2013).

**8 Atmospheric input of chemicals to the ocean (WG 38):** In recognition of the growing interest concerning the impact of the atmospheric input of both natural and anthropogenic substances on ocean chemistry, biology and biochemistry, as well as climate, GESAMP reviewed the activities of its WG 38. The Working Group met for the first time in December 2008 and agreed to prepare three separate papers/documents, in the areas of phosphorus, nitrogen, iron and organic matter deposition from the atmosphere to the ocean. The tentative titles of these three papers are:

- (1) "Implications of changing ratios of limiting nutrients in the surface oceans as a result of atmospheric deposition";

- (2) "Uncertainties in iron and phosphorus deposition to the ocean"; and
- (3) "Atmospheric organic materials and the nutrients they carry to the ocean"

WG 38 would meet again in early 2010 to complete the discussions and prepare the papers for publication. In response to the final part of WG 38's terms of reference two letter reports were submitted by GESAMP to WMO in April 2009.

**9 Global trends in pollution of coastal ecosystems: retrospective ecosystem assessment (WG 39, under consideration):** The main objective of this proposed working group is to contribute to the reduction globally of coastal ecosystem stress by providing stakeholders, scientists and society in general with an objective and global assessment of pollution trends during the last century in sensitive coastal ecosystems, through retrospective ecosystem analysis, by using dated environmental archives and time-series data where available. Following discussion of an initial proposal by IAEA at GESAMP 35, and an agreement on the relevance of this tool for coastal zone managers, GESAMP 36 noted the present status and thanked the IAEA for proceeding cautiously to secure funding for the working group. Some members showed concerns about the ambition of the goals of the working group, but IAEA noted that the work should be based on published results and that, in any case, feasible terms of reference should be developed for approval in future by GESAMP.

**10 Contribution to the United Nations 'Regular Process':** GESAMP received a report on the latest developments and status of the UN Regular Process and its start-up phase, the so-called Assessment of Assessments (AoA), due for a decision by the UN General Assembly in December 2009. The discussions that followed focused on possible roles for GESAMP in the Regular Process and led to a position paper being produced (see Annex IV to this report) for distribution to the Sponsoring Organizations of GESAMP, in particular UN-DOALOS.

**11 Side-event on "Global Atmospheric Input of Chemicals (nutrients) to the Ocean":** This special session was intended to highlight a scientific issue, high on the agenda of the host organization WMO, and to spread some light on how WG 38 is assisting WMO in its efforts. In all three presentations given, the issue of iron input from the atmosphere was considered from different perspectives: (1) as a component of the natural aerosol; (2) as a compound affected by pollution; and (3) as subject of modeling parameterization. GESAMP appreciated this overview of emerging research, noting the quality of the research and agreed to post the three presentations on its web-site.

**12 Identification of new and emerging issues regarding the degradation of the marine environment:** One of GESAMP's core functions is the

identification of new and emerging issues regarding the state of the marine environment and to consider and frame any such issues of concern so that they can be evaluated and brought to the attention of Governments, Sponsoring Organizations and the scientific community in general. The following four issues were raised and discussed by GESAMP.

#### 12.1 *Bioaccumulation in top predators*

One of the members brought to GESAMP's attention the need for a review of the current state of contaminant biomagnification in marine top predators, including mammals, cartilaginous fishes and other groups. The following title was proposed: "Bioaccumulation of contaminants in marine top predators in relation to human health - a global review". A correspondence group was set up to produce terms of reference for further consideration by GESAMP on the justification for forming a new working group or other appropriate action, including recommendations for further research, the expertise needed to explore this issue, as well as for the identification of potential sponsors.

#### 12.2 *Environmental Quality Standards (EQS)*

Another member of GESAMP suggested the development of a global database for Environmental Quality Standards on contaminants in the marine environment. While not strictly speaking an emerging issue, this could provide a useful global service to fill a gap and allow administrations to rapidly check which EQS already apply in other regions. GESAMP agreed that a correspondence group should:

- (1) compile a comprehensive database of current EQS and make them available on the GESAMP web-site;
- (2) promote the GESAMP web-site as the premier link when searching for EQS; and
- (3) prepare a thorough synthesis of current EQS data, including comparison of POPs data (initially for the 12 chemicals listed in the Stockholm Convention) (<http://chm.pops.int>). The results should then be presented to GESAMP 37 with recommendations for future developments.

#### 12.3 *Hypoxia and biological effects*

One GESAMP member, following introduction of this topic at GESAMP 35 had provided a thorough exposition of the effects that low levels of oxygen can have on the endocrine systems in marine organisms, noting that hypoxic regions in the world's oceans have increased in the last decades. GESAMP considered that it needed to be clarified as to whether there was sufficient information to enable an assessment on the topic to be carried out, or whether the issue needed further time to develop. A correspondence group was set up to look at "hypoxia in the marine environment and its implications at ecosystem and eco-physiological level".

#### 12.4 *Mapping for environmental indicators*

It was suggested that GESAMP is in an excellent position to develop a global and visually descriptive product (GIS) of relevant parameters related to the quality of the marine environment accompanied by



synthesis and/or comments on the observations through the medium of its web-site. This could be important for decision- and policy-makers and the public in general, and would therefore be an important outreach product. GESAMP noted that this would indeed be a very interesting product, but might be a large undertaking needing significant funding. It was suggested that GESAMP could take into consideration the work being done by other institutions and, in a first phase, GESAMP could host a metadata site linking to products produced by other institutions. It was agreed to place this issue on the agenda for GESAMP 37. (Editors note: this latter activity has since GESAMP 36 been pursued as part of the GEF/UNEP/IOC led Transboundary Waters Assessment Programme (TWAP) of which GESAMP is a Key contributor.)

### **13 Scoping activities for GESAMP 37:**

Regarding the three new and emerging issues listed under paragraphs 12.1 to 12.3 above GESAMP confirmed the organizational arrangements for

correspondence groups to report to GESAMP 37. In addition, a correspondence group was established on the topic of "Micro-plastics as a vector in transporting persistent and toxic substances" following GESAMP's discussion of the scoping paper shown in annex X to this report. This correspondence group was requested to prepare a workshop to review the subject and develop the terms of reference for an eventual working group.

**14 Other issues:** GESAMP received a request for advice from IMO regarding wash-water discharge criteria from exhaust gas cleaning systems on board ships. It was agreed to complete this advice by correspondence and to convey GESAMP's recommendations in this manner to MEPC. GESAMP also received a request from IMO to peer review a report on the equivalence of Ballast Water Management Systems not depending on chemical substances. GESAMP agreed to peer review this report by correspondence once IMO had further clarified the exact nature of the request.

# RÉSUMÉ ANALYTIQUE

**1 Introduction :** Le Groupe mixte d'experts chargé d'étudier les aspects scientifiques de la protection du milieu marin (GESAMP) a tenu sa trente-sixième session au siège de l'Organisation météorologique mondiale (OMM) à Genève, Suisse, du 28 avril au 1er mai 2009. Le GESAMP a été constitué en 1969 par différents organismes des Nations Unies en tant que groupe mixte pour favoriser l'étude indépendante et interdisciplinaire de la pollution marine et des problèmes de protection de l'environnement, en vue d'éviter le chevauchement des travaux dans le système des Nations Unies. Les principaux points abordés lors de cette session sont présentés ci-après.

**2 La revitalisation du GESAMP :** Depuis la fin de 2005, le GESAMP reçoit le soutien fort utile de l'Agence suédoise de coopération internationale au développement, dans l'objectif principal d'accroître la participation d'experts de pays en développement à ses activités. En outre, l'administration maritime suédoise maintient en détachement, depuis la fin de 2006, un fonctionnaire chargé de remplir les fonctions d'agent du GESAMP. Ce soutien, conjugué à la création d'un bureau du GESAMP à l'OMI, en octobre 2007, dans le cadre d'un arrangement de coparrainage entre les organismes coparrainants du GESAMP, a permis au GESAMP de se donner un nouveau souffle en réactivant ses liens avec la communauté internationale des sciences de la mer et en élargissant ses activités consultatives.

**3 Évaluation des risques liés aux substances nocives transportées par les navires :** (WG 1) : Ce Groupe de travail évalue, à la demande de l'OMI, les risques que posent pour l'environnement et la santé humaine les produits chimiques liquides transportés en vrac sur des navires. Lancée en 1971, la procédure d'évaluation des risques du GESAMP a été révisée en 1998 et, dès 2007, les 800 profils de risques avaient tous été révisés conformément à la nouvelle procédure compatible avec le Système général harmonisé (Rapports et études du GESAMP N° 64, 2002). Le profil de risques contient une empreinte unique de chaque substance, qui fournit des renseignements sur 14 critères distincts de risques pour la santé humaine, pour l'environnement et de risques physico-chimiques. Le Groupe de travail 1 a décidé de préparer un document pour publication, axé sur la méthodologie élaborée pour l'estimation de la toxicité par inhalation. Souvent on ne dispose pas de données sur la toxicité par inhalation, en particulier pour les matières non volatiles, et des craintes se sont fait jour au sujet du fait que, dans des conditions de températures et de pressions élevées, ces produits peuvent constituer un risque supplémentaire par inhalation. Le GESAMP a recommandé que le Groupe de travail 1, après presque 40 ans d'existence, réexamine sa visibilité et ses moyens de communication, y compris un changement de nom du groupe, et qu'il élabore des produits de sensibilisation.

**4 Examen des demandes concernant les "substances actives" à utiliser dans les systèmes de gestion des eaux de ballast (WG 34) :** Le Groupe de travail 34 s'est réuni à quatre reprises pendant l'intersession pour évaluer les risques que peuvent présenter les 14 systèmes proposés de gestion des eaux de ballast pour l'environnement, les équipages et le grand public ainsi que pour la sécurité des navires. Le Groupe a également tenu un premier atelier de bilan en janvier 2009, consacré uniquement aux méthodes d'évaluation. Plusieurs sujets ont été examinés avec le concours d'experts externes, par exemple le développement d'un scénario d'exposition humaine, l'application et la paramétrisation d'un modèle d'exposition environnementale (MAM-PEC) et l'uniformité de l'application des facteurs d'évaluation aux tests d'écotoxicité aiguë et chronique. Le Groupe de travail 34 prévoit d'incorporer les résultats de l'atelier dans la méthodologie.

**5 Développement des activités concernant les questions liées à l'habitat et à la pêche en eau profonde, ainsi qu'aux écosystèmes associés (WG 35) :** Le GESAMP a noté avec regret la décision du Département de la pêche et de l'aquaculture de la FAO de mettre fin à son rôle d'organisme pilote ainsi qu'au soutien technique qu'il apportait au Groupe de travail 35, en raison de graves restrictions budgétaires. Ce fait nouveau que l'on réexamine la question d'un futur fonds d'affectation spéciale pour le GESAMP, afin de s'assurer que les changements d'orientations au sein des institutions pilotes n'ont pas d'incidence négative immédiate sur les groupes de travail et leur permettent d'achever les travaux prévus.

**6 Élaboration d'une approche écosystémique de la mariculture au large des côtes (WG 36) :** Le Groupe de travail 36 n'a pas été en mesure de tenir les réunions planifiées en 2008 et ne sera pas en mesure de le faire au cours de cette année. Les activités futures du Groupe de travail n'avaient donc comme objectif que le parachèvement du rapport du Groupe de travail 36 à la session, sous forme d'un rapport général sur les activités du Groupe de travail, qui a été bien accueilli par le GESAMP.

**7 Examen scientifique élargi du mercure et de ses composés et des menaces qu'ils représentent pour le milieu marin (WG 37) :** Après l'annonce par l'ONUDI en 2008 de son retrait de son rôle d'institution pilote du Groupe de travail 37 en raison de l'évolution des priorités politiques, le GESAMP a estimé que ce Groupe de travail était très important. Après tout, le Groupe de travail 37 s'était déjà réuni deux fois, en dépit de problèmes logistiques, les travaux avançaient bien et on prévoyait qu'il ne faudrait qu'une réunion supplémentaire des 11 experts afin de produire un rapport pour le GESAMP. Le GESAMP a fait l'inventaire du soutien qu'apportent actuellement d'autres organismes coparrainants et a noté avec plaisir que le PNUE était potentiellement intéressé à piloter ce Groupe de travail, en particulier dans le cadre de son Programme d'action mondial et de la Division technologie, industrie et économie

(DTIE) (cette dernière est chargée de préparer la Convention sur le mercure dont l'achèvement est prévu en 2013.

**8 Apport atmosphérique de produits chimiques dans l'océan (WG 38) :** Tenant compte de l'intérêt croissant que suscite l'impact de l'apport atmosphérique de substances naturelles et anthropiques sur la chimie de l'océan, la biologie et la biochimie, ainsi que sur le climat, le GESAMP a examiné les activités de son Groupe de travail 38. Le Groupe de travail s'est réuni pour la première fois en décembre 2008 et est convenu de préparer trois notes/documents distincts sur les questions de l'apport de phosphore, d'azote, de fer et de substances organiques de l'atmosphère dans l'océan. Les titres provisoires de ces trois notes sont :

- 1) "Incidences des changements des taux de nutriments limitants à la surface des océans par suite du dépôt atmosphérique" ;
- 2) "Incertitudes sur l'apport de fer et de phosphore dans l'océan" ;
- 3) "Matières organiques atmosphériques et les nutriments qu'elles apportent dans l'océan".

Le Groupe de travail 38 devait se réunir à nouveau au début de 2010 afin d'achever les discussions et de préparer les notes en vue de leur publication. Conformément à la dernière partie du mandat du Groupe de travail 38, deux rapports/lettres ont été soumis par le GESAMP à l'OMM en avril 2009.

**9 Tendances mondiales de la pollution des écosystèmes côtiers : évaluation rétrospective des écosystèmes (WG 39, à l'étude) :** L'objectif principal de ce groupe de travail proposé est de contribuer à la réduction mondiale des pressions exercées sur les écosystèmes côtiers en fournissant aux parties prenantes, aux scientifiques et à la société en général une évaluation objective et globale des tendances de la pollution au cours du dernier siècle dans les écosystèmes côtiers sensibles, grâce à une analyse rétrospective des écosystèmes, en utilisant de vieilles archives environnementales et des séries chronologiques disponibles. À la suite de discussions sur une proposition initiale faite par l'AIEA à la trente-cinquième session du GESAMP, et d'un accord sur la pertinence de cet outil pour les responsables de zones côtières, la trente-sixième session du GESAMP a pris note de l'état actuel des choses et a remercié l'AIEA d'avoir agi prudemment afin de s'assurer du financement pour le Groupe de travail. Certains membres ont exprimé leur inquiétude quant à l'ambition des objectifs du Groupe de travail, mais l'AIEA a noté que les travaux devraient être fondés sur des résultats publiés et que, de toute façon, un mandat faisable devrait être élaboré en vue son approbation future par le GESAMP.

**10 Contribution au "Mécanisme régulier" des Nations Unies :** Le GESAMP a reçu un rapport sur l'évolution récente et l'état du mécanisme régulier des Nations Unies et de sa phase initiale,

appelée Évaluation des évaluations (AoA), au sujet de laquelle une décision de l'Assemblée générale des Nations Unies était attendue en décembre 2009. Les discussions qui ont suivi ont porté principalement sur les rôles possibles du GESAMP dans le Mécanisme régulier et ont abouti à la rédaction d'une déclaration de principe (voir annexe IV du présent rapport) qui sera distribuée aux organismes coparainants du GESAMP, en particulier la Division des affaires maritimes et du droit de la mer du Bureau des affaires juridiques du Secrétariat des Nations Unies (UN-DOALOS).

**11 Manifestation parallèle sur "l'Apport atmosphérique mondial de produits chimiques (nutriments) dans l'océan" :** Cette session spéciale avait pour objectif d'appeler l'attention sur une question scientifique, à laquelle l'Organisation hôte, l'OMM, attache une grande importance, et de jeter quelque lumière sur la façon dont le Groupe de travail 38 aide l'OMM dans ses efforts. Dans les trois présentations qui ont été faites, la question de l'apport de fer atmosphérique a été examinée sous des angles différents : 1) comme composant de l'aérosol naturel ; 2) comme composant touché par la pollution ; 3) comme objet de paramétrisation pour la modélisation. Le GESAMP a apprécié cet aperçu de la recherche émergente, en notant la qualité de la recherche et est convenu d'afficher les trois présentations sur son site web.

**12 Identification des questions nouvelles et émergentes concernant la dégradation de l'environnement du milieu marin :** L'une des fonctions principales du GESAMP consiste à identifier les questions nouvelles et émergentes concernant l'état du milieu marin et d'examiner et de cadrer les sujets préoccupants afin qu'ils puissent être évalués et portés à l'attention des gouvernements, des organisations de parrainage et de la communauté scientifique en général. Les quatre sujets ci-après ont été abordés et examinés par le GESAMP.

#### 12.1 *Bioaccumulation chez les grands prédateurs*

L'un des membres a appelé l'attention du GESAMP sur la nécessité d'un examen de l'état actuel de la biomagnification des contaminants chez les grands prédateurs marins, y compris les mammifères, les chondrichthyens et d'autres groupes. Le titre suivant a été proposé : "La bioaccumulation de contaminants chez les grands prédateurs et la santé humaine – examen mondial". Un groupe de correspondance a été institué pour préparer un mandat pour examen complémentaire par le GESAMP lorsqu'il étudiera la justification d'une part de la création d'un nouveau groupe de travail ou autres mesures appropriées, y compris des recommandations concernant d'autres recherches et l'expertise nécessaire pour l'étude de cette question et d'autre part de la recherche de donateurs potentiels.

#### 12.2 *Normes de qualité environnementale*

Un autre membre du GESAMP a proposé que soit élaborée une base de données mondiale pour

les normes de qualité environnementale pour les contaminants dans le milieu marin. Même s'il ne s'agit pas à proprement parler d'une question émergente, l'élaboration de cette base pourrait être un service mondial utile pour combler une lacune et permettre aux administrations de vérifier rapidement quelles normes de qualité environnementale s'appliquent déjà dans d'autres régions. Le GESAMP est convenu qu'un groupe de correspondance devrait : 1) constituer une base de données complète sur les normes de qualité environnementale actuelles et les mettre à disposition sur le site web du GESAMP ; 2) promouvoir le site web du GESAMP comme principal lien lors de la recherche de normes de qualité environnementale et 3) préparer une synthèse complète des données actuelles sur les normes de qualité environnementale, notamment la comparaison des données sur les polluants organiques persistants (POP) (initialement pour les 12 produits chimiques inscrits dans la Convention de Stockholm) (<http://chm.pops.int>). Les résultats devraient alors être présentés à la trente-septième session du GESAMP, avec des recommandations d'actions futures.

### 12.3 *Hypoxie et effets biologiques*

Un membre du GESAMP, à la suite de l'inscription de ce point à la trente-cinquième session du GESAMP, avait communiqué un exposé complet des effets que peuvent avoir de faibles niveaux d'oxygène sur les systèmes endocriniens dans les organismes marins, en faisant remarquer que les régions hypoxiques dans les océans du monde ont augmenté au cours des dernières décennies. Le GESAMP a estimé qu'il fallait clarifier la question de savoir s'il y avait suffisamment de renseignements pour permettre de procéder à une évaluation de la question ou s'il fallait encore du temps pour laisser mûrir la question. Un groupe de correspondance a été créé pour examiner la question de l'"hypoxie dans le milieu marin et ses incidences au niveau des écosystèmes et au niveau éco-physiologique".

### 12.4 *Cartographie des indicateurs environnementaux*

Certains ont estimé que le GESAMP était en excellente position pour élaborer un produit mondial et visuellement descriptif (SIG) des paramètres pertinents concernant la qualité du milieu marin, accompagné de synthèses et/ou de commentaires sur les observations à publier sur son site web. Un tel travail pourrait être important pour les décideurs et le public en général, et constituerait donc un important

produit de sensibilisation. Le GESAMP a noté que ce serait en effet un produit très intéressant mais que cela pourrait être un projet de grande ampleur pour lequel il faudrait un important financement. Il a été suggéré que le GESAMP prenne en compte les travaux actuellement réalisés par d'autres institutions : dans une première phase, le GESAMP pourrait accueillir un site de métadonnées avec des liens vers les produits fabriqués par d'autres institutions. Il a été convenu d'inscrire cette question à l'ordre du jour de la trente-septième session du GESAMP. (Note des rédacteurs : depuis la trente-sixième session du GESAMP cette dernière activité est menée dans le cadre du Programme d'évaluation des eaux transfrontières, conduit par le Fonds pour l'environnement mondial, le Programme des Nations Unies pour l'environnement et la Commission océanographique intergouvernementale et dont le GESAMP est un des principaux contributeurs).

**13 Cadrage des activités de la trente-septième session du GESAMP :** En ce qui concerne les trois questions nouvelles et émergentes énumérées aux paragraphes 12.1 à 12.3 ci-dessus, le GESAMP a confirmé les dispositions organisationnelles pour que les groupes de correspondance fassent rapport à la trente-septième session du GESAMP. En outre, un groupe de correspondance a été créé sur la question "Les micro-plastiques comme vecteur du transport de substances persistantes et toxiques", à la suite de l'examen par le GESAMP de la note de cadrage reproduite à l'annexe X du présent rapport. Ce groupe de correspondance a été invité à préparer un atelier pour examiner la question et établir le mandat d'un éventuel groupe de travail.

**14 Autres questions :** Le GESAMP a reçu une demande d'avis de l'OMI sur les critères de déversement des eaux de lavage provenant des systèmes d'épuration des gaz d'échappement à bord des navires. Il a été convenu d'achever cet avis par correspondance et de transmettre les recommandations du GESAMP également par correspondance au Comité de la protection du milieu marin (MEPC). Le GESAMP a également reçu de l'OMI une demande d'examen par les pairs d'un rapport sur l'équivalence des systèmes de gestion des eaux de ballast qui n'ont pas besoin de substances chimiques. Le GESAMP est convenu de soumettre ce rapport à un examen collégial par correspondance une fois que l'OMI aura clarifié plus avant la nature exacte de la demande.

# RESUMEN EJECUTIVO

**1. Introducción:** El Grupo Mixto de Expertos sobre los Aspectos Científicos de la Protección del Medio Marino (GESAMP) celebró del 28 abril al 1 mayo 2009 su trigésimosexto periodo de sesiones en la sede de la Organización Meteorológica Mundial (OMM), en Ginebra (Suiza). El GESAMP fue creado en 1969 por varias organizaciones de la ONU como un grupo mixto cuyo objetivo consistía en fomentar el estudio independiente e interdisciplinario de la contaminación marina y de los problemas de protección medioambiental, y en evitar la duplicación de tareas en el seno del sistema de las Naciones Unidas. A continuación se facilita una descripción de las principales cuestiones examinadas durante la reunión.

**2. La revitalización del GESAMP:** Desde finales de 2005, se agradece a la Agencia Sueca de Cooperación Internacional para el Desarrollo el apoyo que está brindando al GESAMP, principalmente con el objetivo de incrementar la participación de expertos de los países en desarrollo en las actividades del Grupo Mixto. Además, desde 2006, la Administración Marítima de Suecia tiene a uno de sus funcionarios adscrito a la plantilla del GESAMP. Ese apoyo y el establecimiento, en octubre de 2007, de una oficina del GESAMP en la Organización Marítima Internacional (OMI) han permitido una revitalización del Grupo Mixto gracias a su reconexión con la comunidad internacional de ciencias marítimas y a la ampliación del alcance de sus actividades consultivas.

**3. Evaluación de los riesgos que entrañan las sustancias perjudiciales transportadas por los buques (Grupo de trabajo 1):** Este grupo de trabajo se encarga de evaluar, a petición de la OMI, los riesgos que representan para el medio ambiente y la salud humana el transporte por buques de importantes cantidades de productos químicos líquidos. Implantado en 1971, el procedimiento aplicado por el GESAMP para la evaluación de riesgos fue revisado en 1998, y para 2007 se habían examinado los 800 perfiles de riesgo de conformidad con un nuevo procedimiento compatible con el Sistema Mundialmente Armonizado (Informes y estudios del GESAMP, N° 64, 2002). El perfil de riesgo facilita una huella única para cada sustancia, y proporciona información sobre 14 diferentes criterios de riesgos sanitarios, medioambientales y físicoquímicos. El Grupo de trabajo 1 decidió preparar y publicar un documento sobre la metodología aplicada para estimar la toxicidad de las inhalaciones. A menudo, suelen escasear los datos sobre toxicidad de las inhalaciones, en particular en lo referente a materiales no volátiles, y existe la inquietud de que, en caso de elevarse la temperatura y la presión, la inhalación de ese tipo de productos pueda representar un peligro adicional. El GESAMP recomendó que tras casi 40 años de existencia el Grupo de trabajo 1 debiera examinar su imagen y los medios de comunicación que utiliza, en particular en lo relacionado con un nuevo nombre para el grupo y el diseño de productos de divulgación.

**4. Revisión de las aplicaciones de “sustancias activas” que se utilizan en los sistemas de gestión de agua de lastre (Grupo de trabajo 34):** Durante el período entre sesiones el Grupo de trabajo 34 se ha reunido en cuatro ocasiones para evaluar los riesgos que los 14 sistemas propuestos de gestión de agua de lastre entrañan para el medio ambiente, la tripulación y la población en general así como para la seguridad de los buques. Asimismo, en enero de 2009, organizó un primer cursillo para hacer un balance de la situación, centrándose exclusivamente en la metodología aplicada para las evaluaciones. Con ayuda de expertos externos, se examinaron diversas cuestiones como la creación de un escenario de exposición humana, la utilización y el establecimiento de parámetros para un modelo de exposición medioambiental, y la consistencia de los factores de evaluación aplicados para pruebas de ecotoxicidad aguda y crónica. El Grupo de trabajo 34 tiene planeado incorporar los resultados del cursillo en la metodología.

**5. Actividades relacionadas con la pesca en aguas profundas, el hábitat de las actividades pesqueras y los problemas conexos del ecosistema (Grupo de trabajo 35):** El GESAMP tomó nota con pesar de la decisión del Departamento de Pesca y Acuicultura de la Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO) de, a causa de importantes restricciones presupuestarias, no seguir asumiendo la dirección del Grupo de trabajo 35 y brindándole apoyo técnico. Estos acontecimientos implican sin duda alguna que se estudie de nuevo la creación de un futuro fondo fiduciario del GESAMP destinado a garantizar que los cambios de orientación de los principales organismos no tengan un efecto negativo inmediato sobre los grupos de trabajo, y que éstos últimos puedan terminar las tareas que les hayan sido asignadas.

**6. Evolución de un concepto ecosistémico de la maricultura mar adentro (Grupo de trabajo 36):** El grupo de trabajo 36 no pudo celebrar las reuniones planeadas para 2008 y no podría hacerlo durante el año corriente. Por lo tanto, las futuras actividades del Grupo de trabajo únicamente se han centrado en terminar el informe de la reunión bajo forma de un informe general sobre las actividades del Grupo, del cual el GESAMP tomó nota con satisfacción.

**7. Ampliación del análisis científico del mercurio y de sus compuestos así como de la amenaza que entrañan para el medio ambiente marino (Grupo de trabajo 37):** Después de que la Organización de las Naciones Unidas para el Desarrollo Industrial (ONUDI) notificara que tenía que renunciar a su papel de organismo director del Grupo de trabajo 37 a causa del cambio de prioridades políticas, el GESAMP estimó que este Grupo de trabajo era muy importante. Después de todo, dicho Grupo ya se había reunido dos veces a pesar de los problemas logísticos y su trabajo estaba progresando satisfactoriamente. Además, según lo previsto, sólo iba a ser necesario que los expertos

se reunieran una vez más para producir su informe y presentárselo al GESAMP. El Grupo mixto realizó un inventario de los apoyos con los que actualmente se podía contar por parte de otras organizaciones patrocinadoras y tomó nota con beneplácito de la posibilidad de que el Programa de las Naciones Unidas para el Medio Ambiente (PNUMA) estuviera interesado en asumir la dirección de este Grupo de trabajo, en particular a través de su Programa de Acción Mundial y de su División de Tecnología, Industria y Economía (esta última es la encargada de preparar el convenio sobre el mercurio que deberá completarse en 2013).

**8. Entrada en el océano de sustancias químicas provenientes de la atmósfera (Grupo de trabajo 38):** Teniendo en cuenta la preocupación cada vez mayor por los efectos de las aportaciones de sustancias naturales y antropogénicas sobre los procesos químicos, biológicos y biogeoquímicos de los océanos, así como sobre el clima, el GESAMP volvió a examinar las actividades de su Grupo de trabajo 38. Este Grupo se reunió por primera vez en diciembre de 2008 y acordó preparar tres documentos diferentes que tratarían por separado de las deposiciones en el océano de fósforo, nitrógeno hierro y materias orgánicas provenientes de la atmósfera. Los títulos provisionales de estos documentos son:

- 1) Implicaciones de los cambios del porcentaje de nutrientes limitantes en la superficie de los océanos como resultado de deposiciones de sustancias provenientes de la atmósfera;
- 2) Incertidumbres sobre las deposiciones de hierro y fósforo en el océano; y
- 3) Materias orgánicas provenientes de la atmósfera y los nutrientes que aportan al océano.

El Grupo de trabajo 38 tendría que reunirse de nuevo a principios de 2010 para completar los debates y preparar los documentos para su publicación. En abril de 2009, en respuesta a la última parte del mandato del Grupo de trabajo 38, el GESAMP presentó a la OMM dos informes resumidos.

**9. Tendencias mundiales de la contaminación de los ecosistemas costeros:** evaluación retrospectiva de ecosistemas (Grupo de trabajo 39, objeto de estudio): el principal objetivo de este Grupo de trabajo propuesto consistiría en contribuir a reducir a escala mundial el estrés del ecosistema costero, facilitando a las partes interesadas, científicos y sociedad en general una evaluación objetiva de las tendencias mundiales de la contaminación durante los últimos 100 años en ecosistemas litorales sensibles, mediante un análisis retrospectivo del ecosistema y utilizando, cuando existan, archivos fechados del medio ambiente y datos de series temporales. Tras debatir sobre una propuesta inicial presentada por el Organismo Internacional de Energía Atómica (OIEA) en el GESAMP 35, y llegar a un acuerdo sobre la importancia de esta herramienta para los encargados de la gestión de las zonas costeras, el GESAMP 36 tomó nota de la situación actual y agradeció al OIEA que procediera a reunir cuidadosamente los fondos

para este grupo de trabajo. Algunos de los miembros manifestaron la preocupación de que los objetivos de dicho grupo fueran demasiado ambiciosos, pero el OIEA señaló que la tarea se tendría que basar en resultados ya publicados y que, en cualquier caso, se tendría que establecer un mandato viable para que el GESAMP lo aprobara en el futuro.

**10. Contribución al “Proceso Regular” de las Naciones Unidas:** El GESAMP ha recibido un informe sobre los últimos progresos y la situación del Proceso Regular de las Naciones Unidas y sobre su fase de lanzamiento llamada Evaluación de evaluaciones, iniciada a raíz de una decisión adoptada en diciembre de 2009 por la Asamblea General de la ONU. Ulteriormente, el debate se centró sobre las posibles funciones que el GESAMP podría desempeñar en el Proceso Regular y los resultados conformarán un documento de posición que se tiene que redactar (véase Anexo IV a este informe) para ser distribuido a las organizaciones patrocinadoras del GESAMP, y en particular para la División de Asuntos Oceánicos y del Derecho del Mar de la ONU.

**11. Acto paralelo sobre la “Entrada en el océano de sustancias químicas (nutrientes) provenientes de la atmósfera global”:** Se organizó esta reunión especial con la intención de destacar un problema científico que ocupa un lugar prioritario en el orden del día de la organización anfitriona, la Organización Meteorológica Mundial, y para ilustrar, en cierta medida, la forma en que el Grupo de trabajo 38 está prestando ayuda a la OMM en el desempeño de su labor. En las tres presentaciones que se ofrecieron se analizó la cuestión de la aportación de hierro proveniente de la atmósfera desde diferentes perspectivas, a saber:

- 1) como un componente del aerosol natural;
- 2) como un componente afectado por la contaminación; y
- 3) como un sujeto para la parametrización de modelos. El GESAMP se mostró complacido con este panorama de nuevas investigaciones, señaló la calidad de las mismas y estuvo de acuerdo en publicar estas tres exposiciones en su sitio web.

**12. Identificación de nuevos problemas emergentes relacionados con la degradación del medio ambiente marino:** Una de las principales funciones del GESAMP consiste en identificar los nuevos problemas emergentes relacionados con el estado del medio ambiente marino, y estudiar y definir estas cuestiones alarmantes para poder evaluarlas y llamar la atención sobre las mismas de gobiernos, de organizaciones patrocinadoras y de la comunidad científica en general. Fueron cuatro los puntos que se presentaron y que el GESAMP examinó, a saber:

#### 12.1 *Bioacumulación en los depredadores finales*

Uno de los miembros llamó la atención del GESAMP sobre la necesidad de analizar el estado actual de la ampliación biológica contaminante de los depredadores marinos finales, entre los cuales

figuran mamíferos, peces cartilagosos y otros grupos. Se propuso el título siguiente: Bioacumulación contaminante en los depredadores marinos finales en relación con la salud humana - una evaluación mundial. Se creó un grupo de correspondencia encargado de establecer un mandato que se presentaría al GESAMP, justificando la formación de un nuevo grupo de trabajo u otra acción pertinente e incluyendo recomendaciones para futuras investigaciones, los conocimientos de expertos necesarios para examinar la cuestión así como la identificación de patrocinadores potenciales.

#### 12.2 Normas de calidad del medio ambiente

Otro miembro del GESAMP propuso crear una base de datos mundial de normas de calidad del medio ambiente sobre contaminantes del medio ambiente marino. Aunque no se trate propiamente dicho de un asunto nuevo, ello podría ofrecer un servicio mundial útil para llenar un vacío y permitir que las administraciones puedan comprobar rápidamente las normas de calidad del medio ambiente que se apliquen en otras regiones. El GESAMP estuvo de acuerdo en que un grupo de correspondencia debería encargarse de:

- 1) recopilar una base de datos exhaustiva de las actuales normas de calidad del medio ambiente y ponerlas a disposición en el sitio web del GESAMP;
- 2) promover el sitio web del GESAMP para que sea el vínculo principal cuando se estén buscando datos sobre normas de calidad del medio ambiente; y
- 3) preparar una síntesis minuciosa de los datos sobre normas de calidad del medio ambiente actuales, en particular una comparación de los datos sobre contaminantes orgánicos persistentes (COP) – para empezar, sobre las 12 sustancias químicas que figuran en la lista de la Convención de Estocolmo (<http://chm.pops.int>). Los resultados deberían entonces presentarse al GESAMP 37 junto con las recomendaciones para seguir progresando en el futuro.

#### 12.3 Hipoxia y efectos biológicos

Tras la introducción de esta problemática en el GESAMP 35, uno de los miembros del Grupo presentó una detallada exposición de los efectos que pueden producir los bajos niveles de oxígeno sobre los sistemas endocrinos de los organismos marinos, señalando que estos últimos decenios las regiones hipóxicas se han multiplicado en todos los océanos. El GESAMP estimó que era necesario aclarar si la información existente era suficiente para poder llevar a cabo una evaluación en la materia o si era necesario disponer de más tiempo para completar los datos disponibles. Se estableció un grupo de correspondencia para estudiar la “hipoxia en el medio ambiente marino y sus consecuencias a escala ecosistémica y ecofisiológica”.

#### 12.4 Proyección de indicadores medioambientales

Se apuntó que el GESAMP, a través de su sitio web, estaba en excelente posición para desarrollar un producto mundial y visualmente descriptivo de parámetros pertinentes relacionados con la calidad del medio ambiente marino, acompañado por una síntesis y/o comentarios sobre observaciones. Ello podría ser importante para los encargados de la toma de decisiones y de políticas, así como para la población en general y, por lo tanto, podría ser un producto de divulgación destacado. El GESAMP señaló que tal vez fuera efectivamente un producto muy interesante, aunque también podría conllevar una tarea considerable que precisaría de una fuerte financiación. Se propuso que el GESAMP tuviera en cuenta la labor que están realizando otras instituciones y que, en una primera fase, albergara un sitio de metadatos con vínculos a productos ofrecidos por otras instituciones. Se acordó incluir este punto en el orden del día del GESAMP 37. (Nota del editor: a partir del GESAMP 36, esta última actividad se ha llevado a cabo como parte del Programa de Evaluación de las Aguas Transfronterizas dirigido conjuntamente por el Fondo para el Medio Ambiente Mundial (FMAM), el PNUMA y la Comisión Oceanográfica Intergubernamental (COI), y al cual el GESAMP aporta una notable contribución).

#### 13. Panorama general de las actividades para el GESAMP 37:

En lo referente a las tres nuevas cuestiones emergentes que figuran en los párrafos supra 12.1 a 12.3, el GESAMP confirmó las disposiciones organizacionales adoptadas para que los grupos de correspondencia informaran al GESAMP 37. Además, tras el debate del GESAMP sobre el informe presentado en el anexo X a este informe, se estableció un grupo de correspondencia sobre el problema de los “microplásticos como vectores de transporte de sustancias persistentes y tóxicas”. Se solicitó a este grupo de correspondencia que preparara un cursillo para examinar el asunto y establecer el mandato de un posible grupo de trabajo.

**14. Otros asuntos:** La OMI solicitó asesoramiento al GESAMP con referencia a criterios para la descarga de aguas de lavado de los sistemas de limpieza de los gases de escape a bordo de los buques. Se acordó que este asesoramiento se completaría por correspondencia y que de esa forma se presentarían las recomendaciones del GESAMP al Comité de Protección del Medio Marino (CPMM). Asimismo, la OMI pidió al GESAMP que efectuara una revisión de pares del informe sobre la equivalencia de los sistemas de gestión de aguas de lastre no dependientes de sustancias químicas. El GESAMP aceptó llevar a cabo por correspondencia esta revisión una vez que la OMI hubiera aclarado la naturaleza exacta de la solicitud.

# УСТАНОВОЧНОЕ РЕЗЮМЕ

**1 Введение:** Объединенная группа экспертов по научным аспектам охраны морской среды (ГЕЗАМП) провела свою тридцать шестую сессию в штаб-квартире Всемирной Метеорологической Организации (ВМО) в Женеве, Швейцария, с 28 апреля по 1 мая 2009 г. ГЕЗАМП была учреждена в 1969 г. рядом организаций системы Организации Объединенных Наций как объединенная группа в целях поощрения независимого междисциплинарного рассмотрения проблем загрязнения морской среды и охраны окружающей среды для избежания дублирования усилий в рамках системы Организации Объединенных Наций. Ниже описаны основные темы, рассмотренные на этой сессии.

**2 Активизация деятельности ГЕЗАМП:** С конца 2005 г. ГЕЗАМП получает поддержку Шведского агентства международного сотрудничества по вопросам развития с главной целью расширения участия экспертов из развивающихся стран в деятельности ГЕЗАМП. Кроме того, Шведская морская администрация с конца 2006 г. командировала своего сотрудника для выполнения функций сотрудника ГЕЗАМП. Эта поддержка, наряду с учреждением Бюро ГЕЗАМП в ИМО в октябре 2007 г. на основании договоренности о коспонсировании между организациями, спонсирующими ГЕЗАМП, позволила ГЕЗАМП активизировать свою деятельность, восстановив контакты с международным морским научным сообществом и расширив свою консультативную деятельность.

**3 Оценка опасности вредных веществ, перевозимых судами (РГ 1):** Эта рабочая группа оценивает, по поручению ИМО, опасность наливных химических веществ, перевозимых судами, для окружающей среды и здоровья человека. Инициированная в

1971 г. процедура ГЕЗАМП для оценки опасности была пересмотрена в 1998 г., и к 2007 г. все 800 профилей опасности были пересмотрены в соответствии с новой процедурой, совместимой с СГС (GESAMP Reports and Studies No. 64, 2002 (Отчеты и исследования ГЕЗАМП № 64, 2002 г.)). Профиль опасности содержит уникальные характерные признаки каждого вещества, предоставляя информацию о 14 отдельных критериях опасности для здоровья человека и окружающей среды, а также физико-химической опасности. РГ 1 решила подготовить документ для публикации, сфокусированный на методологии, которая была разработана для оценки ингаляционной токсичности. Данные по ингаляционной токсичности часто отсутствуют, особенно по нелетучим материалам, и возникла обеспокоенность в связи с тем, что при повышенной температуре и давлении такие продукты могут создавать дополнительную опасность при вдыхании. ГЕЗАМП рекомендовала, чтобы РГ 1, существующая уже почти 40 лет,

рассмотрела вопрос о своем общественном восприятии и средствах коммуникации, включая переименование группы и разработку информационно-пропагандистской продукции.

**4 Обзор применений для «активных веществ», которые будут использоваться в системах управления водяным балластом (РГ 34):** В межсессионный период РГ 34 провела четыре совещания для оценки рисков для окружающей среды, экипажей и общественности в целом, а также для безопасности судов по 14 предлагаемым системам управления водяным балластом. Она также провела первый семинар «по подведению итогов» в январе 2009 г., сконцентрировав свое внимание исключительно на методологии, используемой для проведения оценок. С помощью внешних экспертов было обсуждено несколько тем, таких как разработка сценария воздействия на человека (СВЧ), применение и параметризация модели воздействия на окружающую среду (МАМ-ПЕК) и последовательность в применении факторов оценки при проведении тестов острой и хронической экотоксичности. РГ 34 планирует включить результаты этого семинара в методологию.

**5 Развитие деятельности, имеющей отношение к глубоководному рыболовству, среде обитания рыб и смежным вопросам, представляющим озабоченность с точки зрения экосистем (РГ 35):** ГЕЗАМП с сожалением отметила решение Департамента рыбных хозяйств и аквакультуры ФАО о прекращении своей ведущей роли и технической поддержки для РГ 35 по причине жестких бюджетных ограничений. Такое развитие событий обусловило возобновление дискуссий по вопросу об учреждении в будущем целевого фонда ГЕЗАМП для обеспечения того, чтобы изменения в основной направленности деятельности ведущих учреждений не оказывали немедленное негативное воздействие на рабочие группы и чтобы рабочие группы имели возможность завершить свою запланированную работу.

**6 Развитие экосистемного подхода к прибрежной марикультуре (РГ 36):** РГ 36 не смогла провести запланированные совещания в 2008 г. и не сможет это сделать в текущем году. Будущая деятельность этой РГ, таким образом, была направлена только на завершение подготовки отчета о совещании РГ 36 в качестве общего отчета о деятельности РГ, который был с признательностью воспринят ГЕЗАМП.

**7 Расширенный научный обзор ртути и ее соединений и угроз для морской среды (РГ 37):** После объявления ЮНИДО в 2008 г. о прекращении своей роли в качестве ведущего учреждения РГ 37 в связи с изменением приоритетов в области политики ГЕЗАМП сочла, что эта РГ является очень важной. В конечном счете РГ 37 провела два совещания, несмотря на материально-технические проблемы; ее работа продвигалась хорошо, и ожидается, что



для подготовки отчета для ГЕЗАМП потребуется еще только одно совещание с участием 11 экспертов. ГЕЗАМП провела обзор имеющейся в настоящее время поддержки со стороны других спонсирующих организаций и с удовлетворением отметила потенциальную заинтересованность ЮНЕП в том, чтобы занять ведущую роль для этой РГ, в частности, посредством своей Глобальной программы действий и Отдела технологий, промышленности и экономики (ОТПЭ) (последний отвечает за подготовку конвенции по ртути, которую планируется завершить в 2013 г.).

**8 Поступление химических веществ в океан из атмосферы (РГ 38):** Признавая растущий интерес к вопросу о влиянии поступающих из атмосферы веществ как природного, так и антропогенного происхождения, на химию, биологию и биохимию океана, а также на климат, ГЕЗАМП рассмотрела деятельность своей РГ 38. Эта рабочая группа провела свое первое совещания в декабре 2008 г. и согласилась подготовить три отдельных доклада/документа по вопросам осаждения фосфора, азота, железа и органических веществ из атмосферы в океан. Предварительные названия этих трех документов являются следующими:

- 1) Implications of changing ratios of limiting nutrients in the surface oceans as a result of atmospheric deposition» (Последствия изменяющихся соотношений лимитирующих питательных веществ на поверхности океана в результате атмосферного осаждения);
- 2) Uncertainties in iron and phosphorus deposition to the ocean» (Неопределенность в осаждении железа и фосфора в океан»);
- 3) Atmospheric organic materials and the nutrients they carry to the ocean» (Атмосферные органические материалы и питательные вещества, которые они приносят в океан).

РГ 38 вновь соберется в начале 2010 г. для завершения обсуждений и подготовки документов для публикации. Принимая во внимание заключительную часть круга обязанностей РГ 38, ГЕЗАМП направила в ВМО два отчета в форме писем в апреле 2009 г.

**9 Глобальные тенденции в загрязнении прибрежных экосистем: ретроспективная оценка экосистем (РГ 39, на стадии рассмотрения):** Основная цель этой предлагаемой рабочей группы заключается в содействии глобальному снижению стресса, которому подвергаются прибрежные экосистемы, посредством предоставления заинтересованным сторонам, учеными и обществу в целом объективной и глобальной оценки тенденций загрязнения за последнее столетие в чувствительных прибрежных экосистемах за счет ретроспективного анализа экосистем с использованием архивов данных об окружающей среде и временных рядов данных, где они доступны. После обсуждения первоначального предложения МАГАТЭ на ГЕЗАМП 35 и достижения согласия

в отношении актуальности этого инструмента для руководителей, занимающихся береговыми зонами, на ГЕЗАМП 36 было отмечено текущее положение дел и выражена признательность МАГАТЭ за предусмотрительные действия, направленные на обеспечение финансирования для этой рабочей группы. Некоторые члены выразили обеспокоенность по поводу амбициозных целей рабочей группы, однако МАГАТЭ отметило, что работа должна основываться на опубликованных результатах и что в любом случае должен быть разработан осуществимый круг обязанностей для утверждения в будущем на ГЕЗАМП.

**10 Вклад в «регулярный процесс» Организации Объединенных Наций:** ГЕЗАМП получила доклад о последних событиях и положении дел в области регулярного процесса ООН и его начального этапа, так называемой оценки оценок (ОО), в связи решением, принятым Генеральной Ассамблеей ООН в декабре 2009 г. Последующие обсуждения были сосредоточены на вопросе о возможных ролях ГЕЗАМП в регулярном процессе и привели к подготовке позиционного документа (см. приложение IV к настоящему отчету) для распространения среди организаций, спонсирующих ГЕЗАМП, в частности ООН-ОВОМП.

**11 Параллельное мероприятие на тему «Глобальное поступление химических веществ (питательных веществ) из атмосферы в океан»:** Эта специальная сессия была предназначена для подчеркивания научной проблемы, занимающей важное место в повестке дня принимающей организации, ВМО, а также для того, чтобы некоторым образом внести ясность по вопросу о том, каким образом РГ 38 оказывает содействие ВМО в ее усилиях. Во всех трех представленных докладах с разных точек зрения рассматривался вопрос об осаждении железа из атмосферы: (1) как компонента природного аэрозоля; (2) как соединения, находящегося под влиянием загрязнения; и (3) как субъекта модельной параметризации. ГЕЗАМП с признательностью восприняла обзор новых исследований, отметив качество исследований, и согласилась разместить эти три доклада на своем веб-сайте.

**12 Выявление новых и возникающих проблем, касающихся деградации морской среды:** Одна из основных функций ГЕЗАМП заключается в выявлении новых и возникающих проблем, касающихся состояния морской среды, а также в рассмотрении и четком формулировании любых таких проблем, вызывающих озабоченность, с тем чтобы они могли быть оценены и доведены до сведения правительств, спонсирующих организаций и научного сообщества в целом. ГЕЗАМП затронула и обсудила четыре следующие проблемы:

**12.1 Биоаккумуляция в крупных хищниках**  
Один из членов обратил внимание ГЕЗАМП на необходимость обзора текущего состояния

загрязняющей биомагнификации в крупных морских хищниках, включая млекопитающих, хрящевых рыб и другие группы. Было предложено следующее название: «Bioaccumulation of contaminants in marine top predators in relation to human health – a global review» (Биоаккумуляция загрязняющих веществ в крупных морских хищниках по отношению к здоровью человека – глобальный обзор). Была создана заочная группа для подготовки круга обязанностей для дальнейшего рассмотрения на ГЕЗАМП в целях обоснования формирования новой рабочей группы или принятия других надлежащих мер, включая вынесение рекомендаций в отношении дальнейших исследований, экспертных знаний, необходимых для изучения этого вопроса, а также выявления потенциальных спонсоров.

#### 12.2 Стандарты качества окружающей среды (СКОС)

Другой член ГЕЗАМП предложил разработать глобальную базу данных для стандартов качества окружающей среды по загрязняющим веществам в морской среде. Хотя этот вопрос по существу не представляет собой возникающую проблему, тем не менее такой вид глобального обслуживания может стать полезным для заполнения пробела и предоставления администрациям возможности быстро проверять, какие СКОС уже применяются в других регионах. ГЕЗАМП согласился с тем, что заочной группе следует:

- (1) составить всеобъемлющую базу данных о текущих СКОС и обеспечить доступ к ним через веб-сайт ГЕЗАМП;
- (2) популяризировать веб-сайт ГЕЗАМП в качестве первой ссылки при поиске СКОС;
- (3) подготовить тщательный синтез текущих данных о СКОС, включая сравнение данных о СОЗ (первоначально для 12 химических веществ, перечисленных в Стокгольмской конвенции) (<http://chm.pops.int>). Результаты должны затем быть представлены на ГЕЗАМП 37 совместно с рекомендациями в отношении дальнейшего развития событий.

#### 12.3 Гипоксия и биологические последствия

Один член ГЕЗАМП после представления этой темы на ГЕЗАМП 35 предоставил подробный обзор последствий, которые могут иметь низкие уровни кислорода на эндокринные системы в морских организмах, отметив, что гипоксические регионы расширились в Мировом океане в течение последних десятилетий. ГЕЗАМП сочла, что необходимо уточнить, имеется ли достаточно информации для проведения оценки по этой теме, или же потребуется дополнительное время для проработки этого вопроса. Была создана заочная группа для рассмотрения «гипоксии в морской среде и ее последствий на экосистемном и экофизиологическом уровнях».

#### 12.4 Картирование для экологических показателей

Было выражено предложение в отношении того, что ГЕЗАМП находится в отличном

положении для разработки глобального и визуально описательного вида продукции (ГИС) с соответствующими параметрами, связанными с качеством морской среды, сопровождаемого обобщением и/или соображениями по поводу результатов наблюдений посредством своего веб-сайта. Этот вид продукции может оказаться важным для лиц, принимающих решения, и лиц, определяющих политику, а также для общественности в целом, и в этой связи он будет являться также важным видом продукции с точки зрения информационно-просветительской деятельности. ГЕЗАМП отметила, что это действительно будет очень интересным видом продукции, но его разработка может оказаться крупным проектом, требующим значительного финансирования. Было предложено, чтобы ГЕЗАМП приняла во внимание работу, осуществляемую другими учреждениями, и чтобы на первом этапе ГЕЗАМП обеспечила хостинг для сайта метаданных со ссылками на продукцию, производимую другими учреждениями. Было решено включить этот вопрос в повестку дня ГЕЗАМП37. (Редакторское примечание: современи проведения ГЕЗАМП 36 этот вид деятельности осуществляется в рамках возглавляемой ГЭФ/ЮНЕП/МОК Программы оценки трансграничных вод (ПОТВ), ключевой вклад в которую вносится ГЕЗАМП.)

#### 13 Деятельность по определению сферы охвата для ГЕЗАМП 37:

По вопросу о трех новых и возникающих проблемах, перечисленных в пунктах 12.1-12.3 выше, ГЕЗАМП подтвердила организационные меры, согласно которым заочные группы представляют отчеты на ГЕЗАМП 37. Кроме того, была учреждена заочная группа по теме «микрочастицы в качестве переносчика стойких и токсичных веществ» после обсуждения на ГЕЗАМП документа, определяющего сферу охвата, который представлен в приложении X к настоящему отчету. Этой заочной группе было поручено подготовить практический семинар по рассмотрению этого вопроса и разработать круг обязанностей для возможной рабочей группы.

#### 14 Прочие вопросы:

В ГЕЗАМП поступил запрос со стороны ИМО в отношении предоставления консультации на предмет критериев сброса пресных вод из систем очистки выхлопных газов на борту судов. Было решено предоставить такую консультацию по переписке и передать рекомендации ГЕЗАМП таким образом КЗМС. В ГЕЗАМП также поступил запрос со стороны ИМО в отношении проведения независимой экспертной оценки доклада об адекватности систем управления водным балластом вне зависимости от химических веществ. ГЕЗАМП согласилась провести независимую экспертную оценку этого доклада по переписке после того, как ИМО предоставит дополнительные разъяснения в отношении точного характера этого запроса.

# 执行摘要

1 引言：海洋环境保护科学方面联合专家组（GESAMP）于2009年4月28日至5月1日在瑞士日内瓦世界气象组织（WMO）总部举行了第三十六次会议。GESAMP是于1969年由一些联合国机构设立的联合专家组，旨在鼓励对海洋污染和环境保护问题展开独立、跨学科审议，避免联合国系统内的重复工作。本次会议上审议的主要议题如下。

2 振兴GESAMP：自2005年底以来，GESAMP得到了瑞典国际发展合作署的支持，主要目的是扩大发展中国家对GESAMP活动的参与。此外，自2006年底以来，瑞典海事局援派了一名工作人员，担任GESAMP的官员。作为GESAMP发起组织之间的一项联合发起安排，2007年10月在国际海事组织（IMO）设立了GESAMP办公室，加上瑞典方面的上述支持，使GESAMP能够与国际海洋科学界恢复联系，通过扩大咨询活动实现了振兴。

3 船载有害物质危害评估（第1工作组）：应IMO的要求，该工作组负责对船载散装液体化学品的环境和人体健康危害作了评估。GESAMP危害评估程序始订于1971年，1998年作了修订，截止2007年按新的GHS兼容程序（GESAMP报告和第64号研究，2002年）完成了所有800项危害度曲线的修订工作。危害度曲线包含每一种物质独一无二的痕迹，提供14个单独的有关人体健康、环境和物理化学危害度标准的信息。第1工作组决定编写文章并发表，主要侧重于为有毒物质吸入的估算建立方法。有毒物质吸入数据往往缺乏，特别是对非挥发性物质，以及人们对在温度和气压上升情况下通过吸入此类物质可形成更大危害的担心。GESAMP建议：成立近40年的第1工作组应考虑其知名度及联络手段，包括工作组的改名和宣传产品的制作。

4 ‘活性物质’用于压载水管理系统的应用审查（第34工作组）：第34工作组在休会期间开了四次会议，对环境风险、船员风险和公共风险作了评估，还对14项拟议的压载水管理系统的船舶安全性开展了评估。还于2009年1月举行了第一次‘盘点’讲习班，专门研讨了评估所使用的各种方法。在外部专家的帮助下，会上讨论了几个专题，如人体暴露情景（HES）的建立、环境暴露度模型（MAM-PEC）的应用和参数化以及评估因子用于急性和慢性生态毒性检测的一致性。第34工作组计划将该讲习班的成果纳入方法体系之中。

5 与深海渔业、渔业栖息地活动的发展态势和有关对生态系统关切（第35工作组）：GESAMP遗憾地注意到由于严重的预算限制，FAO渔业和水产养殖司停止了其牵头作用并不再支持第35工作组。目前的这一发展动向有必要重新讨论未来建立一个GESAMP信托基金，以确保牵头机构的变化不会马上对各工作组产生负面影响，并使它们完成其预期的工作。

6 为近海海水养殖开发一种生态系统方法（第36工作组）：第36工作组未能够按计划于2008年召开会议，并且在本年度仍然无法召开。因此，该工作组未来的活动目标仅是完成第36工作组会议报告的定稿工作，作为该工作组活动的一个总报告，GESAMP对此表示欢迎。

7 扩大对汞其化合物和对海洋环境威胁的科学评审（第37工作组）：在联合国工业发展组织（UNIDO）于2008年宣布决定由于政策重点转移因此停止其作为第37工作组的牵头机构发挥作用，但GESAMP认为该工作组非常重要。虽然存在后勤保障方面存在问题，但最终第37工作组已经举行了两次会议，工作进展顺利并预计只需要再召开一次11人的专家会议，以编写一份报告提交给GESAMP。GESAMP对自其他赞助组织目前提供的支持作了梳理，并高兴地注意到UNEP有兴趣接替对该工作组的牵头作用，特别是通过其全球行动计划和技术、工业和经济处（DTIE）（后者负责编写《汞公约》，计划于2013年完成）。

8 大气化学物质排入海洋（第38工作组）：认识到人们越来越关注大气中自然和人为物质对海洋化学、生物学和生物化学以及气候的影响，GESAMP回顾了其第38工作组开展的各项活动。该工作组于2008年12月召开第一次会议并同意编写三份独立的文章/文件，涉及的领域分别为：由大气排入海洋的磷、氮、铁和有机沉降物。三篇论文的标题暂定为：

- 1) “由于大气沉降原因，洋面中不断变化的受限营养物比率的影响”；
- 2) “沉降到海洋中的铁和磷的不确定性”；以及
- 3) “排入海洋的大气有机物和营养物”

第38工作组原计划将于2010年初再次举行会议，以完成讨论并编写供出版的文件。为了响应第38工作组职责的最后一部分，2009年4月GESAMP以信函形式向WMO提交了两个报告。

9 海岸带生态系统污染的全球趋势：追溯性生态系统评估（第36工作组，正在审议中）：该拟建立的工作组的主要目标是通过以下方式为在全球范围内减少海岸带生态系统压力做出贡献：即向各利益攸关方、科学家和社会提供客观的有关上个世纪敏感的沿海生态系统污染趋势的全球评估报告；开展追溯性生态系统分析；以及利用标明日期的环境档案和现有的时间序列资料。GESAMP第35次会议讨论了IAEA提出的初步建议，并就这一工具与海岸带管理者的相关性达成一致，之后GESAMP第36次会议注意到目前的现况，并感谢IAEA继续慎重从事，以确保为本工作组提供资金支持。有些成员对本工作组的宏大目标表示了关切，但IAEA指出此项工作应基于已公布的结果，并指出无论如何应当为未来GESAMP的批准制定可行的职责。

10 为联合国‘常规进程’做出贡献：由于联合国大会2009年12月作出的一项决定，GESAMP收到了一份关于联合国常规进程及其启动阶段的最

新进展和状况的报告，即所谓的对各项评估的评估（AoA）。后续的讨论侧重于GESAMP在常规进程中可能发挥的作用，进而开始制定立场文件（见本报告的附件4），最终分发给GESAMP的发起组织，尤其是联合国海洋事务与海洋法司（UN-DOALOS）。

11 关于“排入海洋的全球大气化学物质（营养物）”边会：这次特别会议意在强调主办组织WMO议程中的一个重要科学问题，并就第38工作组如何协助WMO的工献计献策。在会上所作的三个报告中，从不同角度审议了大气中铁排入海洋的问题：（1）作为自然气溶胶中的一种成分；（2）受污染影响的一种化合物；（3）参数化模拟对象。GESAMP赞赏对这一新兴研究的综述，也注意到了研究质量并同意将这三个报告在其网站公布。

12 发现与海洋环境退化相关的新出现的问题：GESAMP的核心职能之一是发现与海洋环境状况相关的新出现的问题，审议并划定这类令人关切的问题，从而能够对这些问题作出评估并引起各国政府、主办机构和科学界的注意。GESAMP提出并讨论了下列四个问题。

#### 12.1 顶层掠食动物的生物累积

GESAMP成员之一提请GESAMP注意有必要评审海洋顶层掠食动物（包括哺乳动物、软骨鱼类及其它种群）的污染物生物放大的现状。拟议了下列主题：“事关人类健康的海洋顶层掠食动物的污染物生物累积 - 全球评审”。建立了一个相应的小组，以便为GESAMP制定职责来进一步审议组建新工作组或采取其它相应行动的合理性，包括对进一步研究提出建议、探讨此问题所需的专业知识以及确定潜在的赞助方。

#### 12.2 环境质量标准（EQS）

GESAMP的另一成员建议建立一个有关海洋环境污染物的全球环境质量标准数据库。在严格意义上，虽然这并不是一个新出现的问题，但它可提供一项有益的全球服务，以填补空白，并使管理部门迅速查明哪个EQS已在其它区域采用。GESAMP认为一个通讯组应当：（1）整编一个全面的包括现行EQS的数据库并发布到GESAMP网站上；（2）推广GESAMP网站，使其成为搜索环境质量标准首要链接；（3）编写一个有关当前EQS数据的详细综合报告，内容包括持续性有机污染物（POP）数据比较（最初包括《斯德哥尔摩公约》中列出的12种化学物质）（<http://chm.pops>。

int）。各项结果将提交给GESAMP第37次会议，同时提出未来发展建议。

#### 12.3 低氧及其生物效应

GESAMP的一位成员在听取了GESAMP第35次会议关于该专题的介绍后全面地阐述了缺氧对海洋生物内分泌系统的影响，并指出海洋中的低氧海域在过去几十年里增加了。GESAMP认为需要进一步澄清是否有足够的信息评估有待研究的这一专题，或是否需要更多时间研究该问题。为着眼于“海洋环境中的低氧及其对生态环境和生态生理水平的影响”，GESAMP成立了一个通讯组。

#### 12.4 环境指标绘图

会上提出了一项建议：GESAMP完全有能力开发一个与海洋环境质量有关的涵盖相关参数的全球可视化描述性产品（GIS），并附有综合信息和/或通过GESAMP网站公布对观测的评论。这对于决策者、政策制定者和公众都至关重要，因此这也将是一个重要的宣传产品。GESAMP注意到该产品确实是一个令人非常感兴趣的产品，但或许是一项大事业，需要大量资金。有成员建议GESAMP可考虑由其它机构开展这项工作，并在第一阶段可承建一个与其它机构产品实现链接的元数据网站。会议同意将此问题列入GESAMP第37次会议议程。（编者注：自GESAMP第36次会议以来有关后者的一项活动已继续开展，作为由GEF/UNEP/IOC牵头的跨界水系评估方案（TWAP）的一部分，GESAMP目前是该计划的一个重要贡献方）。

13 GESAMP第37次会议的规划活动：关于在12.1和12.3段中列出的3个新出现的问题，GESAMP确认了为各通讯组向第37次GESAMP会议报告所作出的组织安排。另外，在讨论了本报告附件10中给出的规划文件之后，GESAMP设立了一个关于“在持久的和毒性物质输送过程中作为一种媒介的微塑料”的通讯组。要求该通讯组筹备一个研讨会，以对这一专题作出评审并为最终建立一个工作组制定其职责范围。

14 其它问题：GESAMP收到了国际海事组织提出的关于提供有关船载废气清污系统排放污水排放标准咨询的要求。会议同意以通信方式完成上述咨询并把GESAMP的各项建议通过同意方式转交给海洋环境保护委员会（MEPC）。GESAMP还收到了国际海事组织提出的关于对不依靠化学物质的压载水管理系统同等系统报告开展同行评审的要求。GESAMP同意一旦在国际海事组织进一步澄清此项要求的具体性质后立即以通信方式对该报告开展同行评审。

## ملخص تنفيذي

### 4- استعراض التطبيقات التي ستستخدم

في نظم إدارة مياه الصابورة فيما يتعلق بالمواد النشطة (الفريق العامل 34): اجتمع الفريق العامل 34 أربع مرات في فترة ما بين الدوريتين لتقييم المخاطر المترتبة على 14 نظاماً لإدارة مياه الصابورة بالنسبة إلى البيئة وأطقم السفن والجمهور بشكل عام، وكذلك سلامة السفن. وعقد الفريق أول حلقة عمل 'للحصر والجرد' في كانون الثاني/يناير 2009، وانحصر تركيز حلقة العمل على المنهجية المستخدمة في عمليات التقييم. ونوقشت عدة مواضيع بمساعدة خبراء خارجيين، مثل إعداد سيناريو لتعرض الإنسان (HES)، وتطبيق نموذج للتعرض البيئي ووضع بارامترات له (MAM-PEC)، والاتساق في تطبيق عوامل تقييم السمية البيئية في الاختبارات الدقيقة والمتكررة. ويزعم الفريق العامل 34 دمج نتائج حلقة العمل في المنهجية.

### 5- إعداد أنشطة تتعلق بمصائد الأسماك

في المياه العميقة وموتل مصائد الأسماك والشواغل المتصلة بالنظام الإيكولوجي (الفريق العامل 35): أشار فريق الخبراء (GESAMP) مع الأسف إلى قرار إدارة مصائد الأسماك والزراعة المائية بمنظمة الأغذية والزراعة (FAO) بوقف دورها الريادي ودعمها الفني للفريق العامل 35 بسبب القيود المالية القاسية. وقد سوغ هذا التطور تجديد المناقشات بشأن مستقبل الصندوق الاستئماني لفريق الخبراء (GESAMP) للتأكد من أن تغيير مناهج التركيز في الوكالات الرائدة لا يترتب عليه أثر سلبي مباشر على الأفرقة العاملة، ومن تمكينها من الانتهاء من أنشطتها المزمعة.

### 6- إعداد نهج قائم على النظام الإيكولوجي

للزراعات البحرية البعيدة عن الشاطئ (الفريق العامل 36): لم يتمكن الفريق العامل 36 من عقد الاجتماعات المقررة في 2008، ولن يتمكن من القيام بذلك في هذا العام. ولذا، اقتضت الأنشطة المستقبلية للفريق العامل على الانتهاء من تقرير دورته السادسة والثلاثين باعتباره تقريراً عاماً لأنشطته، وهو ما رحب به فريق الخبراء (GESAMP).

### 7- استعراض علمي موسع للزئبق

ومكوناته وللأخطار التي تتهدد البيئة البحرية (الفريق العامل 37): بعد أن أعلنت منظمة الأمم المتحدة للتنمية الصناعية (اليونيدو) في 2008 بأنها ستوقف عن القيام بدورها الرائد في الفريق العامل 37 بسبب تغير أولويات سياساتها العامة، رأى فريق الخبراء (GESAMP) أن هذا الفريق العامل هام جداً. واجتمع الفريق العامل 37 بالفعل مرتين على الرغم من المشاكل اللوجستية، وتحرز أنشطته تقدماً طيباً ويتوقع أنه لن يلزم سوى اجتماع واحد للخبراء البالغ عددهم 11 لتقديم تقرير إلى فريق الخبراء (GESAMP). وحصر فريق الخبراء (GESAMP) الدعم المتوافر حالياً من المنظمات الراحية الأخرى ولاحظ بسرور اهتمام برنامج الأمم المتحدة للبيئة (UNEP) المحتمل في حمل لواء الريادة في دعم هذا الفريق العامل، لاسيما عن طريق برنامج العالم للعمل وشعبة التكنولوجيا والصناعة والاقتصاد (هذه

### 1- مقدمة: عقد فريق الخبراء المشترك المعني

بالجوانب العلمية لحماية البيئة البحرية (GESAMP) دورته السادسة والثلاثين في مقر المنظمة العالمية للأرصاء الجوية (WMO) في جنيف، سويسرا، في الفترة من 28 نيسان/أبريل إلى 1 أيار/مايو 2009. وقد أنشئ فريق الخبراء (GESAMP) من قِبَل عدد من منظمات الأمم المتحدة في 1969 كفريق مشترك لبحث مشاكل التلوث البحري وحماية البيئة بشكل مستقل ومتعدد التخصصات بغية تجنب ازدواجية الجهود في إطار منظومة الأمم المتحدة. وفيما يلي المواضيع الرئيسية التي بحثتها الدورة.

### 2- تنشيط فريق الخبراء (GESAMP):

تلقي فريق الخبراء (GESAMP) منذ أواخر 2005 دعماً قوياً من الوكالة السويدية للتعاون الإنمائي الدولي، وكان الهدف الأساسي من ذلك هو زيادة مشاركة الخبراء من البلدان النامية في أنشطة الفريق. وإضافة إلى ذلك، فقد أعادت الإدارة البحرية السويدية منذ أواخر 2006 موظفاً للعمل في فريق الخبراء (GESAMP). وقد أدى هذا الدعم، إلى جانب إنشاء مكتب للفريق في المنظمة البحرية الدولية (IMO) في تشرين الأول/أكتوبر 2007، في إطار ترتيب للرعاية المشتركة بين المنظمات الراحية للفريق (GESAMP)، إلى تمكين الفريق من التنشيط الذاتي من خلال إعادة الاتصال بمجتمع العلوم البحرية الدولي وتوسيع نطاق أنشطته الاستشارية.

### 3- تقييم مخاطر المواد الضارة التي

تحمّلها السفن (الفريق العامل 1): يقيم هذا الفريق العامل، بناء على طلب المنظمة البحرية الدولية (IMO)، مخاطر المواد الكيميائية السائلة السائبة التي تحملها السفن على البيئة والصحة البشرية. فإجراء تقييم المخاطر الذي أقره في عام 1971 فريق الخبراء (GESAMP) قد نُقح في 1998، وبحلول 2007 كانت جميع أنواع المخاطر البالغ عددها 800 قد نُقحت وفقاً للإجراء الجديد المتوافق مع النظام المنسق عالمياً (GHS) (تقارير ودراسات فريق الخبراء (GESAMP) رقم 64، 2002). وتتضمن أنماط المخاطر بصمة فريدة لكل مادة، وتقدم معلومات عن 14 معياراً منفصلاً للمخاطر المتصلة بالصحة البشرية والبيئة والمخاطر الفيزيوكيميائية. وقرر الفريق العامل 1 إعداد ورقة بحثية للنشر تركز على المنهجية المستحدثة لتقدير سمية المواد المستنشقة. وغالباً ما تتعدم البيانات عن سمية المواد المستنشقة، لاسيما بالنسبة إلى المواد غير الطيارة. وثمة مخاوف من إمكانية أن تشكل هذه المنتجات عند ارتفاع درجة الحرارة والضغط، مخاطر جديدة للمواد المستنشقة. وأوصى فريق الخبراء (GESAMP) بأن ينظر الفريق العامل 1، الذي أنشئ قبل 40 عاماً تقريباً، في مكانته وبروزه وفي سبل التواصل، بما في ذلك إعادة تسمية الفريق وإعداد نواتج توعوية.

اللازمة لتقصي هذه المسألة، فضلاً عن تحديد الجهات الراعية المحتملة.

## 12.2 معايير الجودة البيئية (EQS)

اقترح عضو آخر في فريق الخبراء (GESAMP) إعداد قاعدة بيانات عالمية لمعايير الجودة البيئية بشأن الملوثات في البيئة البحرية. ولئن كانت هذه المسألة ليست جديدة بالمعنى الدقيق للكلمة، فإنها يمكن أن تقدم خدمة عالمية مفيدة لسد الثغرات وتمكين الإدارات من التحقق سريعاً من معيار الجودة البيئية المطبق في المناطق الأخرى. ووافق فريق الخبراء (GESAMP) على ضرورة أن يقوم الفريق المناظر بما يلي: (1) إعداد قاعدة بيانات شاملة لمعايير الجودة البيئية الراهنة وإتاحتها على الموقع الشبكي لفريق الخبراء (GESAMP)؛ (2) الترويج للموقع الشبكي لفريق الخبراء (GESAMP) باعتباره الوصلة الأولى عند البحث عن معايير الجودة البيئية؛ (3) إعداد خلاصة توليفية شاملة عن بيانات معايير الجودة البيئية، بما في ذلك مقارنة بيانات نقاط الوجود (POPs) (المعدة في أول الأمر بشأن 12 مركباً كيميائياً مدرجاً في اتفاقية استكهولم) <http://chm.pops.int>. وينبغي تقديم النتائج إلى الدورة السابعة والثلاثين لفريق الخبراء (GESAMP)، مشفوعة بتوصيات بشأن التطورات المقبلة.

## 12.3 نقص وصول الأكسجين والآثار البيولوجية

عقب عرض هذا الموضوع في الدورة الخامسة والثلاثين لفريق الخبراء (GESAMP 35)، قدم أحد أعضاء فريق الخبراء (GESAMP) عرضاً شاملاً عن آثار انخفاض مستويات الأكسجين على نظم الغدد الصماء في الكائنات البحرية، وأشار إلى أن المناطق التي ينقص فيها الأكسجين في المحيطات العالمية قد زاد عددها في العقود الماضية. ورأى فريق الخبراء (GESAMP) أنه يلزم توضيح ما إن كانت هناك معلومات كافية تمكن من إجراء تقييم للموضوع أم أن المسألة تحتاج إلى مزيد من الوقت للدراسة. وأنشئ فريق مناظر للنظر في مسألة «نقص الأكسجين في البيئة البحرية وآثاره على النظام الإيكولوجي وعلى المستوى الإيكولوجي الفسيولوجي».

## 12.4 رسم خرائط المؤشرات البيئية

أشار أحد الأعضاء إلى أن فريق الخبراء (GESAMP) في وضع ممتاز لإعداد نواتج عالمية ووصفية مرئية للبارامترات المتصلة بجودة البيئة البحرية على الموقع الشبكي لفريق الخبراء، يصاحبها ملخصات توليفية و/ أو تعليقات عن المشاهدات المنفذة. فهذا الأمر قد يكون هاماً لصانعي

القرارات ومقرري السياسات وللمجتمعات بشكل عام، ويمكنه من ثم أن يمثل ناتجاً توعوياً هاماً. وأشار فريق الخبراء (GESAMP) إلى أنه يمكن أن يكون في الواقع ناتجاً مفيداً جداً، ولكنه مشروع كبير يتطلب تمويلاً هاماً. وقبل أن فريق الخبراء (GESAMP) يمكن أن يأخذ في الاعتبار الأعمال الجارية في المؤسسات الأخرى، ويمكنه، في مرحلة أولى، أن يستضيف موقعا للبيانات الشرحية يوصل بالنواتج التي تعدها مؤسسات أخرى. وتقرر إدراج هذه المسألة في جدول أعمال الدورة السابعة والثلاثين لفريق الخبراء (GESAMP 37). (ملاحظة للمحررين: هذا النشاط الأخير قد تواصل منذ الدورة السادسة والثلاثين لفريق الخبراء (GESAMP 36) في إطار برنامج تقييم المياه العابرة للحدود (TWAP) الذي ينفذه مرفق البيئة العالمي وبرنامج الأمم المتحدة للبيئة واللجنة الدولية الحكومية لعلوم المحيطات (GEF/UNEP/IOC)، والذي يعد فيه فريق الخبراء (GESAMP) مساهماً رئيسياً.

## 13- تحديد نطاق الأنشطة للدورة السابعة

والثلاثين لفريق الخبراء (GESAMP 37): فيما يتعلق بالمسائل الثلاث الجديدة والمستجدة المدرجة في إطار الفقرات 12.1-12.3 أعلاه، أكد فريق الخبراء (GESAMP) الترتيبات التنظيمية للأفرقة المناظرة التي ستقدم تقاريرها إلى الدورة السابعة والثلاثين لفريق الخبراء (GESAMP 37). وإضافة إلى ذلك، أنشئ فريق مناظر بشأن الموضوع «المواد البلاستيكية الدقيقة كناقل للمواد الثابتة والسامة» عقب مناقشة أجراها فريق الخبراء (GESAMP) لورقة تحديد النطاق المبينة في المرفق العاشر بهذا التقرير. وطلب من هذا الفريق المناظر التحضير لعقد حلقة عمل لاستعراض الموضوع وإعداد اختصاصات لفريق عامل يحتمل إنشاؤه.

## 14- مسائل أخرى: تلقى فريق الخبراء

(GESAMP) طلباً لتقديم المشورة من المنظمة البحرية الدولية (IMO) بشأن معايير صرف مياه الغسالات من نظم تنظيف غازات العادم على متن السفن. وأتفق على استكمال هذه المشورة بالمراسلة، ونقل توصيات فريق الخبراء (GESAMP) بهذا الشكل للجنة حماية البيئة البحرية (MAPC). كما تلقى فريق الخبراء (GESAMP) طلباً من المنظمة البحرية الدولية (IMO) لإجراء استعراض أقران لتقرير عن نظم إدارة مياه الصابورة غير المعتمدة على المواد الكيميائية. ووافق فريق الخبراء (GESAMP) على استعراض الأقران لهذا التقرير بالمراسلة بعد أن تقدم المنظمة (IMO) مزيداً من الإيضاح بشأن الطابع المحدد للطلب.

الشعبة مسؤولة عن إعداد اتفاقية الزئبق المزمع استكمالها في (2013).

## 8- انتقال المواد الكيميائية من الغلاف

الجوي للمحيطات (الفريق العامل 38): إقراراً بالأهمية المتزايدة بشأن تأثير المواد المنتقلة من الغلاف الجوي، الطبيعية منها والبشرية المنشأ، على الكيمياء والبيولوجيا والكيمياء الحيوية للمحيطات، وكذلك على المناخ، استعرض فريق الخبراء (GESAMP) أنشطة الفريق العامل 38 التابع له. وكان الفريق العامل قد اجتمع لأول مرة في كانون الأول/ديسمبر 2008، واتفق على إعداد ثلاث ورقات بحثية/وثائق منفصلة في مجالات ترسب الفسفور والنيتروجين والحديد والمواد العضوية من الغلاف الجوي في المحيطات. والعناوين المؤقتة لهذه الورقات البحثية الثلاث هي:

- (1) "Implications of changing ratios of limiting nutrients in the surface oceans as a result of atmospheric deposition";
- (2) "Uncertainties in iron and phosphorus deposition to the ocean"; and
- (3) "Atmospheric organic materials and the nutrients they carry to the ocean"

واجتمع الفريق العامل 38 مرة أخرى في باكورة 2010 لاستكمال المناقشات وإعداد ورقات بحثية للنشر. واستجابة للجزء النهائي من اختصاصات الفريق العامل 38، قدم فريق الخبراء (GESAMP) تقريرين في رسالتين إلى المنظمة (WMO) في نيسان/أبريل 2009.

## 9- الاتجاهات العالمية في تلوث النظم

الإيكولوجية الساحلية: تقييم استعادي للنظام الإيكولوجي (الفريق العامل 39، قيد البحث): الهدف الرئيسي من إنشاء هذا الفريق العامل المقترح هو الإسهام في الحد من إجهاد النظم الإيكولوجية الساحلية على صعيد العالم عن طريق تقديم تقييم موضوعي وعلمي للأطراف المعنية والعلميين والمجتمع بشكل عام عن اتجاهات التلوث خلال العقد الماضي في النظم الإيكولوجية الساحلية الحساسة، ومن خلال تقديم تحليل استعادي للنظم الإيكولوجية باستخدام البيانات البيئية القديمة والسلاسل الزمنية عند توافرها. وعقب مناقشة اقتراح أولي قدمته الوكالة الدولية للطاقة الذرية (IAEA) في الدورة الخامسة والثلاثين لفريق الخبراء (GESAMP)، والاتفاق على ملاءمة هذه الأداة لكي يستخدمها مديرو المناطق الساحلية، أشارت الدورة السادسة والثلاثون لفريق الخبراء (GESAMP) إلى الحالة الراهنة، وقدمت الشكر للوكالة الدولية للطاقة الذرية (IAEA) لعملها الدؤوب على تأمين التمويل للفريق العامل. وأبدى بعض الأعضاء قلقهم بشأن طموحات أهداف الفريق العامل، لكن الوكالة الدولية (IAEA) قد أشارت إلى ضرورة أن يركز العمل على النتائج المنشورة، وإلى أنه ينبغي على أي حال إعداد اختصاصات ملائمة لكي يعتمد عليها فريق الخبراء (GESAMP) في المستقبل.

## 10- الإسهام في 'العملية المنتظمة' للأمم

المتحدة: تلقى فريق الخبراء (GESAMP) تقريراً عن آخر التطورات وحالة العملية المنتظمة للأمم المتحدة ومرحلتها الأولية، والتي تسمى تقييم التقييمات (AoA)، وذلك بسبب قرار الجمعية العامة للأمم المتحدة في كانون الأول/ديسمبر 2009. وانصب تركيز المناقشات التي تلت ذلك على الأدوار الممكنة لفريق الخبراء (GESAMP) في العملية المنتظمة، وأسفرت المناقشات عن ورقة موقف جاري إعدادها (انظر المرفق الرابع بهذا التقرير) لتوزيعها على المنظمات الراعية لفريق الخبراء (GESAMP)، لاسيما شعبة شؤون المحيطات وقانون البحار للأمم المتحدة (UN-DOALOS).

## 11- لقاء جانبي بشأن «انتقال المواد

الكيميائية (المغذيات) من الغلاف الجوي إلى المحيطات على نطاق العالم»: الهدف من هذه الدورة الخاصة هو تسليط الضوء على مسألة علمية تحتل مكاناً متقدماً في جدول أعمال المنظمة (WMO) المضيفة، وإلقاء بعض الضوء على الأسلوب الذي يقدم به الفريق العامل 38 المساعدة إلى المنظمة (WMO) في ما تبذله من جهود. وقد تناولت العروض الثلاثة المقدمة قضية ترسب الحديد من الغلاف الجوي من جوانب مختلفة:

- (1) باعتبار الحديد عنصراً من الأهباء الطبيعية؛
- (2) باعتباره مركباً متأثراً بتلوث؛
- (3) كموضوع لتحديد بارامترات النمذجة. وأعرب فريق الخبراء (GESAMP) عن تقديره لهذه النظرة العامة على البحوث الجديدة، وأشار إلى جودة البحوث واتفق على وضع هذه العروض الثلاثة على موقعه الشبكي.

## 12- تحديد المسائل الجديدة والمستجدة فيما

يتعلق بتدهور البيئة البحرية: تتمثل إحدى المهام الرئيسية لفريق الخبراء (GESAMP) في تحديد المسائل الجديدة والمستجدة فيما يتعلق بحالة البيئة البحرية، وفي النظر في أي مسائل من هذا القبيل قد تثير القلق ووضعها في إطار بحيث يمكن تقييمها وتوجيه انتباه الحكومات والمنظمات الراعية والمجتمع العلمي ككل إليها. وقد أثار فريق الخبراء (GESAMP) المسائل الأربع التالية وناقشها.

### 12.1 التراكم البيولوجي في الحيوانات البحرية المفترسة الرئيسية

وجه أحد الأعضاء عناية فريق الخبراء (GESAMP) إلى ضرورة إجراء استعراض للحالة الراهنة للتضخيم البيولوجي للملوثات في الحيوانات البحرية المفترسة الرئيسية، بما في ذلك الثدييات والأسماك الغضروفية والمجموعات الأخرى. واقترح العنوان التالي «التراكم البيولوجي للملوثات في الحيوانات البحرية المفترسة الرئيسية فيما يتعلق بصحة الإنسان - استعراض شامل». وأنشئ فريق مناظر لإعداد اختصاصات لكي يواصل فريق الخبراء (GESAMP) النظر في مسوغات تشكيل فريق عامل جديد أو اتخاذ إجراء ملائم آخر، بما في ذلك تقديم توصيات لمواصلة البحوث، والخبرات





# 1 INTRODUCTION

1.1 The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) held its 36th session from 28 April to 1 May 2009 at the Headquarters of the World Meteorological Organization (WMO) in Geneva, Switzerland. The session was held under the Chairmanship of Mr. Tim Bowmer, while Mr. Lawrence Awosika and Mr. Sandor Mulsow served as the Vice-Chairmen. On Monday 27 April, the Members of GESAMP met for informal discussions, while the Executive Committee held meetings on 27 April and 1 May.

## *Opening of the session*

1.2 The Chairman of GESAMP, Mr. Tim Bowmer, called the 36th session of GESAMP to order at 09.00 a.m. on 28 April 2009.

1.3 Mrs. Liisa Jalkanen, Chief, Atmospheric Environment Research Division (AER) Research Department (RES), in her opening remarks on behalf of the World Meteorological Organization, emphasized that WMO is dedicated to continue support of GESAMP through co-sponsorship and through studying processes at the air-sea interface impacting weather, water, climate and environment. The establishment of the GESAMP WG 38 led by WMO which deals with the atmospheric input of chemicals to the ocean illustrates the WMO interest in cooperating with GESAMP. Mrs. Jalkanen briefly presented the organizational structure of the WMO Secretariat and its major programs, including their research activities on atmospheric environment and weather. Mrs. Jalkanen wished a successful GESAMP session to all participants.

# 2 REPORT OF THE CHAIRPERSON OF GESAMP

## *Introduction*

2.1 This report provides a summary of the activities of GESAMP in the intersessional period. At GESAMP 35 held in Accra, Ghana, Mr. Tim Bowmer replaced Mr. Michael Huber as Chairman of GESAMP. At the same meeting Mr. Larry Awosika and Mr. Sandor Mulsow were elected as Vice-Chairmen.

2.2 GESAMP has continued to grow and currently has 16 members, the largest number in recent years, as well as several very active Working Groups. A range of new issues are under consideration with which to assess

the need for future marine environmental assessments. The GESAMP office continues to deliver the support needed to sustain a high level of activity, in part, thanks to the Swedish Maritime Administration (SMA) which provides the office with a full-time officer on secondment.

## *Working Group Activities*

2.3 The Chairman referred to the excellent work accomplished in the intersessional period by GESAMP's current Working Groups, noting that the topics covered were more

WG No.	Name	Context	Sponsor
1	The Evaluation of the Hazards of [Chemical] Substances Carried by Ships	Standing Working Group in support of the MARPOL Convention	IMO
34	The review of applications for 'active substances' to be used in ballast water management systems	Standing Working Group in support of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004	IMO
35	Deep water fisheries	Assessment Working Group	FAO
36	The ecosystem approach to mariculture with emphasis on off shore farming	Assessment Working Group	FAO
37	An 'Expanded scientific review of mercury and its compounds and threats to the marine environment	Assessment Working Group	UNIDO, IAEA
38	The atmospheric input of chemicals to the ocean	Assessment Working Group	WMO
Task Team	Pollution in the open ocean: a review of assessments and related studies	Task Team in support of the UNGA Regular Process, Assessment of Assessments	UNEP, IOC, Sida

**Note:** the numbering shows historical gaps where Working Groups have been formed, carried out their work and then been discharged of their duties to be replaced by other Working Groups on new topics.

diverse than ever before. He expressed the hope that the challenging and ambitious agendas chosen by the Working Groups and approved by GESAMP would produce excellent results. A list of the Working groups is given below.

- 2.4 The reports of the Working Group Chairpersons are presented in detail in Section 5 below.
- 2.5 The GESAMP Task Team for the Assessment of Assessments (AoA) finalized its report under the Chairmanship of Mr. Rick Boelens, and GESAMP reviewed and approved this intersessionally. The report has been published as Reports and Studies No.79. GESAMP conveyed its thanks to Mr. Boelens for his excellent work and to UNEP for publishing this report.

#### *The UN Regular Process – Assessment of Assessments*

- 2.6 The UN General Assembly, in its resolution 60/30, made provision for a Regular Process to assess the state of the global marine environment.<sup>1</sup>
- 2.7 During the intersessional period GESAMP has been very active in its support of UNEP and UNESCO-IOC, the lead agencies for the Assessment of Assessments (AoA) phase of the UN Regular Process, i.e., a preparatory programme tasked with preparing an overview of the marine environmental assessment landscape and to propose a structure for the Regular Process. At the time of writing, the AoA Group of Experts has produced its final report.<sup>2</sup>
- 2.8 GESAMP was represented at all five meetings of the AoA Group of Experts. In addition, and in his independent scientific advice capacity, the former Chairman, Mr. Mike Huber, continued his work as a member of the AoA Group of Experts.
- 2.9 At the request of the lead agencies, UNEP and UNESCO-IOC, GESAMP contributed the following to the AoA:
- an assessment of pollution in the open oceans (GESAMP Reports and Studies No. 79) prepared by a task team under the leadership of Mr. Rick Boelens, and
  - as part of a wider review, a panel of GESAMP members led by the Vice-Chairman Mr. Larry Awosika prepared an independent peer review the AoA final

report, providing substantial comments on the content and structure.

- 2.10 GESAMP has responded to every request from the lead agencies, has contributed in a flexible manner on the basis of its unique experience of marine environmental assessments and will continue to do so when called upon.

#### *Networking*

- 2.11 One of GESAMP's core functions is to advise its sponsoring agencies on avoiding duplication of effort in the assessment of the marine environment. This requires GESAMP, through its members to be familiar with the activities of the Sponsoring Organizations and their collaborating partners and to maintain a widening network within the marine science community. In the intersessional period the following meetings were attended:

- Mr. Larry Awosika was present at the Intergovernmental Consultative Panel on the Law of the Sea in New York, June 2008.
- Mr. Sandor Mulsow visited the 50th anniversary meeting of SCOR, at Woods Hole, United States, in November 2008.
- Mr. Tim Bowmer representing GESAMP WG 1 gave a lecture on 'Hazard Evaluation of Chemicals under the revised Annex II of MARPOL' to the Norwegian Chamber of Shipping in Bergen, Norway, November 2008.
- Mr. René Coenen participated on behalf of IMO and GESAMP at the meeting of UN Oceans in Paris, April 2009.
- Mrs. Helen Keenan gave a presentation on GESAMP at the UNEP 6th meeting on Mercury Emissions from Coal, in Ljubljana, April 2009.

#### *Building Internal Cohesion*

- 2.12 To strengthen the bonds with the current Sponsoring Organizations of GESAMP the Chairman together with the GESAMP Officer, Mr. Haag, continued a series of visits, starting at IAEA's Marine Environment Laboratories (December 2007), UN-DOALOS (March 2008), FAO (June 2008), UNESCO-IOC's Executive Council Meeting (June 2008), UNEP Nairobi and WMO (both in October 2008) and finally, IMO on three occasions in the same period.
- 2.13 The main aim of these working visits is to introduce the revitalized GESAMP to a wider audience within the Sponsoring Organizations, meeting their collaborating organizations and building partnerships.

<sup>1</sup> [http://www.unga-regular-process.org/index.php?option=com\\_content&task=view&id=18&Itemid=20](http://www.unga-regular-process.org/index.php?option=com_content&task=view&id=18&Itemid=20)

<sup>2</sup> Idem as in footnote 1.

2.14 The Chairman expressed his appreciation to the Technical Secretaries of the Sponsoring Organizations for their time and effort in arranging these one or two-day visits and for making many appointments with colleagues and interested parties. It was heartening to receive such a warm welcome and to see new possibilities emerging for GESAMP.

#### *SIDA Funding*

2.15 In accordance with the original contract between the Swedish International Development Agency (Sida) and IMO, the three years of support for GESAMP ended in December 2008. As the process of concluding a contract for a second period of support has been delayed, IMO has requested an extension of the first support period.<sup>3</sup>

2.16 Financial support from Sida has enabled GESAMP to reaffirm its standing as an active body of experts and valued science resource within the UN System. It has also allowed the recommendations for the new GESAMP to be implemented. Currently ten GESAMP members are supported by the SIDA funding.

#### *Fundraising*

2.17 It is imperative for the future of GESAMP to maintain and increase financial support in order to ensure an active future for the organization. The Chairman, together with the GESAMP Officer identified some possibilities

<sup>3</sup> At the time of writing, extensions have been granted, covering activities during 2009 and 2010.

for additional funding of GESAMP, dividing activities into three groups of sponsorship, namely: structural funding, thematic or programme based funding and funding of specific projects on sectoral issues.

2.18 The Office has identified a number of potential funding bodies which support the protection of the marine environment. Our case will be strengthened when the new GESAMP Memorandum of Understanding has been signed by the Sponsoring Organizations. The Office is planning to approach bodies in the second category, i.e., thematic funding, and the first ideas under discussion for possible projects are centred on:

- monitoring of long-term pollution trends, i.e. a link to the proposed WG 39 (see below); and
- marine litter, in particular micro-plastic pollution.

#### *Concluding remarks*

2.19 GESAMP is most effective when tasked actively by its Sponsoring Organizations to provide high quality and independent scientific advice. The increased GESAMP membership and level of activities present today is proof of the commitment of the Sponsoring Organizations. The Chairman expressed his hope that the members will use their creativity and scientific experience to take the decisions necessary to move GESAMP forward through active leadership and participation in its Working Groups, Task Teams and correspondence groups.

## **3 REPORT OF THE ADMINISTRATIVE SECRETARY OF GESAMP**

#### *Activities and achievements of the Sponsoring Organizations of GESAMP since 2008*

3.1 On behalf of the Administrative Secretary of GESAMP, Mr. René Coenen (IMO) introduced an overview of the activities and achievements of the Sponsoring Organizations, with the aim of providing a context of their involvement and interest in the activities GESAMP undertakes (GESAMP 36/3). The highlights of these achievements are reported in detail in Annex V to this report.

3.2 GESAMP noted that co-operation on ocean science issues between intergovernmental organizations and non-governmental organizations was increasing, e.g., the International Council of Science Unions

(ICSU) contribution to the Monaco Declaration on Oceans in a High CO<sub>2</sub> Environment.

3.3 Since the 35th session of GESAMP, the main focus of the Executive Committee of GESAMP has been the conclusion of the Memorandum of Understanding on GESAMP, to replace the existing one dating from 1993, aimed at submitting the final text for signature to the Deputy Executive Heads of the Sponsoring Organizations by the end of June 2009.

#### *Activities of the GESAMP Office*

3.4 On 1 October 2007, the GESAMP Office was formally established at IMO, as a

co-sponsoring arrangement between the current sponsors of GESAMP, based on a decision by the Executive Committee. The Office is currently staffed by one GESAMP Officer on secondment from the Swedish Maritime Administration. Mr. Fredrik Haag's secondment contract expired in December 2008 and he is succeeded by Mr. Martin Soderberg, under a similar arrangement until November 2009. New secondment arrangements are being discussed, also in light of the fact that it would be highly unlikely in the current economic climate for the IMO Council to agree to the establishment of a full GESAMP Officer post, starting from the biennium 2010-2011. In addition, IMO provides the time of the Administrative Secretary and Technical Secretary (extended support to the Office, in addition to the normal duties of the Technical Secretary) as an in-kind contribution. Furthermore, IMO provides office space and equipment,

storage, etc. as well as secretarial support.

3.5 The main activities of the GESAMP office, in its second year of operation, were reported and GESAMP took note of these developments.

3.6 Mr. Coenen conveyed the gratitude of the Sponsoring Organizations to the Swedish International Development Co-operation Agency (SIDA) and the Swedish Maritime Administration for the substantive support that they had given to GESAMP's activities since the end of 2005 and for their positive interest in giving independent scientific advice for protection and sustainable use of the marine environment the attention it deserved. The Executive Committee was confident that SIDA would respond favourably to IMO's request for continuation of this support in the near future.

**Box 1. Activities of the Sponsoring agencies of GESAMP in the intersessional period (see Annex V for further details)**

**IMO**

- London Convention and Protocol: moving towards regulation of ocean fertilization under the LC/LP, The LC/LP Parties reviewed and adopted in 2008 various technical guidelines
- Anti-Fouling Systems Convention: The convention entered into force on 17 September 2008, the final guidance on best management practises for removal of anti-fouling coatings from ships, including TBT hull paints forwarded for adoption in July 2009
- Two oil pollution manuals and two HNS model courses completed: manuals aimed at assisting countries in assessing the level and magnitude of risk of oil spills to be utilized for planning and preparedness
- Proposed amendments to MARPOL Annex I: MEPC 58 approved, in October 2008, draft amendments to Annex I aimed at further enhancing the prevention of oil pollution from ships
- Ballast Water Management Convention: Work continued in preparation for the entry into force of the 2004 Ballast Water Management Convention
- Revision completed of MARPOL Annex VI (Air pollution): the Annex VI, which entered into force on 19 May 2005, has undergone a substantial revision with the view to significantly tighten the emission limits in the shortest possible time
- Work expedited on control and reduction of greenhouse gas emissions from ships: IMO is giving increased attention to reduce greenhouse gas (GHG) emissions emanating from shipping operations

**FAO**

- Management of deep sea fisheries in the high seas: In response to the requests by COFI and the UNGA, to address the major concerns and challenges related to the management of deep-sea fisheries in the high seas
- Climate change implications for fisheries and aquaculture: FAO activities in this field included the holding of a range of meetings
- Illegal, Unreported and Unregulated Fishing: FAO continued to facilitate the implementation of the IPOA-IUU
- Consultation with IMO on marine debris: FAO continued to address the issue of marine debris with IMO
- Marine Protected Areas (MPAs) as a Tool for Fisheries Management: A working version of the Technical Guidelines for MPAs was made available to COFI in March 2009
- FAO collaboration with IMO and ILO for safety at sea: FAO is working together with ILO and IMO in developing new safety standards for small fishing vessels that are not covered by the revised FAO/ILO/IMO Code of Safety and Voluntary Guidelines
- Ecosystem Approach to Aquaculture (EAA): FAO initiated in 2006 an effort towards the development and application of the ecosystem approach to aquaculture production
- Technical guidelines on aquaculture certification: Draft technical guidelines on certification in aquaculture have been presented to the COFI Sub-Committee on Aquaculture
- Environmental impact assessment (EIA) and monitoring in aquaculture: An Expert Workshop was held in Rome in September 2008 to review and discuss a range of thematic

*Box 1. Activities of the Sponsoring agencies of GESAMP in the intersessional period (see Annex V for further details)...continued*

#### **UNEP**

- The Regional Seas Programme: The UNEP Regional Seas Programme (RSP) continues to provide a comprehensive institutional framework for regional and global co-operation
- Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA): The GPA is the primary mechanism for strengthening global, regional and national efforts to address the interface between the freshwater and marine environments
- UNEP World Conservation Monitoring Centre (WCMC) & UNEP Coral Reef Unit (CRU): UNEP-WCMC has been addressing marine and coastal biodiversity issues for over twenty years
- Marine sciences: UNEP-WCMC has initiated collaboration with the Ocean Biogeographic Information System (OBIS)
- UNEP - Division of Early Warning and Assessment (DEWA) - The regular process for global reporting and assessment of the state of the marine environment including socio-economic aspects: In resolution 60/30, the UN General Assembly decided to launch a preparatory stage, the "Assessment of Assessments", towards the establishment of a Regular Process for the Global Reporting and Assessment of the State of the Marine Environment, Including Socio-Economic Aspects. An Ad Hoc Steering Group was established to oversee the assessment phase.
- Secretariat of the Convention on Migratory Species and the Joint CMS/ASCOBANS Secretariat: The Convention on the Conservation of Migratory Species of Wild Animals (CMS) aims to conserve terrestrial, marine and avian migratory species throughout their range
- DTIE- Fisheries Subsidies
- Negotiations in the WTO and Sustainability Criteria
- Access Agreements
- Trade Liberalization and Fisheries
- Eco-labelling and Market Access for sustainable fisheries

#### **WMO**

- WMO Precipitation Chemistry Programme
- WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)
- WMO Marine Meteorology and Oceanography Programme

#### **IAEA**

- Impacts of Climate Change and Ocean Acidification on Fisheries and Biodiversity
- Use of nuclear techniques to address coastal zone management problems
- On-line access to world-wide marine radioactivity data
- Stable isotope labelling in marine food web studies

UNIDO, IOC of UNESCO and UN-DOALOS did not submit information for this meeting.

## **4 GESAMP POOL OF EXPERTS AND WEB-SITE**

### *Introduction*

4.1 In December 2006 a MoU was signed by IMO and IAEA under which both Agencies agreed to work jointly in the implementation of specific activities aimed at revitalizing GESAMP. These activities involved two major tasks; 1) creating a new GESAMP web-site; and 2) the development and operation of the GESAMP Pool of Experts. These two elements were based primarily on the requirements set out in GESAMP's Strategic Vision document.<sup>4</sup>

### *GESAMP web-site*

4.2 IAEA first introduced a new temporary web-site and Pool of Expert database at the 34th Session of GESAMP. During 2008 the

majority of IAEA activities were focused on web-site maintenance and testing of the new permanent web-site created by a commercial media company in Monaco.

4.3 In mid-year the new test web site was launched and a check made that all documents had been correctly imported from the old web site and that all functions were working properly and a share-point software package was incorporated.

4.4 In early autumn the new web site was re-directed to its permanent domain <http://www.gesamp.org> which is registered with UNICC on behalf of IMO. In late February the fully developed web-site and operational

<sup>4</sup> GESAMP (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection) 2005. The new GESAMP: Science for Sustainable Oceans: A strategic vision for IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection. London, IMO. 21p.

management and maintenance of the site and its database were taken over by the GESAMP office at IMO and to ensure that service is not disrupted during the transition period, IAEA will continue to pay the web site server costs until the end of 2009.

- 4.5 In conjunction with web site-development, a GESAMP promotional leaflet, a poster and a PowerPoint presentation template were finalized for use by the Office and the members.

#### *Expert Pool and Database*

- 4.6 The Pool of Experts is an important mechanism to select experts for GESAMP, and its Working Group and Task Team members. After nearly two years in operation, the Pool of Experts database continues to grow although at a fairly slow rate. At present there are 259 expert nominations in the Pool representing institutions in some 45 different countries. From that total number of registrants, 183 nominations (~70%) have been validated by the Web Editor and can be used by GESAMP for its activities. Of those validated experts, as well as the remaining 76 non-validated entries, 83% are men and 17% are women.
- 4.7 At GESAMP 35, a request was again made to the Technical Secretaries and GESAMP members to assist by furnishing names of potential experts who could be pre-registered in the Pool.

- 4.8 Experts registered through the self-nomination mechanism on the web-site probably number less than 4% of the total nominees. Therefore additional effort will be needed in the future to obtain relevant experts for the Pool from databases of other UN agencies, regional organizations, scientific societies, NGOs, etc.

#### *Conclusions*

- 4.9 There is now a functioning web-site at <http://www.gesamp.org> that can be routinely used for communication and sharing information. The chairman expressed special thanks to the IAEA consultant, Mr. Scott Fowler, and the IAEA Publications Department for the excellent work performed on preparing the web-site.
- 4.10 With regard to the pool of experts, GESAMP considered it important to: a) further expand the geographical reach which may be possible by holding GESAMP sessions in the regional offices as opposed to the Headquarters of Sponsoring Organizations; b) improve as a matter of urgency the regional and gender balance in the pool and thereby of GESAMP itself; and c) expand the breadth of expertise, with e.g., social sciences, ecotoxicology, maritime engineering and occupational hygiene. The Pool of Experts will require continued effort on the part of GESAMP and the Sponsoring Organizations. To this end it was agreed that a Membership Committee should be established to expand and maintain the pool of experts.

## 5 GESAMP ACTIVITIES

This section contains the progress reports of the Working Groups of GESAMP as delivered by their Chairpersons. Each section is followed by a brief record of GESAMP's deliberations with regard to decisions or approval of proposed actions required by the Working Groups in order to fulfill their terms of reference.

### 5.1 Evaluation of the hazards of harmful substances carried by ships (WG 1)

#### *Introduction and history*

- 5.1.1 Bulk liquid chemicals are those which are pumped into or discharged from fixed tanks onboard a ship and are listed in the International Bulk Chemicals (IBC) Code<sup>5</sup>.

<sup>5</sup> International Maritime Organization. (2007) IBC Code; International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk. 2007 edn. London : International Maritime Organization

With well over 1000 chemical tankers on the high seas, these form an important focus of IMO's pollution prevention activities. Under Annex II of the revised MARPOL Convention, IMO regulates the ship type and safety considerations required for the safe transport of chemicals by sea. In addition, it regulates the discharge of tank slops at sea or more frequently to port reception facilities.

- 5.1.2 At the request of IMO The GESAMP Working Group on the Evaluation of Hazards of Substances carried by Ships (EHS Working Group, or WG 1) evaluates the hazards to the environment and human health of bulk liquid chemicals carried by ships and has provided support to IMO in this field for 40 years.
- 5.1.3 The GESAMP hazard profile is an alpha-numerical listing of environmental, physico-chemical and human health hazard

properties for each chemical substance and provides the basis for the pollution categorization of over 850 bulk liquid substances transported by sea. The working methods of WG 1 are contained in GESAMP Reports and Studies No. 64, entitled The Revised GESAMP Hazard Evaluation Procedure for Chemical Substances Carried by Ships (2002).

5.1.4 WG 1 met at IMO in London, United Kingdom from 20 April to 24 April 2009. The report of the meeting, is available on the IMO web-site ([http://www5.imo.org/SharePoint/blastData.asp/doc\\_id=11612/29.pdf](http://www5.imo.org/SharePoint/blastData.asp/doc_id=11612/29.pdf)). As Chairman of WG 1, Mr. Tim Bowmer will present the above report to the ESPH Working Group of the IMO Marine Environment Protection Committee (MEPC) when it meets at IMO in October 2009.

5.1.5 GESAMP noted the following progress since its 35th Session:

#### 5.1.5.1 **New substances and correspondence with the chemical industry**

- WG 1 evaluated nine new bulk chemicals for maritime transport according to their environmental, human health and physical-chemical criteria laid down in Reports and Studies No.64. The GESAMP hazard profiles determined for each chemical will be used by IMO to assign pollution category, ship type and carriage conditions.
- New information was provided by industry, in relation to two substances, having had previous evaluations, with a view to reappraising specific elements of their GESAMP profiles.
- At the request of IMO, a comprehensive review of short and long-chain olefin substances and mixtures was undertaken which addressed both nomenclature issues and profile consistency within the product family. This resulted in the consolidation of the hazard profiles for this product group.

#### 5.1.5.2 **Hazard profiles for gasoline and diesel**

- The safe transport of biofuel and mineral fuel blends is a matter of concern to IMO given the rapid increase in volumes carried in recent years. Consideration was given to the development of generic hazard profiles for gasoline (petrol) and mineral diesel products in order that the hazards of bio-fuel/petroleum blends could be more easily calculated by self-classification. This is in line with the standard procedures established for assessing mixture products as specified

under IMO guidelines. Information on a number of bio-fuel substances, e.g., pure materials such as fatty acid methyl ethers and ethanol are already available since these products have been evaluated by WG 1 under MARPOL as Annex II cargoes (chemicals). Comparable data for petroleum products are needed as these substances are conventionally shipped under the separate regulations of Annex I (mineral oil) of MARPOL. Work will continue on this topic over the coming year and contacts will be made with regional petrochemical associations in order to try to assimilate the necessary compositional and safety/environmental information on gasoline (petrol) and diesel.

#### 5.1.5.3 **Extended hazard profiles for WG 4 (BWVG)**

- To support the work of the GESAMP Ballast Water Working Group (WG 34), WG 1 commenced the evaluation of key environmental, human health and physical-chemistry properties for eighteen substances produced in seawater by the action of oxidizing biocides used in ballast water treatment systems such as chlorine and ozone. Hazard profiles were generated in full for five substances and partial profiles for the remaining 13 substances. This work will be completed intersessionally.

#### 5.1.5.4 **Inhalation toxicity**

- To highlight some of the Group's recent experience of using the more unique aspects of the revised GESAMP hazard evaluation procedure (Reports and Studies No.64, 2002), it was decided to prepare a paper for publication focused on the methodology developed for the estimation of inhalation toxicity. Data on inhalation toxicity are often absent, particularly for non-volatile materials. Concern arises that such products at elevated temperature and pressure may form an additional hazard by inhalation. The Maritime Safety Committee of IMO decided that all chemical substances shipped in bulk should be assessed for this hazard criterion. As a result and in order to fill in a substantial amount of missing data on hundreds of substances, WG 1 developed an extrapolation method using other measured acute toxicity endpoints such as skin and eye irritation and corrosion as well as oral and dermal toxicity to estimate toxicity by inhalation. An initial text has been developed which includes details of a comprehensive validation study undertaken in support of

this approach. It was agreed that further work on the Draft would be undertaken intersessionally and that this should include setting into context the need and the resultant benefits associated with this work. Consideration of a publication strategy will follow in due course but it was proposed that initially, the review paper could be presented and made available on the GESAMP web-site.

#### 5.1.5.5 **IMO payment system for hazard evaluations**

In line with an earlier decision taken by IMO, charges have now been introduced for the evaluation of new substances. This follows the precedent set by WG 34 for which IMO introduced charges from its inception. The mechanism employed for WG 1 treats the evaluation of: (1) products to be carried in bulk; (2) products used as a component in a bulk mixture; and (3) components used in tank cleaning additives in an identical manner and is based on a fixed fee/user pays principle. As part of these arrangements, it has been agreed that the fixed fee must be paid each time an evaluation is carried out on a product since this encourages fully comprehensive datasets to be put forward from the outset of the process. Extra charges will not apply, however, in cases where only limited follow-up action is needed on a specific issue in order just to clarify study methodology details or test results. In accordance with IMO guidance, the income now available will be used to support and maintain expertise at meetings of WG 1.

5.1.5.6 The activities of WG 1 have continued to provide a level playing field for the chemical and shipping industry whereby the hazards of substances are scientifically and fairly evaluated separately from their later pollution categorization or classification. In this way, politically motivated decision-making is avoided. The work of WG 1 is unique, as it is the only international peer-review body that evaluates the hazards of commodity chemicals by means of an independent scientific assessment.

#### *Discussion*

5.1.5.7 In discussion, the following issues were raised and clarifications given. In contrast with the reports of other GESAMP Working Groups, the reports of WG 1 are not reviewed by GESAMP, but are submitted directly to the appropriate Working Group of MEPC. GESAMP only becomes involved when changes are proposed to the hazard evaluation procedure. One side-effect of the routing of the reports of WG 1 directly

to MEPC was that they are not well known outside that audience. The visibility of these reports could be increased by placing them on the GESAMP web-site, accompanied by a short explanation aimed at a broader audience. It was noted that they are always available from the IMO web site.

5.1.5.8 As a standing body of GESAMP, WG 1 is in its 40th year and is tasked with the evaluation of hazards of high volume commodity and specialty chemicals related to an important UN Convention (MARPOL), GESAMP recommended that WG 1 should consider its visibility and means of communication; this might include renaming the group and the development of outreach products.

### **5.2 Review of applications for 'active substances' to be used in ballast water management systems (WG 34)**

#### *Introduction and history*

5.2.1 The International Convention for the Control and Management of Ships' Ballast Water and Sediments, (BWM Convention) was adopted at IMO on 13 February 2004, in response to the increasing concern of the international community with regard to the transfer of invasive species in ships' ballast water. To date, 18 of the required minimum of 30 countries are party to the BWM Convention, so it is not yet in force.

5.2.2 Within this framework an approval system has been set up for those Ballast Water Treatment Systems (BWMS) on board ships which make use of an 'active substance' or preparation to comply with the Convention that consists of a two step approach, establishing a Basic Approval and a Final Approval. MEPC grants or rejects approval of these systems, based on the advice of the Ballast Water Working Group of GESAMP (WG 34).

5.2.3 The more general outline, scope and aim of the BWM Convention have been addressed in the report of GESAMP 35 (GESAMP Reports and Studies No.78). WG 34 does not evaluate the operation or design of the systems, or their effectiveness, only their potential for risks to ship, crew, human health and the environment. In contrast with the hazard-based approach applied by WG 1, the evaluations by WG 34 follow a risk-based approach. WG 34 also focusses on the further development of its evaluation methods; this latter 'methodology' has been accepted as a 'living' document by MEPC and is an issue for discussion at almost every meeting of the Group when refinements and improvements are made, as appropriate.



### *Active substances'*

- 5.2.4 WG 34's task is to evaluate the risks for the crew, the ship's safety, the risk for the public at large and the environmental safety of the BWMS. Active Substances' are defined by the BWM Convention as "substances or organisms, including a virus or a fungus, that have a general or specific action on or against harmful aquatic organisms and pathogens". The approval of systems using such substances is described in MEPC resolution 169(57) adopted in 2008. In addition to 'active substances', WG 34, also evaluates all other substances considered to be of relevance, including what the Convention distinguishes as 'Relevant Chemicals' and 'Other Chemicals'.
- 5.2.5 Since GESAMP 35 was held in 2008, WG 34 convened four times to evaluate proposed BWMS. During these meeting 14 BWMS were discussed and evaluated, nine of which received a recommendation for Basic Approval and seven received a recommendation for Final Approval (two systems received both). MEPC endorsed the recommendation of WG 34 in all cases and gave the approval accordingly. Basic Approval was given to BWMS from Japan, Netherlands, Germany (twice), China and the Republic of Korea. Final Approval was given to BWMS from Germany, Republic of Korea (twice), Norway, Japan and Netherlands.
- 5.2.6 WG 34 has not been able to evaluate all 12 systems that were submitted for approval to MEPC 59, which meets in July 2009, as it is only able to thoroughly review three to four systems during one meeting. Nevertheless, the Working Group evaluated five systems during its 8th meeting, which was facilitated by the fortunate availability of two consultants. Therefore, four BWMS are still in the pipeline for evaluation at its 10th meeting. The Chairman of WG 34, Mr. Jan Linders, will present the recommendations of the most recent two WG 34 reports to MEPC 59 in July 2009.

### *Methodology for information gathering and its conduct of work*

- 5.2.7 WG 34 continuously develops its methodology based on its increasing experience in the evaluation of BWMS. Nevertheless it was recognized, also by GESAMP 35, that in order to ensure a high level of consistency, it would be necessary to focus on this methodology without the pressure of the evaluation work itself. Therefore, a two-day stock-taking workshop was held at IMO Headquarters from 21 to 22 January 2009 focusing solely on the methodology. Several topics were discussed with the aid of external experts, such

as the development of a Human Exposure Scenario (HES), the application and parameterisation of an environmental exposure model (MAM-PEC) and the consistency in the application of assessment factors to acute and chronic eco-toxicity tests. WG 34 plans to incorporate the results of the workshop into the methodology.

- 5.2.8 A very important additional achievement of the stock-taking workshop was the proposed cooperation with WG 1. During the workshop it became clear that an overview of inherently available data on the physico-chemical characteristics and the toxicological and eco-toxicological data of chemical by-products formed during the operation of the BWMS would be extremely beneficial for the consistent progress of WG 34. It was believed that the expertise of WG 1 of GESAMP could be instrumental to produce data forms for the most frequently occurring 17 chemicals and a proposal in this respect was put to WG 1 (see for the outcome paragraph 5.1.5.3 above).
- 5.2.9 Notwithstanding the progress made at the stock-taking workshop, WG 34 recognized that a lot of work still had to be done to: (1) improve the methodology; (2) develop the HES; (3) develop the model MAM-PEC; and (4) to further develop the data base into useful tools. In addition, WG 34 expressed the need for the development of an environmental exposure scenario, i.e., a template containing standardized background data such as environmental criteria, to assist in the determination of environmental risk. Although the Administration of the United Kingdom offered its support in this regard, WG 34 did not yet have the time to start this activity. Therefore, it was agreed to hold a second stock-taking workshop to be organized in the autumn of 2009.

### *Future work*

- 5.2.10 Currently, the reports of the 8th and 9th sessions of WG 34 are under consideration by GESAMP through correspondence prior to forwarding the final recommendations to MEPC 59 which is due to be held from 13 to 17 July 2009.

### *Discussion*

- 5.2.11 In discussion, the following issues were raised:
- It was clarified that almost all BWMS applications are designed to use active substances generated in situ. To date, only one of the evaluated BWMS applications uses chemicals from a supply

- stored on board;
- it was assumed that the number of applications submitted for evaluation would decrease as soon as the first BWMS become commercially available after 2010;
- changes made in the methodology would not lead to a retrospective assessment of the BWMS already approved for application.

5.2.12 GESAMP thanked those members that had actively contributed to the review of the reports of WG 34, which had sometimes been distributed at very short notice.

### 5.3 Development of activities in relation to deepwater fisheries, fisheries habitat and related ecosystem concerns (WG 35)

#### *Introduction and history*

5.3.1 No activities have been undertaken within the framework of GESAMP WG 35 after the 35th Session of GESAMP in May 2008. Activities of WG 35 have been hampered by the retirement of the technical secretary and the completion of the contract of the consultant temporarily acting as the technical secretary for this WG.

5.3.2 However, it is noted that considerable other activity related to deep sea fisheries in the high seas has taken place, as reported to the Administrative Secretary of GESAMP. FAO staff has been extremely busy during 2007-2008 providing the technical secretariat to a process of expert and technical consultations on the management of deep sea fisheries in the high seas.

5.3.3 Given that FAO is facing severe budgetary restrictions and therefore the focus of FAO's efforts has been on the aforementioned process of inter-governmental expert discussions. This has made it necessary to significantly reduce the allocation of staff and other resources in support of activities of WG 35.

5.3.4 In light of the above, FAO's Fisheries and Aquaculture Department has decided to discontinue its lead role of, and technical secretariat support for WG 35, and recommends to GESAMP the cessation of this Working Group.

#### *Discussion*

5.3.5 GESAMP noted with regret the decision to close down WG 35. The current development warranted a renewed discussion on a future GESAMP trust fund, to make sure that changing focuses in lead agencies do not have an immediate negative impact on

Working Groups and allowing them to finish their intended work.

### 5.4 Development of an ecosystem approach to mariculture (WG 36)

#### *Introduction and history*

5.4.1 Due to budget restrictions WG 36 has not been able to hold planned meetings in 2008, and will not be able to do so in the current year. Therefore, future activities of the WG aim only to finalize the meeting report as a general report of the WG activities. The report of the first meeting of the Group is therefore attached at Annex VIII.

#### *Discussion*

5.4.2 The Chairman commented and expressed his pleasure in hearing that a final report will be produced, despite problems with funding and altered priorities within the lead agency.

### 5.5 Expanded scientific review of mercury and its compounds and threats to the marine environment (WG37)

5.5.1 Shortly before GESAMP 35, UNIDO announced its decision by letter to discontinue its role as the lead agency of WG 37 due to changing policy priorities. The Chairperson of WG 37, Mrs. Helen Keenan, indicated that this situation is untimely as a proposed global convention on Mercury (coordinated by UNEP) was recently announced, and is scheduled for completion in 2013. Despite logistical problems, WG 37 has already met twice, the work is advancing well and it is anticipated that only one more meeting of the 11 experts is needed to produce a report to GESAMP and the lead agency.

#### *Discussion*

5.5.2 GESAMP considers that this WG is very important and expressed concern about the situation, which is beyond its control. GESAMP is also concerned that its reputation may have been damaged by association regarding potential new members, experts and external organizations. GESAMP recommended that every effort should be made to conclude the ongoing work, possibly with the collaboration of other co-Sponsoring Organizations, and that a way should be found to cover the expenses already incurred by some WG members. The GESAMP Chairman would reply to the UNIDO letter and was planning to visit UNIDO within the next few weeks.

5.5.3 The GESAMP Chairman asked the Sponsoring Organizations to share their views about WG 37. The IAEA maintained the offer made in GESAMP 35 to host a meeting in its Monaco

Laboratories and to contribute with one expert to WG 37. WMO explained the procedures used to secure funding for WG 38 (WMO led) and noted that commitment by Senior Management is essential in this process. IMO mentioned that Sida funding for WG activities could still be available. UNESCO/IOC suggested that it would be good practise to ensure that some external funding should be obtained for all WGs. UNEP indicated the potential interest of the Global Programme of Action and Division of Technology, Industry and Economics (DTIE) (responsible for preparing the Mercury convention) in this WG. UNEP encouraged GESAMP to contact them, and suggested that Agencies should explore the possibility of funding remaining activities, including printing of the final report.

## 5.6 Atmospheric input of chemicals to the ocean (WG 38)

### *Introduction and history*

5.6.1 There is still growing interest concerning the impact of the atmospheric input of both natural and anthropogenic substances on ocean chemistry, biology, and biogeochemistry as well as climate. The atmospheric input of chemicals to the ocean is closely related to a number of important global change issues. The atmospheric input of this anthropogenic nitrogen to the ocean may lead to the increased oceanic production and emission of  $N_2O$  that could offset as much as two-thirds of the decrease in radiative forcing that result from the increased drawdown of  $CO_2$  from the anthropogenic nitrogen input. There is also a close connection with climate here, as a windier and dryer climate would result in increased quantities of iron entering the ocean, with its consequent impact on marine productivity and thus both  $CO_2$  drawdown and dimethyl sulfide release.

5.6.2 To date there has been relatively little interaction between the atmospheric and oceanic communities in this area. Opportunities now exist for the inclusion of atmospheric transport and deposition studies to the ocean in new and developing atmospheric research and monitoring programs. For example, WMO is developing plans to initiate new, and improve existing, measurement and modeling programmes in the areas of precipitation chemistry. WMO is also developing a Sand and Dust Storm Warning and Assessment System that links products of operational research forecasts of sand and dust to users. Until now there has been little involvement of the marine community in either of these efforts, although clearly both would be of significant interest and value to the ocean sciences.

### *Activities and plans*

5.6.3 WG 38 has been formed with Mr. Robert Duce and Mr. Peter Liss, as Co-Chairs and with the following Terms of Reference:

- Assess the need for the development of new model and measurement products for improving our understanding of the impacts of the atmospheric deposition of nitrogen species and dust (iron) to the ocean;
- Review the present information on the atmospheric deposition of phosphorus species to both the marine and terrestrial environments, considering both natural and anthropogenic sources, and evaluate the impact of atmospheric phosphorus deposition on marine and terrestrial ecosystems. Consider whether such a review of any other substance would be useful; and
- Work with the WMO Sand and Dust Storm Warning and Assessment System and with the WMO Precipitation Chemistry Data Synthesis and Community Project to evaluate the needs of the marine community and assist in clearly articulating them in the development of these WMO efforts.

5.6.4 The first meeting of WG 38 took place at the University of Arizona, Tucson, Arizona, United States, from 10-14 December 2008. This meeting was organized and supported by the Global Atmosphere Watch (GAW) and the World Weather Research Programme of WMO, with additional support from the Swedish International Development Agency, IMO, the international research program SOLAS (Surface Ocean/Lower Atmosphere Study) of the International Geosphere/ Biosphere Program (IGBP), EU Joint Research Centre, and the University of Arizona.

5.6.5 During the meeting the Working Group addressed these three charges in detail. Charges 1) and 2) were addressed by gathering information for three separate papers/ documents that WG 38 will write in the areas of phosphorus, nitrogen, iron and organic matter deposition from the atmosphere to the ocean. The tentative titles of these three papers are:

*"Implications of changing ratios of limiting nutrients in the surface oceans as a result of atmospheric deposition"*

*"Uncertainties in iron and phosphorus deposition to the ocean"*

*"Atmospheric organic materials and the nutrients they carry to the ocean"*

- 5.6.6 Three subgroups were formed to address these three topics, and detailed outlines and responsibilities for various parts of these documents were made. The co-authors of these three papers will work throughout the coming year gathering all the data and information necessary to complete the papers, with draft sections being written in the intersessional period. WG 38 will meet again in early 2010 to complete the discussions and prepare the papers for publication.
- 5.6.7 Charge 3 in the Terms of Reference list was addressed by the development during the meeting of two letter reports, including recommendations. These letter reports address the issues outlined in Charge 3) and were submitted by GESAMP to WMO in April 2009. Additionally, Mr. Robert Duce, Mr. James Galloway and Mr. Peter Liss also published a short paper in the WMO bulletin entitled 'The impacts of atmospheric deposition to the ocean on marine ecosystems and climate'.
- 5.6.8 WG 38 has tentatively chosen the week of 11 to 15 January 2010 for its second meeting, to be held at IMO Headquarters in London.
- 5.7 Global trends in pollution of coastal ecosystems: retrospective ecosystem assessment (WG 39, under consideration)**

#### *Introduction and history*

- 5.7.1 The main objective of this proposed working group is to contribute to the reduction globally of coastal ecosystem stress by providing stakeholders, scientists and society in general with an objective and global assessment of pollution trends during the last century in sensitive coastal ecosystems, through retrospective ecosystem analysis, by using dated environmental archives and time-series data where available. The main tasks to be carried out by the working group are: 1) to establish links with other organizations; 2) to revise existing methodologies on suitable environmental archives, dating methods, pollution indicators, analytical techniques and trend analysis; 3) to revise existing data, including data quality, on a regional basis; and 4) to disseminate the working group activities. The main outputs of the working group will be reports on the proposed methodology and a synthesis on existing data. No new data are expected to be produced

although the results of the work might trigger new data acquisition projects in the future. The working group might like to consider the organization of regional meetings and a Conference, for which outside funding will need to be obtained.

- 5.7.2 IAEA had originally presented this proposal for a new working group to GESAMP 35. IMO, UNEP and UNIDO expressed their interest to co-sponsor this Working Group. GESAMP 35 largely expressed agreement on the relevance of this tool for coastal zone managers, and provided comments that will be considered for the final Terms of Reference. The proposal of the new working group was approved by GESAMP 35 in principle, subject to final approval of the Terms of Reference. During the intersessional period IAEA had planned a meeting, including experts from partner organizations, to fully develop the Terms of Reference. The IAEA is committed to the implementation of the working group, but the meeting will not be called until the budget for the next biennium is approved and funding secured. The revised Terms of Reference will then be submitted intersessionally for final approval to GESAMP.

#### *Discussion*

- 5.7.3 GESAMP 36 noted the present status and thanked the IAEA for proceeding cautiously to secure funding for the working group. It was recognized that this is a very interesting proposal and IAEA was encouraged to proceed as soon as funding is secured. Some members showed concerns about the ambition of the goals of the working group, but IAEA noted that the work should be based on published results and that, in any case, the experts group should draft feasible Terms of Reference. It was also suggested that a framework programme could be developed and tasks be executed with specific Terms of Reference. The Chairman proposed to seek external funding to help the operation of this important working group. UNEP encouraged IAEA to contact its new GPA office to coordinate efforts. IAEA noted that other organizations such as UNDP and NOWPAP had expressed their interest in this working group to GESAMP 35, and that in the recent letter addressed to the Chairman of GESAMP, UNIDO confirmed their commitment to co-fund this working group.

## 6 CONTRIBUTION TO THE ASSESSMENT OF ASSESSMENTS (AoA) UNDER THE 'UN REGULAR PROCESS'

- 6.1 The UNEP and UNESCO-IOC Technical Secretaries provided a presentation of the latest developments and status of the UN Regular Process (RP) and its start-up phase, the so-called Assessment of Assessments (AoA), under UNGA resolution 60/30.
- 6.2 The AoA Report will first be discussed in the UNGA Working Group in August/September 2009 and then UNGA will make its decision in December 2009. Based on the outcomes of the last meeting of the Group of Experts for the AoA, and the subsequent meeting of the Ad Hoc Steering Group for the AoA, (March and April 2009), a summary presentation has been prepared
- by both lead agencies, with an emphasis on the following:
- Why is a Regular Process needed;
  - What is the role of assessments in supporting sound policy responses;
  - What could a Regular Process do;
  - The overall structure of the AoA Report of the RP; and
  - The framework and options for the RP.
- 6.3 The discussions that followed focused on possible roles for GESAMP in the Regular Process and led to a position paper being produced (see Annex IV) for distribution to the Sponsoring Organizations of GESAMP, in particular UN-DOALOS.

## 7 SIDE-EVENT ON "GLOBAL ATMOSPHERIC INPUT OF CHEMICALS TO THE OCEANS"

- 7.1 As part of GESAMP 36, a special session on Global Atmospheric Input of Chemicals (nutrients) to the Oceans was arranged. The session was intended to highlight a scientific issue, high on the agenda of the host organization WMO, and to spread some light on how GESAMP WG 38 is assisting WMO in its efforts.
- 7.2 Mr. Robert Duce, Departments of Oceanography and Atmospheric Sciences, Texas A&M University, College Station, Texas, United States, gave a presentation titled 'The impact of atmospheric deposition to the oceans'.
- 7.3 A second presentation was given by Mr. Manmohan Sarin, Physical Research Laboratory, Ahmedabad, India, on the topic of 'Chemical characteristics of aerosols over Arabian Sea and Bay of Bengal: Impact of anthropogenic sources'.
- 7.4 The third and last presentation was given by Mr. Slobodan Nickovic, WMO, Geneva, Switzerland, on the topic of 'The atmospheric iron cycle: Relevant WMO research programmes and recent modeling examples'.
- 7.5 In all three presentations the issue of iron input from the atmosphere was considered from different perspectives – as a component of the natural aerosol, as a compound affected by pollution, and as subject of modeling parameterization.
- 7.6 GESAMP appreciated this overview of emerging research, noting the quality of the research and agreed to post the three presentations on its web site.

## 8 IDENTIFICATION OF NEW AND EMERGING ISSUES REGARDING THE DEGRADATION OF THE MARINE ENVIRONMENT OF RELEVANCE TO GOVERNMENTS AND SPONSORING ORGANIZATIONS

### Introduction

8.1 One of GESAMP's core functions is the identification of new and emerging issues regarding the state of the marine environment. At each session, GESAMP is invited to consider and frame any such issues of concern so that they can be evaluated and brought to the attention of Governments, Sponsoring Organizations and the scientific community in general. The following issues were raised and discussed by GESAMP.

### Emerging Issue 1: bioaccumulation in top predators

8.2 One of the members brought to GESAMP's attention the need for a review of the current state of contaminant biomagnification in marine top predators, including mammals, cartilaginous fishes and other groups. The following title was proposed:

*"Bioaccumulation of contaminants in marine top predators in relation to human health - a global review"*

8.3 It is well established that many persistent pollutants can be transferred up food chains, leading to biomagnification at higher trophic levels, in particular in top predators. Many coastal communities are dependent for a high proportion of their protein on the consumption of seafood, and this can result in increased ingestion of POPs. For example, in Arctic communities this has led to indigenous peoples reliant on marine-food sources having relatively high body burdens of POPs, and has caused health concerns for lactating women (Arctic Monitoring and Assessment Programme<sup>6</sup>).

8.4 The following aspects could be considered in establishing the scope of the assessment:

- human health concerns
- a global scope including all ocean and coastal regions
- potential impacts on ecosystems, i.e., non-human populations
- existing regional assessments, such as AMAP, could be taken into account

8.5 A correspondence group was proposed to produce Terms of Reference for further consideration by GESAMP on the justification for forming a new Working Group or other appropriate action. Recommendations may be made for further research and the expertise explore this issue could be identified. Potential sponsors should also be identified as a priority; e.g., within the UN: WHO, FAO, IAEA, UNEP as well as external sponsors.

### Emerging Issue 2 - Environmental Quality Standards

8.6 Another member of GESAMP suggested the development of a global database for Environmental Quality Standards on contaminants in the marine environment. While not strictly speaking an emerging issue, this could provide a useful global service to fill a gap and allow administrations to rapidly check which EQS already apply in other regions. Initially it will focus on those contaminants listed on Annexes A to C of the Stockholm Convention<sup>7</sup>.

8.7 The following tasks were agreed:

- compile a comprehensive database of current EQS and make them available on the GESAMP web-site,
- promote the GESAMP web-site as the premier link when searching for EQS,
- prepare a thorough synthesis of current EQS data, including comparison of POPs data (initially for the 12 chemicals listed in the Stockholm Convention).

8.8 The results will be presented to GESAMP 37 with recommendations for future developments. In regard to this item a correspondence group will be set up.

### Emerging Issue 3: hypoxia and biological effects

8.9 One GESAMP member, following introduction of this topic at GESAMP 35 had provided a thorough exposition of the effects that low levels of oxygen can have on the endocrine systems in marine organisms, noting that hypoxic regions in the world's oceans have increased in the last decades.

<sup>6</sup> [www.amap.no](http://www.amap.no)

<sup>7</sup> <http://chm.pops.int/>

- 8.10 GESAMP considered that it needed to be clarified as to whether there was sufficient information to enable an assessment on the topic to be carried out, or whether the issue needed further time to develop.
- 8.11 In regard to this item, a correspondence group to look at “hypoxia in the marine environment and its implications at ecosystem and ecophysiological level” would be set up.

#### Emerging Issue 4: mapping of environmental indicators

- 8.12 It was suggested that GESAMP is in an excellent position to develop a global and visually descriptive product (GIS) of relevant parameters related to the quality of the marine environment accompanied by synthesis and/or comments on the observations through the medium of its web-site. This could be important for decision and policy-makers and the public in general, and would therefore be an important outreach product. GESAMP noted that this would indeed be a very interesting

product, but might be a large undertaking needing significant funding. It was suggested that GESAMP could take into consideration the work being done by other institutions in this field and, in a first phase, GESAMP could host a metadata site linking to products produced by other institutions. GESAMP could nominate a Task Team to review present products and efforts, and propose a way forward. In any case, it is necessary to develop policies and objectives on the use and development of the existing web-site. It was agreed to place this issue on the agenda for GESAMP 37.

Editors note: this latter activity has been pursued as part of the GEF/UNEP/IOC led Transboundary Waters Assessment Programme (TWAP) of which GESAMP is a Key contributor; TWAP is preparing the methodology for an indicator-based global assessment of the open oceans, large marine ecosystems, lakes, rivers and groundwater compartments. It will therefore be considered under a separate heading at future meetings and will not be discussed under New and Emerging Issues.

## 9 SCOPING ACTIVITIES FOR GESAMP 37

- 9.1 Correspondence group on Environmental Quality Standards (EQS) to explore the possibility of global standards and to expand the GESAMP web-site section on EQS.

Lead: H. Keenan  
 Members: S. Mulsow, A. R. Fernandez, E. Ajao and J. Linders (correspondence via the GESAMP virtual office)

- 9.2 Correspondence group on “Micro-plastics as a vector in transporting persistent and toxic substances” to prepare a workshop to review the subject and develop the terms of reference for an eventual working group.

Lead: P. Kershaw  
 Members: C. T. Bowmer, H. Keenan

- 9.3 Correspondence group to further develop a scoping paper on endocrine disruption as a result of hypoxia in the marine environment.

Lead: R. Wu  
 Members: A. R. Fernandez, S. Mulsow, E. Ajao, P. Kershaw

- 9.4 Correspondence group on biomagnification in top predators and its ecological and social implications to develop a terms of reference for a working group.

Lead: A. R. Fernandez  
 Members: E. Sombrito, G. Wiafe, F. Briand (CIESM), in collaboration with AMAP

# 10 FUTURE WORK PROGRAMME

## 10.1 Evaluation of the hazards of harmful substances carried by ships (Working Group 1)

Lead Agency: IMO

Co-sponsors: none

Chairperson: C. T. Bowmer

Members: T. Höfer, D. James, S. le Floch, M. Morrisette, H. Saito, N. Soutar (consultant)

Product: Report of the working group, containing an updated version of the composite list of 800 chemicals; this latter to be posted on the IMO and GESAMP web-sites

Planning: The 47th session will be held at IMO in London from 19-23 April 2010.

## 10.2 Review of proposals for approval of ballast water management systems that make use of 'active substances (Working Group 34)

Lead Agency: IMO

Co-sponsors: none

Chairperson: J. Linders

Members: T. Borges, A Craven (consultant), S. Gollasch, S. Hanayama, A. Kronborg, E. Lemieux, K. Rhie, F. Stuer-Lauridsen, D. Tongue.

Products: Three individual reports of the Working Group, approved by GESAMP, containing recommendations to the IMO/MEPC for the approval or rejection of the submitted ballast water treatment systems; further recommendations as appropriate from the second stocktaking workshop to GESAMP and/or IMO.

Planning: The 10th session of the working group is planned for 14-18 September 2009, and the 11th session for 19-23 October 2009, in conjunction with the second stocktaking workshop 26-28 October 2009. IMO will be requested to cover the expenses of some members of WG 1, two members of GESAMP, as well as an expert on the MAM-PEC model to take part in this Workshop. A further

input to the Workshop will be the evaluations by WG 1 of the 17 chemical by-products formed during the operation of the ballast water management systems evaluated thus far. The 12th session is planned for 7-11 December 2009.

## 10.3 Development of an ecosystem approach to mariculture with emphasis on off-shore farming (Working Group 36)

Lead Agency: FAO

Co-sponsors: none

Chairperson: J. Marra

Members: D. Benetti, I. Karakassis, M. P. Kuton, P. Pitta, N. Sims, Y. Olsen, Q. Tang, C. Wurmman.

Product: The report of the first meeting of the Working group has been completed and is contained in annex VIII. Further products are not envisaged.

## 10.4 Expanded scientific review of mercury and its compounds and threats to the marine environment (Working Group 37)

Lead Agency: [to be confirmed]

Co-sponsors: IAEA

Chairperson: H. Keenan

Members: B. Alo, J. Davee-Guimaraes, T. Hennessey, M. Horvat, J. Hurley, J. Leaner, R. Mason, J. Oh, A. Songsasen, T. Tamiyasu.

Product: It is hoped that WG 37 can prepare its final report according to its Terms of Reference. If approved by GESAMP, the report of this WG could then be published in the course of 2010.

Planning: A 3rd and final meeting is required to complete the work. Pending reconfirmation of the administrative and financial arrangements for WG 37, its activities have temporarily been put on hold.

## 10.5 Atmospheric input of chemicals to the ocean (Working Group 38)

Lead Agency: WMO



Co-sponsors: IMO, SOLAS, EU Joint Research Center, University of Arizona

Co-Chairpersons: R. Duce, P. Liss

Members: A. Baker, F. Dentener, K. Hunter, M. Kanakidou, N. Kubilay, N. Mahowald, G. Okin, J. Prospero, M. Sarin, V. Surapipith, I Tegen, M. Uematsu, T. Zhu.

Product: Two advisory letters from GESAMP to WMO were prepared by the Working Group, and GESAMP delivered these letters to WMO. One letter was sent to the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) and the other to the WMO Precipitation Chemistry Data Synthesis and Community Project. WG 38 has also planned three peer-reviewed papers for publication in the scientific literature, leading to a final report, which if approved by GESAMP could then be published in 2010 or 2011.

Planning: The 1st meeting of WG 38 was held from 10 to 14 December 2008 at the University of Arizona, Tucson, United States. The 2nd meeting will be held in London from 11 to 15 January 2010.

#### **10.6 Global trends in pollution of coastal ecosystems: retrospective ecosystem assessment (Working Group 39)**

Lead Agency: IAEA

Co-sponsors: to be determined

Chairperson: to be determined

Members: to be determined

Product: Initially, a refined terms of references is to be provided to GESAMP as proposed by IAEA with the help of an invited expert meeting.

One or more reports, which if approved by GESAMP, could then be published in the GESAMP Reports and Studies Series.

Planning: GESAMP approved an initial terms of reference for this WG intersessionally. The 1st meeting will be planned when the budget for the next biennium is approved by IAEA and funding from co-sponsors has been secured. The revised terms of reference will then be submitted to GESAMP for final approval.

#### **10.7 Other activities**

The following activities will continue in the intersessional period:

.1 The standing Task Team on the UN Regular Process will continue its work through meetings or correspondence as required to service the needs of the UN General Assembly Regular Process and at the request of UNEP and UNESCO-IOC.

Members: R. Duce, R. Boelens, C.T. Bowmer, L. Awosika

.2 A GESAMP membership committee will be formed, consisting of the Vice-Chairpersons of GESAMP, who will develop procedures for expansion of the GESAMP Pool of Experts.

.4 A request from IMO regarding advice on wash-water discharge criteria from exhaust gas cleaning systems on board ships was received. It is agreed to complete this advice by correspondence and to convey GESAMP's recommendations in this manner to MEPC.

.5 A request was received from IMO for GESAMP to peer review a report on the equivalence of Ballast Water Management Systems not depending on chemical substances. GESAMP agreed to peer review this report by correspondence once IMO has further clarified the exact nature of the request.

## **11 ANY OTHER BUSINESS**

11.1 No issues were raised under this agenda item.

## **12 DATE AND PLACE OF GESAMP 37**

12.1 GESAMP accepted the offer of UNEP to host the thirty-seventh session of GESAMP at the UNEP Regional Headquarters in Bangkok, Thailand, at a date to be decided upon intersessionally. The Chairman

noted, with pleasure, that other Sponsoring Organizations showed interest in hosting session thirty-seven, but that, according to the rotation scheme for hosting sessions, UNEP was next in line.

## **13 ELECTION OF CHAIRPERSONS**

13.1 The Group unanimously re-elected Mr. Tim Bowmer as Chairman of GESAMP for a further two years, and Mr. Lawrence Awosika

and Mr. Sandor Mulsow as Vice-Chairmen for the forthcoming intersessional period and the thirty-seventh session of GESAMP.

## **14 CONSIDERATION AND ADOPTION OF THE REPORT OF GESAMP 36**

14.1 The report of the thirty-sixth session of GESAMP was considered and approved by the Group on the last day of the session.

## **15. CLOSURE OF THE SESSION**

15.1 The Chairperson of GESAMP, Mr. Tim Bowmer, closed the thirty-sixth session of GESAMP on 1 May 2009 at 11.50 hrs.

# ANNEX I

## AGENDA

### *Opening*

- |     |   |     |  |
|-----|---|-----|--|
| 1   | Adoption of the agenda  | 5.7 | Establishment of trends in global pollution in coastal environments (WG 39)  |
| 2   | Report of the Chairperson of GESAMP   | 5.8 | Any other proposals for new Working Groups   |
| 3   | Report of the Administrative Secretary of GESAMP  | 6   | Contributions to the Assessment of Assessments under the 'UN Regular Process'  |
| 4   | GESAMP Pool of Experts and Web site and the GESAMP Office   | 7   | Sid-event on 'Global atmospheric input of chemicals to the oceans'   |
| 5   | Planning of GESAMP activities:  | 8   | Identification of new and emerging issues regarding the degradation of the marine environment of relevance to governments and sponsoring organizations |
| 5.1 | Evaluation of the hazards of harmful substances carried by ships (WG 1)   | 9   | Scoping activities   |
| 5.2 | Review of Applications for 'active substances' to be used in ballast water management systems (WG 34)                   | 10  | Future work programme  |
| 5.3 | Development of activities in relation to deep-water fisheries, fisheries habitat and related ecosystem concerns (WG 35) | 11  | Any other business   |
| 5.4 | Development of and ecosystem approach to mariculture (WG 36)  | 12  | Date and place of GESAMP 37  |
| 5.5 | Expanded scientific review of mercury and its compounds and threats to the marine environment (WG 37)                   | 13  | Election of chairpersons   |
| 5.6 | Atmospheric input of pollutants to the oceans (WG 38)   | 14  | Consideration and adoption of the report of GESAMP 36  |
|     |   |     | Closure  |

## ANNEX II

### LIST OF DOCUMENTS FOR GESAMP 36

GESAMP 36/1	Administrative Secretary	Provisional Agenda.
GESAMP 36/1/1	Administrative Secretary	Annotations to the Provisional Agenda.
GESAMP 36/2	Chairperson	Report of the Chairman of GESAMP
GESAMP 36/3	Administrative Secretary	Report of the Administrative Secretary of GESAMP. Activities and achievements of sponsoring organizations of GESAMP Since the 35th session.
GESAMP 36/4	S. Fowler	GESAMP Pool of Experts and web-site.
GESAMP 36/5/1	IMO	Planning of GESAMP Activities: Evaluation of the Hazards of Harmful Substances Carried by Ships.
(WG 1)		
GESAMP 36/5/2	IMO	Planning of GESAMP Activities: Review of Applications for 'Active Substances' to be used in Ballast Water Management Systems.
(WG 34)		
GESAMP 36/5/3	FAO	Planning of GESAMP Activities: Deep-Sea Fisheries, Habitat and Ecosystem Concerns. (WG 35)
GESAMP 36/5/4	FAO	Planning of GESAMP Activities: Ecosystem Approach to Mariculture (EAMAR) with emphasis on Off Shore Farming. (WG 36)
GESAMP 36/5/5	UNIDO	Planning of GESAMP Activities: Mercury and its Compounds. (WG 37)
GESAMP 36/5/6	WMO	Planning of GESAMP Activities: The Atmospheric input of Chemicals to the Ocean. (WG 38)
GESAMP 36/5/7	IAEA	Planning of GESAMP Activities: Global Trends in Pollution of Coastal Ecosystems: Retrospective Ecosystem Assessment. (WG 39)
GESAMP 36/6	Secretariat	Contributions to the Assessment of Assessments under the 'UN Regular Process'
GESAMP 36/7	WMO	Proposed Programme and Timetable for Side-Event on 'Global Atmospheric Input of Chemicals to the Ocean'
GESAMP 36/INF.1	Secretariat	Draft List of Participants.

# ANNEX III

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**United Nations Division for Ocean Affairs and the Law of the Sea/Office of Legal Affairs (UNDOALOS)**

Not attending

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# ANNEX IV

## POSSIBLE ROLES FOR GESAMP IN THE UNITED NATIONS REGULAR PROCESS

GESAMP has a long-standing interest in the United Nations Regular Process for global reporting and assessment of the state of the marine environment, including socio-economic aspects (the “Regular Process”), and since 2001 has participated in many aspects of its development, including the start-up phase, the “Assessment of Assessments” (AoA). GESAMP congratulates the Group of Experts, the Ad Hoc Steering Group, and the Lead Agencies of the AoA for their excellent work in completing the Assessment of Assessments, which GESAMP views as a major step towards establishing the Regular Process.

At this critical juncture for the Regular Process, GESAMP has considered how it may best continue to contribute to the Regular Process in light of the framework which has been proposed as a way forward by the Group of Experts and the recommendations of the Ad Hoc Working Group of the Whole, as reflected in UNGA Resolution A/64/347.

As envisaged by the Group of Experts, the framework of the Regular Process is expected to comprise a number of organizational arrangements such as, a Management and Review Body (MRB), an Expert Panel, a Pool of Experts, and a Secretariat and to provide for some functions, including the preparation of thematic assessments to address specific needs of the Regular Process.

GESAMP considers that it would best participate in the Regular Process by conducting thematic assessments, by having formal linkages with the Regular Process Expert Panel to foster cooperation and coordination, by providing its Pool of Experts and by participating in peer reviews.

**Thematic Assessments.** The Regular Process is likely to include thematic assessments on specific topics, probably on shorter time frames than the five-year cycle envisaged for integrated global assessments. GESAMP has a long history of producing such assessments and contributed in this way to the Assessment of Assessments with a review of assessment activities relating to pollution in the open ocean. GESAMP considers that, as an established mechanism, it could make a strong contribution to thematic assessments as part of the Regular Process. This could be done on an ad hoc basis, but there would be advantages in establishing a standing institutional arrangement in which GESAMP conducts thematic assessments for the Regular Process which are appropriate to GESAMP’s expertise. It would expedite the initiation and execution of assessments, help foster a consistent approach to thematic assessments and promote the alignment of GESAMP’s expertise and work plan to the needs of the Regular Process. GESAMP’s existing systems for external

peer review and approval would streamline delivery, and GESAMP’s reputation for high-quality assessments would contribute to the scientific credibility of the Regular Process.

**Panel of Experts.** A Panel of Experts acting in an individual capacity will lead the generation of assessments for the Regular Process. GESAMP considers that it would be beneficial for the Regular Process Panel of Experts and GESAMP to have effective formal linkages. This would promote coordination and cooperation between the two groups. It would assist GESAMP in aligning its membership and work programme to the needs of the Regular Process and also promote the dissemination and application of the findings and recommendations of the Regular Process through GESAMP’s activities.

**Pool of Experts.** The Regular Process will need access to a broad range of experts, for example to contribute to individual assessments, provide specialist knowledge on specific topics, and serve as peer reviewers. The Assessment of Assessments envisages a Pool of Experts upon which the Regular Process can draw to meet these needs. GESAMP has established a similar Pool of Experts to broaden its expertise and foster geographic and gender balance. This task has required extensive consideration, planning, time, and resources and is not to be undertaken lightly. In GESAMP’s view, the Regular Process would benefit from building upon existing expert networks, including by making use of the GESAMP Pool of Experts. The selection criteria and profile of expertise for the GESAMP Pool of Experts aligns well with those outlined in the Assessment of Assessments, and could easily accommodate the requirements of the Regular Process. GESAMP recognizes that the Regular Process may need to draw upon other expert networks to ensure access to the broadest possible range of expertise.

**Peer Review.** A thorough, transparent peer review process will be essential for the credibility of the Regular Process. GESAMP has a transparent mechanism for reviewing its products and external documents, and considers it appropriate for the Regular Process to draw upon this experience. GESAMP could undertake peer review of the main integrated global assessments or of thematic assessments conducted by other groups. GESAMP performed such a role in the Assessment of Assessments by establishing a task team to review the report of the Group of Experts. The Regular Process could also draw upon the GESAMP Pool of Experts as a source of individual expert peer reviewers. GESAMP stands ready to be part of the Regular Process peer review process.

It is also useful to identify components of the Regular Process in which GESAMP does not consider



itself to have an appropriate role. One of these is the Management and Review Body, which is likely to represent decision makers in establishing the objectives and design of the Regular Process to ensure its policy relevance, as well as undertaking administrative functions such as the approval of budgets and work-plans. GESAMP has no legitimate role in such functions. Similarly, given that its mandate is to provide independent scientific advice, GESAMP does not consider itself to have an appropriate role in providing or contributing to the Secretariat of the Regular Process.

The Regular Process will clearly require the support of a Secretariat, presumably in the context of an institutional arrangement among UN organizations. The GESAMP Office would provide a focal point for interactions between GESAMP and the Regular Process Secretariat.

In conclusion, GESAMP regards the establishment of the Regular Process as an important and positive step forward towards improved ocean governance. We stand willing to assist the Regular Process in any manner which is within our capabilities and deemed appropriate by the Regular Process.

# ANNEX V

## ACTIVITIES AND ACHIEVEMENTS OF THE SPONSORING ORGANIZATIONS OF GESAMP SINCE 2003

1 The Administrative Secretary of GESAMP, traditionally, reports on the activities and achievements of the Sponsoring Organizations of GESAMP with the aim to provide GESAMP with an account of their involvement and interest in the activities GESAMP undertakes. This document provides a summary of the Organizations' achievements since GESAMP 35 (May 2008) from IAEA, IMO, FAO, WMO and UNEP. IOC/UNESCO, UNIDO and UN-DOALOS have not been able to submit contributions in writing, but information on their activities have been given orally during the session.

### IAEA

#### *Impacts of Climate Change and Ocean Acidification on Fisheries and Biodiversity*

2 There is growing concern about the likely effects on the ocean of climate change and increasing levels of contaminants and carbon dioxide, and about how these changes may impact the sustainability of fisheries and biodiversity. In 2008, IAEA-MEL completed a series of experimental radiotracer studies on the potential impact of ocean acidification on the biological processes of three species of commercial seafood. Radiotracers were applied to sea bream and sea bass, and to cuttlefish to assess the incorporation into their tissues of trace elements such as cadmium and zinc – commonly found in marine ecosystems. Levels of these contaminants are expected to rise in the future owing to a combination of factors such as industrial growth and greater use of nuclear power to mitigate carbon emissions. All three of the fish species used in the studies are of increasing importance to commercial fisheries, given the steep decline of finfish catches in recent years. The experimental parameters used in the studies were based on scenarios of seawater pH levels derived from various models of future carbon emissions by the Intergovernmental Panel on Climate Change (IPCC). Studies of the eggs and larvae of sea bream and cuttlefish showed both morphological and physiological impacts of ocean acidification, as well as increasing accumulation of some metal contaminants, and indicated negative effects on the potential viability or rates of increase of commercial species. Data of this kind enable the monetary valuation of the costs of carbon dioxide emissions and their application to policy assessment, in the context of the aquaculture and fisheries industries.

3 In October 2008, over 150 international marine specialists signed the Monaco Declaration. The Declaration, chaired and facilitated by the Agency with support from Prince Albert II of Monaco, expresses concern about recent rapid changes in ocean chemistry and their potential, within decades, to severely affect marine organisms, food webs,

biodiversity and fisheries. The scientists urge policy-makers to launch the following four types of initiatives:

- 1) To help improving understanding of impacts of ocean acidification by promoting research in this field, which is still in its infancy;
- 2) To help build links between economists and scientists that are needed to evaluate the socioeconomic extent of impacts and costs for action versus inaction;
- 3) To help improve communication between policy-makers and scientists so that new policies are based on current findings and scientific studies can be widened to include most policy relevant questions; and
- 4) To prevent severe damages from ocean acidification by developing ambitious, urgent plans to cut emissions drastically.

#### *Use of nuclear techniques to address coastal zone management problems*

4 In Africa, as part of the second phase of a project on coastal zone management, the Agency supported Angola, Kenya, Mauritius, Namibia and South Africa in applying isotope techniques in national phytoplankton monitoring programmes to address the adverse health and environmental effects of harmful algal blooms. The aim was to increase levels of expertise in these countries, enabling them to contribute to the sustainable development and management of the marine coastal environment. Phase II started in 2007 and will end in 2011. In 2008, capacity building was achieved in the three new countries under phase II and all counterparts received a combined training on the use of the Receptor Binding Assay for toxin quantification and on the identification of toxic algae through collaboration with IOC-UNESCO.

5 In Latin America, an Agency technical cooperation project on the use of nuclear techniques to address management problems of coastal zones in the Caribbean fostered collaboration between 12 Member States in the region as well as with UNEP's Caribbean Regional Coordinating Unit, and France, Italy and Spain. The outcomes of the project are:

- 1) the establishment of a network of institutions using nuclear techniques to address coastal zone management issues;
- 2) samples have been collected from areas of interest of all participating Member States and preliminary results indicate the usefulness of nuclear techniques in the region;

- 3) a new regional project on Harmful Algal Blooms in Latin-America has been formulated; and
- 4) potential sites and counterparts for the study of submarine groundwater discharges have been identified.

*On-line access to world-wide marine radioactivity data*

6 Through the IAEA's NUCLEUS portal for nuclear knowledge and information (<http://nucleus.iaea.org>) one can access the MARIS database (<http://maris.iaea.org>), which contains over 110,000 data on radionuclide levels in the marine environment. The main objective of this database is to provide easy access to a large volume of marine radioactivity data. MARIS contains past and present radioactivity data on the most significant anthropogenic and natural radionuclides in the world's oceans and seas, in deep basins as well as in coastal zones, in seawater, particulate matter, sediment and marine biota. These data originate from published scientific papers, reports and databases developed within institutes or scientific programmes in Member States. Thus the IAEA acts as a clearing-house for information on radioactive contaminants in the marine environment and makes data on marine radionuclide levels readily available to Member States. MARIS is an international reference source on radionuclide levels and trends in the marine environment, against which any further contributions from eventual releases to the marine environment can be evaluated.

7 The data in MARIS are used in baseline studies; for the evaluation of levels, inventories and time-trends of radionuclides in the marine environment; in environmental impact assessments; and for the assessment of doses from marine exposure pathways. Together with oceanographic data, MARIS data are used to better characterize ocean currents, water column processes and sediment dynamics and to study the fate of contaminants in the marine environment using radionuclides as analogues. MARIS data are also used to validate regional and global scale circulation and dispersion models which are useful, for example, for the prediction of climate change and ocean acidification.

*Stable isotope labelling in marine food web studies*

8 To study the sources of organic carbons in ecosystems, and their use in the food chain, stable carbon-isotopes are widely used. Understanding the transfer of carbon and nutrients between the environment and the marine organisms is a key to advance our knowledge on biogeochemical cycling and ecosystem functioning and how both relate. The deliberate addition of a tracer such as <sup>13</sup>C-labeled compounds under controlled conditions, and its subsequent tracking into the various components, provides valuable further information. It allows to reveal which pathways are significant and to identify the role of key organisms within the ecosystem.

Through analysis of lipid biomarkers characteristic of certain groups of organisms and appearance of label in these substances, it is now possible to resolve species-specific interactions using stable isotopes at the molecular level. In combination with mathematical modelling, such data may also serve to estimate the production and turnover rates of photosynthetic products from different marine organisms. The IAEA is now conducting experiments to trace the transfer of <sup>13</sup>C-labelled and non-labelled compounds through marine food chains, such as corals, plankton and bacteria based on the analysis of isotopic ratios of specific compounds by gas chromatography-isotope ratio mass spectrometry (GC-IRMS). This new developed nuclear technology should help Member States to better understand food web interactions and carbon cycling in the marine environment.

**IMO**

*Moving towards regulation of ocean fertilization under the London Convention and Protocol (LC/LP)*

9 Acting on the "Statement of Concern" of the Scientific Groups in June 2007 that knowledge on the effectiveness and potential environmental impacts of ocean fertilization was currently insufficient to justify large-scale operations and that this could have negative impacts on the marine environment and human health, the LC/LP Parties:

- 1) agreed in November 2007 that they would further study the issue from the scientific and legal perspectives with a view to its regulation;
- 2) adopted in October 2008 the (non-binding) resolution LC LP.1 (2008) on the regulation of ocean fertilization, by which they declared, inter alia, that, "given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed";
- 3) agreed to further consider a potential legally binding resolution or an amendment to the London Protocol on ocean fertilization at their next session in October 2009; and
- 4) requested the Scientific Groups to prepare a document, for the information of all Parties, summarizing the current state of knowledge on ocean fertilization, relevant to assessing impacts on the marine environment, taking into account the work done on this issue in other fora.

*Completion of various technical guidelines*

10 The LC/LP Parties reviewed and adopted in 2008 the following technical guidance documents:

- 1) The "Revised Generic Guidelines for the Assessment of Wastes and Other Matter", replacing the 1997 Guidelines on the same issue;
- 2) The "Revised Specific Guidelines for the Assessment of Inert, Inorganic Geological Material", replacing the 2000 Guidelines on the same issue;

- 3) The “Guidance for the Development of Action Lists and Action Levels for Dredged Material”. This guidance is due to be published in May 2009;
- 4) The “LC/LP-UNEP Guidelines for the Placement of Artificial Reefs”. These Guidelines are also due to be published in May 2009; and
- 5) The “Guidance on Managing Spoilt Cargoes”. Building on the history of co-operation between the governing bodies and MEPC, which is aimed at the development of practical guidance for mariners to manage spoilt cargoes, it was agreed to forward this Guidance to MEPC 59 for its consideration and adoption in July 2009.

11 Visit for further information on the London Convention and Protocol: <http://www.londonprotocol.imo.org>.

#### *Entry into force of the Anti-Fouling Systems Convention*

12 For the last 20 years scientific studies have shown that certain anti-fouling systems used on ships, specifically TBT based anti-fouling paints, pose a substantial risk of toxicity and may have significant chronic impacts at the species, habitat and ecosystem levels. Human health may also be at risk as a result of the consumption of affected seafood. IMO responded to this serious marine environmental issue by adopting the Anti-Fouling Systems (AFS) Convention in October 2001, which has entered into force on 17 September 2008. As a consequence in this new regime, ships would, either have to replace, or overcoat, their existing organotin-based anti fouling systems in the near future. The Scientific Groups under the London Convention and Protocol took the initiative in 2006 to collate best management practices for removal of TBT paints from ships, and other marine structures. An interim report on such information was submitted to MEPC 57 in March 2008, while the final “Guidance on best management practices for removal of anti fouling coatings from ships, including TBT hull paints”, adopted by the LC/LP Parties in October 2008 has been forwarded to MEPC 59 for its adoption in July 2009.

#### *Two oil pollution manuals and two HNS model courses completed*

13 Work has been completed on the following two manuals aimed at assisting countries in assessing the level and magnitude of risk of oil spills to be utilized for planning and preparedness, as well as a manual to assist countries in assessing damage from oil spills, as follows:

- 1) the Manual on oil spill risk evaluation and assessment of response preparedness; and
- 2) the IMO/UNEP Manual on the Assessment and Restoration of Environmental Damage following Marine Oil Spills.

14 In addition, two introductory courses on preparedness and response to HNS in the marine environment have recently been finalized and are expected to be approved at MEPC 59.

#### *Proposed amendments to MARPOL Annex I*

15 MEPC 58 approved, in October 2008, draft amendments to Annex I aimed at further enhancing the prevention of oil pollution from ships. These amendments consist of:

- 1) The addition of a new Chapter 8 on Prevention of pollution during transfer of oil cargo between oil tankers at sea; and
- 2) New definitions for oil residue (sludge) and oily bilge water and improved detailed requirements for oily waste treatment on board.

16 The draft amendments are expected to be formally adopted at MEPC 59 in July 2009.

#### *Implementation of the Ballast Water Management Convention*

17 Work continued in preparation for the entry into force of the 2004 Ballast Water Management Convention aimed to prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships’ Ballast Water and Sediments. The complete series of fourteen sets of guidelines required under the Convention have been developed and adopted and four ballast water management systems that make use of Active Substances have been given Final Approval by the MEPC by October 2008. Based on the Final Approval granted by the Committee, three systems have been type approved by the relevant Administrations being now commercially available and further paving the way for the entry into force of the BWM Convention. See also document GESAMP 36/5/1.

#### *Revision completed of MARPOL Annex VI (Air pollution)*

18 The 1997 Protocol to the MARPOL Convention, Annex VI - Regulations for the Prevention of Air Pollution from Ships, which entered into force on 19 May 2005, has undergone a substantial revision with the view to significantly tighten the emission limits in the shortest possible time. This Annex applies to ships and drilling rigs and (1) prohibits deliberate emissions of ozone depleting substances and installation of new systems containing such substances, (2) sets emission limits on nitrogen-oxides for new engines, and (3) regulates the sulphur content in marine fuel oil, as well as shipboard incineration. MEPC 57 reached agreement on all major issues and approved the amendments and MEPC 58 unanimously adopted these amendments. The outcome is

a significant and remarkable achievement since many of the issues were highly controversial with a very diverse set of opinions on what options and specific limitations were appropriate in light of the relevant risks to human health and the environment. The measures will significantly and quickly reduce air pollution from ships, offering benefits for the environment and human health.

19 The main changes to MARPOL Annex VI will see a progressive reduction in sulphur oxide (SO<sub>x</sub>) emissions from ships, with the global sulphur cap reduced initially to 3.50% (from the current 4.50%), effective from 1 January 2012; then progressively to 0.50 %, effective from 1 January 2020, subject to a feasibility review to be completed no later than 2018. The limits applicable in Sulphur Emission Control Areas (SECAs) will be reduced to 1.00%, beginning on 1 July 2010 (from the current 1.50 %); being further reduced to 0.10 %, effective from 1 January 2015. Progressive reductions in nitrogen oxide (NO<sub>x</sub>) emissions from marine engines were also agreed, with the most stringent controls on so-called "Tier III" engines, i.e. those installed on ships constructed on or after 1 January 2016, operating in Emission Control Areas.

20 The revised Annex VI will allow for an Emission Control Area to be designated for SO<sub>x</sub> and particulate matter, or NO<sub>x</sub>, or all three types of emissions from ships, subject to a proposal from a Party or Parties to the Annex, which would be considered for adoption by the Organization, if supported by a demonstrated need to prevent, reduce and control one or all three of those emissions from ships.

21 The revised Annex VI will enter into force on 1 July 2010.

#### *Work expedited on control and reduction of greenhouse gas emissions from ships*

22 IMO is giving increased attention to reduce greenhouse gas (GHG) emissions emanating from shipping operations. In April 2008, MEPC endorsed a proposal to expedite the Organization's current work plan on GHG emissions, in particular with regard to developing the CO<sub>2</sub> Emission Indexing Scheme and the CO<sub>2</sub> Emission baseline(s). MEPC also agreed on a set of principles for a coherent and comprehensive future IMO regulatory framework on GHG emissions from ships and prepared practical next steps to develop both short-term and longer-term technical, operational and market based-measures to control such emissions. The IMO measures should act in concert with the wider international efforts being prepared in the UNFCCC context - seeking the development and adoption of a global agreement by December 2009 and the coming into force of that new regime by 2012. This is in keeping with the ongoing UNFCCC process and the mandate given to IMO in the Kyoto Protocol to address the limitation or reduction of greenhouse gas emissions from ships.

23 Momentum was maintained at MEPC 58 in October 2008 and substantive progress made in defining technical and operational measures to address greenhouse gases from ships, including the development of an energy efficiency design index for new ships and an energy efficiency operational index, with associated guidelines for both; an efficiency management plan suitable for all ships; and a voluntary code on best practice in energy efficient ship operations. MEPC 58 approved the usage of the draft Interim Guidelines on the method of calculation of the Energy Efficiency Design Index for new ships, for calculation/trial purposes with a view to further refinement and improvement. The Committee also held a discussion on market-based measures, and agreed to further discuss such measures at MEPC 59.

24 The outcome of MEPC 59 will, in accordance with the Committee's established action plan, be presented to the UNFCCC in Copenhagen in December 2009.

25 Visit for further information on the abovementioned topics also: <http://www.imo.org>.

#### **FAO**

26 The Code of Conduct for Responsible Fisheries<sup>8</sup>, adopted in 1995 as the global intergovernmental framework for sustainable fisheries is based on major international agreements (UNCLOS, UNCED, CBD). The Code of Conduct for Responsible Fisheries (CCRF) calls for effective conservation of living aquatic resources with due respect to the ecosystem and biodiversity, and for responsible management and development of the fisheries exploiting them. Its implementation is a top priority of FAO.

27 The FAO Fisheries and Aquaculture Department is promoting the implementation of the CCRF through numerous regular programme and field project activities. FAO disseminates technical, scientific as well as policy and governance guidelines in support of implementation of fisheries conservation and management measures for responsible use and development of living aquatic resources in marine and freshwater environments. The Organization provides a leading forum for inter-governmental consultations, consensus-building and standards-setting on global fisheries issues. The FAO Committee on Fisheries (COFI), and its Sub-Committees on Fish Trade and on Aquaculture, have a membership of more than 100 countries and numerous international intergovernmental and non-governmental organizations.

#### *Management of deep sea fisheries in the high seas*

28 In response to the requests by COFI and the UNGA, to address the major concerns and challenges related to the management of deep-sea fisheries in the high seas, FAO undertook a series of activities

<sup>8</sup> FAO, 1995. Code of Conduct for Responsible Fisheries. Rome, FAO. 41 p. <http://www.fao.org/DOCREP/005/v9878e/v9878e00.htm>

over the past years. Two Expert Consultations on the Management of Deep-sea Fisheries in the High Seas had been organized in June and September 2007. This work as well as a number of workshops and reviews paved the way for the organization of a Technical Consultation for the development of the International Guidelines for the Management of Deep-sea Fisheries in the High Seas. This Consultation was organized in two sessions (Rome, 4-8 February and 25-29 August 2008), where the Guidelines were reviewed and adopted.

<ftp://ftp.fao.org/docrep/fao/011/i0605t/i0605t00.pdf>

#### *Climate change implications for fisheries and aquaculture*

29 FAO activities in this field included the holding of a range of meetings in particular: (i) of an Expert Workshop on Climate Change Implications for Fisheries and Aquaculture held in Rome in April 2008 (key issues and policy options, are summarized in FAO Fisheries Report No. 870); (ii) the High-Level Conference on World Food Security: The Challenges of Climate Change and Bioenergy held at FAO Headquarters from 3-5 June 2008; and (iii) the International Scientific Symposium on Coping with Global Change in Marine Social-Ecological Systems co-organized by the Global Ocean Ecosystem Dynamics (GLOBEC) programme, the European Network of Excellence for Oceans Ecosystem Analysis (EUR-OCEANS) and FAO, Rome, 8-11 July 2008. A Fisheries Technical Paper has been produced comprising the current knowledge on the physical and ecological impacts of climate change, their implications for capture fisheries and aquaculture, and the appropriate mitigation and adaptation measures. FAO, WorldFish and the World Bank have co-organized a coordination meeting on climate change impacts, adaptation and mitigation in fisheries and aquaculture which was held in Rome from 9 to 11 March 2009. <ftp://ftp.fao.org/docrep/fao/010/i0203e/i0203e00.pdf>

#### *Illegal, Unreported and Unregulated Fishing*

30 FAO continued to facilitate the implementation of the IPOA-IUU (the 2001 FAO International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing). An Expert Consultation titled "Best Practice Technical Guidelines for IPOA/NPOA-Seabirds" was held in Bergen, Norway, in September 2008. The report of the Expert Consultation has been published as FAO Fisheries and Aquaculture Report No. 880. A review and assessment of mitigation measures to reduce incidental catch of seabirds in long-line, trawl and gill-net fisheries has also been published (FAO Fisheries and Aquaculture Circular No. 1040).

<ftp://ftp.fao.org/docrep/fao/011/i0459e/i0459e00.pdf>;

<ftp://ftp.fao.org/docrep/fao/011/i0447e/i0447e00.pdf>

#### *Consultation with IMO on marine debris*

31 FAO continued to address the issue of marine debris with IMO through the Correspondence Group, established by MEPC 55 in 2006, and tasked to develop the framework, method of work and timetable for a comprehensive review of MARPOL Annex V and the associated Guidelines for its implementation. FAO has also addressed the issue of marine debris through the Joint FAO/IMO ad hoc Working Group on Illegal, Unreported and Unregulated (IUU) Fishing and Related Matters (JWG). The MEPC Correspondence Group is to make its final report to MEPC 59 in July 2009. Through these fora, FAO has expressed its concern over lost, abandoned or otherwise discarded fishing gear. FAO has made available to the Correspondence Group the findings of the FAO/UNEP study titled "Abandoned, Lost or Otherwise Discarded Fishing Gears" (Fisheries Technical Paper 523).

<ftp://ftp.fao.org/docrep/fao/011/i0620e/i0620e.pdf>

#### *Marine Protected Areas (MPAs) as a Tool for Fisheries Management: Technical guidelines on the design, implementation and testing of MPAs in relation to fishing*

32 A working version of the Technical Guidelines for MPAs was made available to COFI in March 2009. The document presented the emerging and complex issues related to the use of MPAs, in various forms, for fisheries management and other objectives. A global series of case studies examining lessons learned on the implementation of MPAs in relation to governance and institutional issues are being finalized and will be used to complement the final version of the Guidelines. FAO has launched a web site to increase knowledge on the contribution of MPAs to fisheries management. <http://www.fao.org/fishery/mpas/1/en>

#### *FAO collaboration with IMO and ILO for safety at sea*

33 FAO is working together with ILO and IMO in developing new safety standards for small fishing vessels that are not covered by the revised FAO/ILO/IMO Code of Safety and Voluntary Guidelines. The target completion date for this work, which also includes the development of new guidelines to assist Competent Authorities in the implementation of Part B of the Code of Safety, the Voluntary Guidelines and the Safety recommendations, is 2010. FAO took active part in the development of the ILO Work in Fishing Convention (No. 188) and its accompanying Recommendation No. 199, which were adopted in 2007. FAO has also been assisting IMO in accelerating the entry into force of the 1993 Torremolinos Protocol and the most recent related activity is the development by IMO of a new Agreement on the implementation of the Protocol. This activity is a follow-up to the Second Joint FAO/IMO ad hoc Working Group on IUU fishing and related matters, which was held at FAO Headquarters in July 2007. An Expert Consultation on Best Practices for Safety at Sea in the Fisheries Sector was held in Rome in November

2008 to develop a draft outline of guidelines for best practices to improve safety at sea in the fisheries sector.

#### *Ecosystem Approach to Aquaculture (EAA)*

34 FAO initiated in 2006 an effort towards the development and application of the ecosystem approach to aquaculture production. An expert workshop was held in May 2007 in Mallorca, Spain on "Building an Ecosystem Approach to Aquaculture: initial steps for guidelines." A follow up Expert Workshop held in Rome in November 2008 discussed the preparation of Guidelines on the EAA. Activities also include development of spatial tools for the implementation of EAA. <ftp://ftp.fao.org/docrep/fao/011/i0339e/i0339e.pdf>

#### *Technical guidelines on aquaculture certification*

35 Draft technical guidelines on certification in aquaculture have been presented to the COFI Sub-Committee on Aquaculture at its 4th Session in Chile in October 2008. The Sub-Committee requested FAO to invite members to submit their comments on the present draft guidelines by 31 January 2009, and that these comments be consolidated by FAO into a new version of the draft guidelines to be sent to FAO members by 31 March 2009. It was further recommended that the revised version will be discussed at a technical consultation to be held in 2009.

#### *Environmental impact assessment (EIA) and monitoring in aquaculture*

36 An Expert Workshop was held in Rome in September 2008 to review and discuss a range of thematic, regional and global reviews on the regulatory requirements, practices, effectiveness and possible improvements in the use of EIA and monitoring in aquaculture. A FAO Technical Paper on environmental impact assessment and monitoring in aquaculture is being published.

### **WMO**

#### *WMO Precipitation Chemistry Programme*

37 Within the WMO Precipitation Chemistry Programme, the work in 2009 continued to develop a new global assessment of the precipitation chemistry deposition. The Precipitation Chemistry Programme integrates measurements of WMO partners' regional networks: EMEP (Europe), DEBITS (Africa), EANET (East Asia), CAPMoN (Canada), NADP (USA). The integration includes ground-based measurements and atmospheric chemistry models to fill gaps, especially over sea and in regions where generally there is lack of measurements (e.g. southern hemisphere). The ongoing assessment activity reviews the state of the science on precipitation chemistry, regionally and globally, and collects and archives the observed data for the 2000-2006 period. The assessment includes, among others, nitrogen, phosphorus and metals (such as Fe) – components also relevant for

the air-sea exchange process. The assessment is scheduled to be finished in late 2010.

38 The GESAMP WG38 recently issued an advisory report to WMO advising what types of measurements of wet deposition over the ocean should be included in a potential database, and where such measurements are needed. These recommendations are based on the growing evidence that significant quantities of a number of chemicals enter the global ocean from the atmosphere and that over large areas of the global ocean deposition the input is linked to, and dominated by, continental sources.

#### *WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)*

39 The WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) project advanced in 2008 by developing the SDS-WAS Implementation Plan. Following the Plan, two regional centers have been established: one in China, hosting the cooperative work of partners in Asia; and another one in Spain, by establishing partner cooperation in the Northern Africa-Middle East-Europe region. SDS-WAS partners include the institutions providing dust-related observations and experimental dust forecasts. The establishment of the SDS-WAS centers is considered as a pre-condition to ensure operational sustainability of dust observations/predictions. GESAMP WG38 has recently evaluated the needs of the marine community for improved understanding of the input of dust (including Fe and P) to the ocean, dust being a probable most significant nutrient in the ocean primary productivity process.

#### *WMO Marine Meteorology and Oceanography Programme*

40 WMO cooperates with other international organizations involved with activities related to the oceans and primarily with UNESCO-IOC, IMO and IHO. A strong partnership was established with IOC in 1999 in the form of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

41 WMO provides quality meteorological forecast and warning services in support of the safety of life and property at sea. The provision of marine meteorological and oceanographic services, to meet the requirements of marine users, is the highest priority for the Marine Meteorology and Oceanography Programme (MMOP), since they contribute substantially to national economies, as well as being essential for the safety of life at sea, as recognized in the International Convention for the Safety of Life at Sea (SOLAS).

42 WMO cooperates closely with IMO to ensure that the best and most complete services are provided to meet the needs of mariners. Requirements for the provision of such services, as well as the role of WMO in their global coordination and regulation, are

written into SOLAS and WMO works to ensure that the provisions of SOLAS are fulfilled, using the WMO Marine Broadcast System for the Global Maritime Distress and Safety System (GMDSS). This System is also coordinated with the World-Wide Navigational Warning Service operated by IHO.

## UNEP

### *The Regional Seas Programme*

43 The UNEP Regional Seas Programme (RSP) continues to provide a comprehensive institutional framework for regional and global co-operation on issues pertaining to the coasts, oceans and seas and to engage governments in efforts to protect the coastal and marine environment. Currently, the global RSP covers eighteen regions, supported either through a regional convention or a regional action plan. In addition to supporting the implementation of the work programmes of the individual RSPs, UNEP/RSP continues to support the implementation of the six global Regional Seas Strategic Directions for 2004-2007 (endorsed at the 6th Global Meeting of the Regional Seas Conventions and Action Plans, Istanbul, Turkey, December 2004) leading to a strengthened programme and a global alliance of Regional Seas Conventions and Action Plans (RSCAPs).

44 Likewise, at the 9th Global Meeting of the Regional Seas Conventions and Action Plans in the Kingdom of Saudi Arabia, 29-31 October 2007, the new Global Strategic Directions for the Regional Seas Programme 2008-2012 were adopted. The aim of these strategic directions was to continue and build upon the successes of the previous Strategic Directions (2004-2007) and pave the way towards the engagement of emerging issues that threaten the marine and coastal environment, such as, climate change, deep-sea biodiversity, the conservation and sustainable use of the high seas and exploitation of the seabed and pollution from land-based activities, amongst others. Moreover it is envisioned that these strategic directions would also provide a framework for implementation which acknowledges the linkages between marine and coastal ecosystems services with economic and human development.

45 The following specific outputs are reflected against each of the six Strategic Directions for 2004-2007.<sup>9</sup>

### *Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA)*

46 The GPA is the primary mechanism for strengthening global, regional and national efforts to address the interface between the freshwater and marine environments, with a special focus on land-based sources of pollution and the physical alteration and destruction of coastal habitats. The GPA is an effective tool for integrating environmental concerns

into development planning and strategies at the regional and national levels and contributes substantially to the achievement of the internationally agreed development goals.

47 The second session of the Intergovernmental Review Meeting of the GPA (IGR 2), held in Beijing from 16-20 October 2006, considered progress in the implementation of the GPA and identified options for strengthening its implementation. IGR-2 endorsed a new approach for the GPA focused on mainstreaming, financing, and legislative and institutional strengthening. In 2007, the UNEP/GPA Coordination Office (UNEP/GPA) began to implement this mandate with a primary focus on ensuring that further efforts by national authorities to address land-based sources of marine pollution are well integrated into relevant national development processes, including processes supported by the international community such as the Bali Strategic Plan on Technology Support and Capacity Building.

48 The GPA has been embedded in the GEF-4 International Waters Strategy. GEF-4 IW will support, amongst others, interventions aimed at reducing nutrient over-enrichment of coastal zones leading to eutrophication and the formation of 'dead zones' in ways that are consistent with the GPA. This specific recognition of the GPA in GEF-4 is a result of the active involvement of UNEP/GPA, at the invitation of GEF, in the Technical Advisory Group for International Waters. This important step builds on many years of UNEP/GPA engagement in the GEF supported Large Marine Ecosystem projects and contaminant-based programmes, in many regions including the Black Sea, the Guinea Current, and the East Asian Seas.

### *UNEP World Conservation Monitoring Centre (WCMC) & UNEP Coral Reef Unit (CRU)*

#### **A. One Ocean Programme**

49 UNEP-WCMC has been addressing marine and coastal biodiversity issues for over twenty years, from the Polar Regions to the tropics, and from coastlines to the shallow and deep seas. Last year the marine expertise was consolidated to form the "One Ocean Programme" – so titled and designed to reflect the interconnected nature of the world's oceans and coastlines, the biodiversity it supports and value of this biodiversity to people.

50 The Programme is actively involved in bringing together, analyzing and disseminating marine and coastal biodiversity knowledge (e.g., distribution and status of coral reefs, mangroves, sea grasses, etc.) in a range of environments and supporting policy and country/field level efforts. The Programme is active in one way or another, with a range of partners, in all oceans, and has particular expertise in the tropical, high and deep sea environments. The Programme focuses on the following themes: deep/high Seas, marine ecosystems (e.g., coral reefs, mangroves, sea grasses, etc.), marine protected areas, coastal

<sup>9</sup> <http://www.unep.org/regionalseas/About/Strategy/default.asp>



livelihoods (capacity development) and support to UN marine and coastal work.

51 The One Ocean Programme also encompasses the Secretariat of the International Coral Reef Initiative (ICRI), the Coordinating Unit of the International Coral Reef Action Network (ICRAN), and the UNEP Coral Reef Unit (CRU) to form a Centre of Excellence with respect to coral reefs –the greatest concentration of coral reef expertise within the UN system.

52 Current and recent projects of note are:

- 1) Mangroves for the Future
- 2) Assessment of Assessments of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socio-Economic
- 3) MPA Managers Toolkit for South Asia
- 4) Deep-sea biodiversity and ecosystems
- 5) Deep-sea sponge fields
- 6) Marine viruses and bacteria
- 7) Assessing Networks of MPAs and progress towards 2012 CBD target
- 8) International Coral Reef Crime Scene Investigation Program
- 9) Developing a Global Islands Database and Global Coral Disease Database
- 10) Working towards the development of a Marine and Coastal GeoWiki
- 11) Following and addressing emerging marine environmental issues, including the impact of climate change induced changes in water chemistry ('ocean acidification') and the pros/cons of potential geo-engineering solutions (e.g. 'ocean fertilization') to reduce atmospheric CO<sub>2</sub> concentrations; and marine diseases.
- 12) How healthy are our oceans? The state of knowledge of marine diseases, implications for policy and their spatial extent.

53 More information is available at <http://www.unepwcmc.org/oneocean/>.

#### *Marine sciences*

54 UNEP-WCMC has initiated collaboration with the Ocean Biogeographic Information System (OBIS) established by the Census of Marine Life (CoML) programme. The objective of this collaboration is to exchange and share geo-referenced data on marine biodiversity (e.g., on vulnerable deep-water ecosystems such as cold-water coral reefs, or data coming forward under the various CoML programmes) with a

view to improving the internet-based access to this information for all stakeholders ([www.iobis.org](http://www.iobis.org)).

UNEP - Division of Early Warning and Assessment (DEWA) - The regular process for global reporting and assessment of the state of the marine environment including socio-economic aspects.

55 The United Nations General Assembly at its 57 session endorsed the proposal in paragraph 36 (b) of the Johannesburg Plan of Implementation, where 33 States agreed to establish a regular process, under the United Nations, for global reporting and assessment of the state of the marine environment, including socio-economic aspects, both current and foreseeable, building on existing regional assessments in resolution 57/141.

56 In resolution 60/30, the UN General Assembly decided to launch a preparatory stage, the "Assessment of Assessments", towards the establishment of a Regular Process for the Global Reporting and Assessment of the State of the Marine Environment, Including Socio-Economic Aspects. An Ad Hoc Steering Group was established to oversee the assessment phase. The Assembly also invited UNEP and IOC/UNESCO to jointly lead the preparatory stage, and provided for the establishment of a group of experts to undertake the assessment of assessments. The membership of the Group of Experts (GoE) was approved by the Ad Hoc Steering Group (AHSG) following their first meeting in June 2006. In accordance with their work plan; the Group of Experts have conducted in each of the 21 designated regions an overview and assessment of existing oceans and coastal areas assessments, amongst others with regard to food security, public health and safety, ecosystem health and function, and economic and social benefits in relation to global and regional ecosystem goods and services. An analysis of the current assessment landscape through the lens of five major criteria namely: i) Scientific credibility, ii) Policy relevance iii) Communication, iv) Legitimacy and v) Usefulness was followed by evaluations of existing assessments for the purpose of identifying best practices to inform a proposal for a framework and options for the establishment of a Regular process. Experts worked in cooperation with national and regional institutions and, in addition, organizations and institutions working in this area were invited to participate.

57 Overall the Ad Hoc Steering Group has had four meetings over the period June 2006 to date whilst the Group of Experts has had five meeting since March 2007 with two additional preparatory meetings being organized between the regular scheduled meetings. All the meeting reports are available at the following web address: <http://www.unga-regular-process.org>

58 The Assessment of Assessments report prepared by the Group of Experts has evaluated a wide range of regional and, where relevant, some national assessments. Assessments of particular sectors and

themes at global and supra-regional levels have also been evaluated. The Assessment of Assessments report sets out the analytical framework used, provides an overview of existing marine assessments and summarizes main findings in relation to both assessment product and assessment process. Drawing on relevant literature as well as its evaluation of assessments, it then distils best practice in respect of crucial features and then sets out conclusions on the framework and options for the future Regular Process including socioeconomic aspects. Finally in addition to providing a framework and options to build the Regular Process, potential costs based upon current relevant assessment processes and practices have also been provided. The report includes a Summary for Decision Markers.

59 The report itself has been peer reviewed extensively by independent scientific experts, institutions and Governments in order to get the most out of the saliency and credibility of the information presented.

60 The report was endorsed by the AHSG at its final meeting held 15-17 April 2009 in Paris and will be presented to the 64th Session of the UNGA in October 2009. In its resolution 63/111 on oceans and Law of the Sea, the UNGA requested that an Ad Hoc Working Group of the Whole should be constituted to study the report and recommend a course of action to the Session in October. This meeting is to be held from 31 August to the 4th September 2009 in New York.

#### *Secretariat of the Convention on Migratory Species and the Joint CMS/ASCOBANS Secretariat*

61 The Convention on the Conservation of Migratory Species of Wild Animals (CMS) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of UNEP, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 108 Parties (as of 1 March 2008) from Africa, Central and South America, Asia, Europe and Oceania.

62 Given the nature of migratory species, the Convention covers marine habitats worldwide. One of the main operational instruments of the Convention is the establishment of intergovernmental Agreements concerning the conservation of individual species or groups of related species. The present report focuses on activities undertaken by CMS and its UNEP administered daughter agreements concerning marine species. Considering that the Secretary-General's report is expected to have emphasis on the topic of maritime security and safety, some emphasis on this report is placed on activities relevant to the issue of ship collisions with cetaceans, which appears to be the most closely related to the topic above-mentioned among those dealt by CMS and related agreements.

#### *DTIE- Fisheries Subsidies*

63 The World Summit for Sustainable Development (WSSD) in 2002 identified the reform of environmentally harmful subsidies as a pressing need. Inappropriate subsidies to the fishing industry are a key factor driving the depletion, overcapitalization, and ecosystem degradation associated with fisheries worldwide. UNEP seeks to further the understanding and awareness of the negative impacts of environmentally harmful subsidies, particularly on developing countries where small-scale fishing is most prevalent, and contribute to the international discussion on subsidy reform by conducting analyses, facilitating international stakeholder consultations and enhancing the capacities of policy makers to develop the necessary reform policies.

64 In 1997, UNEP's Division on Technology, Industry and Economics (DTIE) (Economics and Trade Branch -ETB) helped to galvanize international attention to this problem by hosting a workshop dedicated to the issue. Over the following years, leading IGOs (including World Bank, ADB, FAO, UNCSD, OECD) and NGOs joined in calling for the reduction and reform of fisheries subsidies. In 2001, WTO ministers placed new fisheries subsidies disciplines on the negotiating agenda for the Doha Round. And in 2002, the WSSD Plan of Implementation made eliminating harmful subsidies one of the top eight priorities for achieving sustainable fisheries.

65 The following activities are of particular relevance to small-scale fisheries stakeholders in policy development and fisheries management strategies. They are currently being implemented jointly with numerous partners:

#### *Negotiations in the WTO and Sustainability Criteria*

66 UNEP regularly hosts discussions in form of Workshops, Symposia or Informal Roundtables to facilitate the discussion amongst WTO delegates as well as between WTO delegates and environment and fisheries stakeholders on how to integrate environmental and sustainability considerations into the more formal negotiations.

#### *Access Agreements*

67 Access Agreements that offer foreign fleets' access to developing countries waters are, in effect, subsidies since in most cases, the fleets do not fully pay back the access fee to their governments. Many developing countries – often acting on behalf of their small scale fishers - now seek to reduce fishing pressure by foreign fleets in their waters. With national and international expert involvement, UNEP-ETB is working on two main issues:

- 1) Improving Sustainability and Transparency; and
- 2) Access Agreements and the WTO.

### *Trade Liberalization and Fisheries*

68 To date, UNEP ETB has undertaken 14 Country Projects in the fisheries sector, with the involvement of small-scale stakeholders, focusing on the impacts of trade liberalization on fisheries resources and the interaction between fisheries subsidies and fisheries management policies. The studies have confirmed the negative effects of poorly managed subsidies, particularly their contribution to resource and environmental depletion, food insecurity and unemployment. These impacts are especially

felt at the small-scale. For more information, see: <http://www.unep.ch/etb/publications/FishCountryStudies.php>

### *Eco-labelling and Market Access for sustainable fisheries*

69 UNEP is promoting new approaches and incentives to improve the sustainability of especially small-scale fisheries, such as the implementation of market-oriented certification schemes for fisheries.

# ANNEX VI

## TERMS OF REFERENCES FOR CURRENT GESAMP WORKING GROUPS

The Terms of Reference for each of the currently active Working Groups are reproduced below, with the information on administrative arrangements, background and context, etc.

\*\*\*

Working Group 1: GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships (EHS)

The terms of reference of the GESAMP EHS Working Group, as given by GESAMP at its 6th session in Geneva (1974) and amended at its 8th session in Rome (1976) are:

*To examine and evaluate data and to provide such other advice as may be requested, particularly by IMO, for evaluating the environmental hazards of harmful substances carried by ships, in accordance with the rationale approved by GESAMP for this purpose.*

At that time, the rationale for hazard evaluation specified for the Working Group was laid down in GESAMP IV/19/ Supp. 1; this was replaced in 1982 by GESAMP Reports and Studies No. 17, which was in turn superseded by GESAMP Reports and Studies No. 35 in 1989. As approved by GESAMP at its 28th session in 1998, the procedure described in GESAMP Reports and Studies No. 64 (2001), replaces all previous versions. The terms of reference remain the same.

\*

Working Group 34: Review of applications for 'Active Substances' to be used in Ballast Water Management Systems

Terms of Reference approved intersessionally by GESAMP, November 2005, are:

1 Consideration of development of necessary methodologies and information requirements in accordance with G9<sup>\*</sup> for consideration by MEPC 56.

2 For Basic Approval, the Group should review the comprehensive proposal submitted by the Member of the Organization along with any additional data submitted as well as other relevant information available to the Group and report to the Organization. In particular, the Group should undertake:

1) scientific evaluation of the data-set in the proposal for approval (see paragraphs 4.2, 6.1, 8.1.2.3, 8.1.2.4 of G9);

<sup>\*</sup> G9 stands equivalent for MEPC 53/2/1 annex, as amended: Procedure for approval of ballast water management systems that make use of Active Substances (G9).

- 2) scientific evaluation of the assessment report contained in the proposal for approval (see paragraph 4.3.1 of G9);
- 3) scientific evaluation of the risks to the ship and personnel to include consideration of the storage, handling and application of the active substance (see paragraph 6.3 of G9);
- 4) scientific evaluation of any further information submitted (see paragraph 8.1.2.6 of G9);
- 5) scientific review of the risk characterization and analysis contained in the proposal for approval (see paragraph 5.3 of G9);
- 6) scientific recommendations on whether the proposal has demonstrated a potential for unreasonable risk to the environment, human health, property or resources (see paragraph 8.1.2.8 of G9); and
- 7) preparation of a Report addressing the above-mentioned aspects for consideration by MEPC (see paragraph 8.1.2.10 of G9).

3 For Final Approval, the Group should review the discharge testing (field) data and confirm that the residual toxicity of the discharge conforms to the evaluation undertaken for Basic Approval and that the previous evaluation of the risks to the ship and personnel including consideration of the storage, handling and application of the active substance remains valid. The evaluation will be reported to MEPC (see paragraph 8.2 of G9).

4 The Group shall keep confidential all data, the disclosure of which would undermine protection of the commercial interests of the applicant, including intellectual property.

\*

Working Group on 35: Deep-water Fisheries

Terms of Reference approved intersessionally by GESAMP, January 2008

*A strategic evaluation of future developments in deep-water fisheries with emphasis on secondary species currently forming part of the bycatch.*

The background to this ToR is as follows:

- a) The number of targeted deep-water species is relatively small and, although there are many gaps, knowledge of their biology and ecology is increasing

and the spatial distribution and status of the stocks are, in most cases, being reported.

- b) Most deep-water fisheries have a significant bycatch which is either landed or discarded. Whether a species is landed ultimately depends on market preferences but it may also be related to the small quantities caught because the fishing gear is designed for the capture of the main target species. Future gear developments or a move of a fishery into new area or habitat may result in some of the species that are presently secondary bycatch species becoming target species.
- c) As stocks of the present target species decline it is likely that more attention will be focussed on these secondary species. In most cases there has been no systematic collection of data. To avoid the problems of the past now is the time to carry out a strategic evaluation of the secondary deep-water species. Examples of such species include alfonosinos (*Beryx* spp), roughhead grenadier (*Macrourus berglax*), cardinal fish (*Epigonus* spp.) wreckfish (*Polyprion* spp.) and armourhead (*Pseudopentaceros* spp.)
- d) Working Group 35 should carry out a global review on the available information on a representative selection of secondary deep-water species. This would include: a) information on spatial distribution (are new areas likely to be exploited?), b) relative abundance, c) biological parameters, d) catch trends, e) environmental impacts, f) marketability, and g) existing and future management structures (coastal state and RFMOs). The output of this activity would be a report that describes the status of such fish and enable some prediction of future trends in deepwater fisheries.

\*

Working Group 36: Ecosystem Approaches to Mariculture (EAMAR) with emphasis on Off Shore Farming

Terms of Reference approved by GESAMP inter-sessionally, September 2008

#### Tasks

Among its tasks this Working Group will initially address the following tasks which are outlines on a proposed priority order:

- i) Compile information to assess present and potential ecosystem effects of offshore mariculture and identify unresolved or unknown ecosystem effects, i.e. the priority needs for more research;
- ii) Propose a roadmap for an ecosystem approach framework for Environmental Impact Assessment protocols for offshore mariculture, including monitoring programmes with an ecosystem perspective, plans for mitigation and management; and
- iii) Propose a road map for the identification of legal

issues and international mandates related to environmental requirements for the leasing process to offshore aquaculture as they apply to ecological issues.

#### Outputs

A report will be written and published, and which will review the issues surrounding an EAMAR, and which includes a set of guidelines based upon this review.

\*

#### Working Group 37: Mercury and Its Compounds

Terms of Reference approved by GESAMP at the 35th session, May 2008

The Terms of Reference for GESAMP Working Group 37 are to undertake a scientific review of mercury and its compounds. Topics to be included in the review are:

- Sources
- Transport
- Fate
- Pathways of Bioaccumulation and Biomagnification
- Toxicity
- Monitoring and Evaluation
- Special Considerations

\*

#### Working Group 38: Atmospheric Input of Chemicals to the Ocean

Terms of Reference approved intersessionally by GESAMP, February 2008, are:

- Assess the need for the development of new model and measurement products for improving our understanding of the impacts of the atmospheric deposition of nitrogen species and dust (iron) to the ocean;
- Review the present information on the atmospheric deposition of phosphorus species to both the marine and terrestrial environments, considering both natural and anthropogenic sources, and evaluate the impact of atmospheric phosphorus deposition on marine and terrestrial ecosystems. Consider whether such a review of any other substance would be useful.
- Work with the WMO Sand and Dust Storm Warning and Assessment System and with the WMO Precipitation Chemistry Data Synthesis and Community Project to evaluate the needs of the marine community and assist in clearly articulating them in the development of these WMO efforts
- To address these issues, individuals with the following expertise are required as members of the working group: atmospheric chemistry, marine

biogeochemistry, air/sea chemical exchange, atmospheric dust and iron, nitrogen, and phosphorus measurement and modelling, general atmospheric transport modelling, precipitation chemistry measurement and modelling.

\*

#### Working Group 39: Global Trends in Pollution of Coastal Ecosystems

Terms of Reference partly approved by GESAMP at the 37th session, February 2010, are:

- Bibliographic Review, definitions, methodologies

  1. Categorize all bibliographical review on environmental pollution temporal records, both sediment column and spatial temporal series by LME, evaluate quality of data.

2. Generate a table with the information classified by contaminant origin (organic, inorganic), toxicity, and geographical distribution.

3. Generate a database with the sources and link to data on SQL format or similar (example MORS)

- Critical review of existing methodologies on suitable environmental archives, dating methods, pollution indicators, analytical techniques and trend analysis. Review existing data, including data quality

1. Distribute by coordinator a working hypothesis for the methodology to critically evaluate the database gathered in Task 1.

2. Distribute by coordinator specific tasks to WG and GoE participating in the meeting.

3. Generate a draft and Report on the evaluation, methodologies, and quality of data.

# ANNEX VII

## TEMPLATE FOR TERMS OF REFERENCE FOR GESAMP WORKING GROUPS

### BACKGROUND & CONTEXT

- The subject: Brief general background on subject of the study?
- The issue/problem: Why is the subject of concern or interest to the international community from the perspective of marine environmental protection?
- The need: why is a GESAMP study needed? (e.g., synthesis of scattered information, assessment of environmental status/impacts, development of new methodologies, establishment of standards or guidelines, identify requirements for research, monitoring, management, and/or policy development.

### TERMS OF REFERENCE

- Specific, concrete, point-by-point tasks to be carried out by the WG, and/or specific information to be included in the report.
- Defined scope: what will and won't be done?
- Not open-ended: focus on a specific product to be produced (usually a report).
- If additional tasks are envisioned they may be identified as future work for the WG, but TOR should focus on specific task being proposed.
- Identify expertise required for the WG

### WORK PLAN

- Work methods (usually meetings and intersessional work/correspondence);
- Provisional timeline, including:
  - o Meeting dates
  - o Milestones (drafts, reviews, revisions, etc.)
  - o Deliverables and delivery date (usually publication of a report)
- Provisions for peer review
- Provisions for publication, dissemination and outreach (PR)

### ADMINISTRATIVE ARRANGEMENTS

- Sponsors
- Budget & funding
- WG Chairperson(s) & members if available at time of proposal
- Technical secretary for the WG

# ANNEX VIII

## REPORT FROM WORKING GROUP 36

### Ecosystem Approach to Offshore Mariculture

Report of the First Meeting

University of Crete, Biology Department, Heraklion,  
Greece 24 –27 September 2007

Working Group 36 (hereafter WG36) held its first meeting at the University of Crete, Heraklion, Greece. Professor Ioannis Karakassis of the Biology Department of the University hosted the meeting. The agenda for the meeting is in Appendix 1. A list of the attendees is given in Appendix 2

#### PART 1: PRELIMINARY TOPICS AND REVIEW

The meeting began with a review of the origin of WG36, from the scoping meeting at Lamont-Doherty Earth Observatory (April 2007), to the review of the WG36 proposal by GESAMP at its Paris meeting in May 2007 (GESAMP 34). The working group proposal is contained in Appendix 3 to this report. The Group reviewed relevant information and documents, particularly the previous GESAMP report on aquaculture from Working Group 31 (“Environmental Interactions, Risks and Uncertainties Associated with Coastal Aquaculture”), the report from the U.S. Marine Aquaculture Task Force (MATF), the report from the COMPASS Workshop (November 2005)<sup>10</sup> and the Ocean Stewards Institute.. One major topic was the FAO’s reliance on an Ecosystem Approach to Aquaculture (EAA).

#### *Ecosystem Approach to Aquaculture (EAA)*

FAO-FIMA is developing an EAA framework, through the process of brainstorming, global reviews, concept papers, workshops and meetings. Aquaculture has both to be seen to contribute to sustainable development, to ensure that it fulfills human needs, and that it is managed as part of the larger ecosystem. As such, management and legal issues are a function of scale, that is, of the farm, the regional watershed and ocean, and the global ocean. As well, EAA has analogous initiatives in agriculture, forestry, and urbanization. Finally, it should be recognized that fisheries and aquaculture are closely intertwined; 60% of capture fisheries has its fate as feed for aquaculture operations.

#### *US Marine Aquaculture Task Force Report*

Dan Benetti was a member of the MATF and briefly reviewed their findings, especially with regards to the ‘feeds’ issue. First, by 2015, aquaculture sources will exceed capture fisheries for human

consumption. Second, it was found that it is more efficient to use forage fish for fishmeal than as food directly. Third, the industry is progressing on the issue of conversion efficiencies, by making advances in plant-based nutritionals. Finally, fish farmers have to be sensitive to indirect effects of the capture of forage fish, for example, the effect on tuna (the predator) on the removal of anchoveta (their prey). There was a question as to whether the anchoveta population was fully exploited, and there was a question as to the assessment of mortality (natural or fishing) for anchoveta.

#### *Ocean Stewards Institute*

Neil Sims is a member of the OSI (<http://oceanstewards.org/>), and reported on their recent meeting. The OSI originated because most aquaculturists represent freshwater interests, so the question became, “Who will speak for the oceans?” OSI is an advocate of sustainable development of aquaculture. Their mission is the best use and management of the open ocean. The goals of the OSI are to:

1. Support the U.S. Aquaculture bill before Congress;
2. Work toward third party certification of sustainability (by, for example, the World Wildlife Federation);
3. Foster industry communication and networking;
4. Create industry dive standards and training standards to reduce insurance liability;
5. Promote the market for farmed fish; and
6. Advocate for more research funding.

OSI is comprised of interest groups, industry representatives, marine engineering firms (cage designers), fish processors, retailers and restaurateurs and chefs, and academic and NGO interests.

#### *Aquaculture as a Contributor to Environmental Sustainability*

There are many definitions of ‘sustainability’ and what constitutes ‘sustainable development and these vary depending on the purpose and point of view. For the purposes of WG36, the definition provided by the United Nations Council on Economic Development (UNCED) in 1987 is useful: “A sustainable condition for this planet is one in which there is stability for both physical and social systems, achieved through meeting the needs of the present without compromising the ability of future generations to meet their needs.” Aquaculture, practiced in accordance with this definition will contribute to environmental sustainability.

#### *Review of Aquaculture Research in the Mediterranean*

Ioannis Karakassis reviewed four programs that he participated in, which have the acronyms

<sup>10</sup> [http://www.compassonline.org/meetings/workshops\\_1105.php](http://www.compassonline.org/meetings/workshops_1105.php)



MERAME, MedVeg, BIOFAQS, and AQCESS. There was also a program to quantify the escapes, and the most objective way to do this was to contact the insurance companies to find out what claims were filed.

## **PART 2: IDENTIFICATION OF MAJOR ISSUES**

The Working Group identified several major issues associated with EAA. Subgroups were formed to identify these without constraint, and during the facilitation, seven topics were identified as being, initially, the most important. These were:

1. Diseases and parasites
2. Nutrient enrichment and fate
3. Feeds
4. Technology challenges in offshore environments
5. Escapes
6. Effects of climate change
7. Socio-economic issues

Sub-groups of 2 to 3 members then met to discuss the issues under each of these topics. Sub-group discussions were centered on the following questions:

1. What are the ecosystem implications of the issue?
2. Do we know enough to establish a level of risk?
3. What is the research needed to establish the level of risk?
4. What are the possible management solutions involving the issue?
5. What monitoring program should be put in place, to assess environmental impacts?

The questions were tailored to the particular topic, and not all questions mapped to all topics. By the beginning of Day 2 of the Meeting, the sub-groups were ready to review their findings for the entire WG36. These are listed in this report in the order of their presentation to the Group as a whole

### *Sub-Group 1: Diseases and Parasites*

Ecosystem Implications and Risks. Aquaculture takes place with fish at concentrations above that in the natural environment, with less throughput of water. Therefore, it should be expected that the transmittance of disease and parasites would be enhanced. In addition, there is the increased potential for the spread of the diseases to natural populations. Treating the disease can also mean problems, since the heavy use of chemicals and antibiotics can have unintended consequences for the larger ecosystem and environment. Offshore aquaculture systems may be more secure, and have less effect on the environment. For example being in waters of deeper depth means less impact on bottom sediments. Water flow through the systems may also be beneficial in diluting pathogens and parasites. The sub-group recognized that there is little information on which to base an analysis of risk, but the general idea of moving offshore would lessen the problems with diseases and parasites. The following table compares coastal with offshore farms in terms of the issue of diseases and

parasites, summarizing the conditions, the hazards to the farmed fish, and the hazards to the environment.

Present information indicates that the likelihood of disease outbreaks in off shore may be much lower than in the case of coastal farming for two reasons: i) fish should be less stressed in offshore well oxygenated farms and ii) disease vectors and hazards should be much less in offshore farms, which are far from many sources including nearest farms. However, if disease outbreak happens, the impact could be much greater as the densities and total biomass is much larger. Risk assessment tools are very relevant at this point both for the farmer managerial decisions and also for the design of a monitoring program. The COMPASS report notes that larger farms can amplify a disease to wild fish populations, especially if the fish escape from enclosure. They also note that exotic fish may cause diseases for which natural populations have no built-in immunity. It is important to determine whether a disease is host-specific.

Research Needs. The sub-group arrived at the following questions.

1. Is there a correlation between the bottom depth and the occurrence of disease?
2. Is there a correlation between ocean current velocity and disease?
3. Do larger, offshore, farms experience less disease?
4. What are the life cycles of parasites? Transmission mechanisms?
5. Can fish diseases and parasites be controlled through natural means?

### *Recommendations*

1. The density of farms should be determined by the risk of the spread of disease.
2. Prophylactic treatment of farmed fish for disease should take place at low levels of infestation.
3. Monitoring natural populations for the occurrence of diseases can provide potential proliferation avenues and epidemiology.
4. Certain species may be valuable as monitoring tools.
5. Management of disease has to include the perspective of the local environment.

### *Sub-Group 2: Nutrient Enrichment and Fate*

What is known. First, given that we are considering offshore aquaculture, there is little worry about the effect on the benthos.

There have been lots of studies on the effects of farming operations on the local marine environment and these are almost entirely for coastal systems. There is no overall consensus on the effects on the local environment, but the impact is probably small. There are a few examples of nutrient additions in the pelagic zone of the ocean, notably, the CYCLOPS program in the eastern Mediterranean, and IronEx in the equatorial Pacific, and these have fairly comprehensive understanding of the effects on the local plankton populations. However, the impact

of aquaculture systems on the ocean's pelagic will be different, because the nutrient input is continuous, or at least episodic. Biofouling of cages can also affect the local environment. There has been some work done on the effect of aquaculture systems on local fish populations, and the work done thus far indicates that fish landings increase in the vicinity of fish farms.

**Research Needs.** The sub-group suggested three areas where research could improve understanding of the effects of aquaculture systems on the environment.

1. Offshore aquaculture systems will transmit fish wastes (ammonia, faeces) more or less continuously into the local environment. We do not understand how this might affect the ecosystem surrounding the sites, since previous work only considers nutrient input at a single point. Given the results of Cyclops, however, where phosphate additions affected bacterial populations more strongly than they did phytoplankton, there may be surprising results. A study on the effects of continuous nutrient input is desirable, and should proceed from results from studies such as Cyclops and IronEx, and from studies of sewage outfalls.

2. Aquaculture systems will likely act as 'fish attraction devices' (FADs), but the nature of this effect is not clear. The character of this effect is not known.

3. With the advent of terrestrial plant-based feeds, the chemical nature of feeds might have an effect on microheterotrophic populations, since marine bacteria are adapted to the chemistry of marine products.

#### *Sub-group 3: Feeds*

**What is known.** Humanity needs protein, and the need will become more acute in the coming decades. This need for protein cannot be met with either terrestrial-based sources or with the capture of wild fish. Aquaculture is therefore necessary. The need for aquaculture will put increasing demand for fishmeal and fish oil, which means an increase in the capture of forage fish. The increase in forage, or reduction, fisheries is probably not sustainable.

At the same time, the pressures against further coastal development and the deterioration of the coastal environment mean that aquaculture operations will move offshore. The movement to offshore operations entails further expense, and high-value fish will be the only kind that is economically viable.

The above two constraints, the unsustainability of reduction fisheries and the move toward high-value fish farming offshore means that there is a need to find alternate sources of protein-based feed and fish oil. In practice, other seafood by-products do not work, and other kinds of animal by-products are not marketable (because, for example of 'mad-cow' disease). Thus far, protist, bacterial, and algal alternatives for protein and oil replacements have proved expensive, and

with nutritional deficiencies. Current research has focused on these microorganism alternatives.

At the same time, there is on-going research to reduce the food conversion ratios to create greater growth efficiencies. There have been dramatic improvements in therefore lowering costs and increasing digestibility of the alternate food sources.

The expansion of feed production raises questions of sustainability. The expansion of plant protein production (e.g., from soybean) means that farmland so dedicated will compete with food production for humans. And the rising costs of energy create competition in the marketplace. There has been a move toward a certification to recognize and reward farmers for sustainable feeds, and which would allow increased use of more expensive alternative feeds.

**Research Needs.** The sub-group arrived at the following questions and statements regarding future research needs.

1. Are reduction fisheries adequately managed?
2. There is a need to accelerate research on advanced nutritional.
3. Further evaluation is necessary regarding the digestibility and food conversion ratios.
4. A study on the trade-off between lower temperatures and higher oxygen levels in offshore environments would be very useful.

#### *Sub-group 4: Technology Challenges for Offshore Aquaculture*

There are very few offshore aquaculture operations, and therefore the challenges are many. For example, the cage design itself, whether it is rigid or flexible, needs to be determined. We list here several considerations necessary before an operation is contemplated. These are as follows:

1. Development of materials adequate for OOA engineering devices
2. Mooring systems for deep water and high energy sites
3. Energy supply to operate the farms
4. Communication systems related to weather, oceanic, and operational conditions
5. Feed barge design
6. Safe accommodations for operators
7. High-speed transportation equipment: for personnel, feed, juveniles, harvested fish
8. Harvesting equipment and systems
9. Disposal of wastes
10. Protection against predators, pirates
11. Protection systems against escapements

In addition, there are several environmental hazards that will require technological innovation. For example, there must be a provision in the design of the system for extreme conditions will be necessary to protect the investment and prevent escapes. There will be site considerations for commercial and military shipping, and for other activities such as

seabed mining and oil extraction. The last points bring up legal issues and international regulations, sea transportation, and state interests.

#### *Sub-group 5: Escapes in Offshore Conditions*

What is Known. Escapes happen and will happen. Escapes and their effects have been very well documented for salmon in many regions and specially *Salmo salar*. However most effects have been measured in coastal areas, rivers, and fjords. Impacts and effects have been well established in Chile for the three salmonid species. Negative and positive effects have been highlighted (Soto et al 2001, 2007). However the ecosystem effects are not well known and so far there is only evidence of establishment on one species (Chinook salmon).

Although the environment of southern Chile is similar to the regions where salmon is endemic, such as the Pacific Northwest, Scotland, Norway, and the Northwest Atlantic, salmon is not native. Thus, the experience in southern Chile is instructive. Escapes of exotic salmonids in Southern Chile have been seen with two views. First there is the negative perspective of society seeing a potential deterioration of native biodiversity. Also, fishermen complain that escapes are affecting their fishery. Other portions of Chilean society, however, enjoy an artisanal fishery of escaped fish, and sports fishing.

Not much is known in the case of sea bream and sea bass although some recent studies have published on the potential genetic pollution the effect of fertilized eggs and larvae. Escapes are also happening of farmed cod, cobia etc. Also the reproduction in the cages on site is also common in the farming of these species. In the case of sea bream, sea bass and cobia there is not enough awareness yet about the issue although "genetic pollution" is a potential problem if the farmed individuals are carrying selected foreign genes. For cod farming there seems to be more social concern and pressure.

Hybridisation of farmed with wild salmon, and gene flow from farmed to wild salmon through backcrossing of these hybrids in subsequent generations, can cause

1. a change in the level of genetic variability, and
2. changes in the frequency and type of alleles present.

Hence, hybridisation of farmed with wild salmon has the potential to genetically alter native populations, reduce local adaptation and negatively affect population viability and character. Several molecular marker studies have shown that escaped farmed salmon breeding in the wild have changed the genetic composition of wild populations.

Similar concerns can be raised with cod farming since this species escape and could also spawn. There is potential social issue here. There is one report on risk assessment for the escape of farmed cod.

#### *Research Needs.*

1. The introduction of exotic species can have great impact on native biodiversity, however there could be as well positive social impacts, e.g. sport fishing, artisanal fishing etc.
2. Because for the offshore, the cages are more exposed to weather events the risk of escape events is at least as large as it is presently in coastal zones, and the numbers of escapees could be much larger.
3. A comprehensive analysis of the potential impacts of escaped fish is needed, in terms of genetic disturbance, the potential for establishing a truly exotic species, and the transfer of diseases.
4. The effect of escaped fish on ecological interactions (predation, competition) is not known.
5. What is the potential for creating sterile fish.

#### *Sub-Group 6. Aquaculture and Global Climate Change*

What We Know. Offshore mariculture will interact with the global carbon cycle, and therefore climate change in several ways. First, offshore mariculture of macro algae or shellfish has the potential for removing carbon from the atmosphere, and depending on depth, sequestering carbon in the deep sea. However, given recycling, and the fact that calcite production generates CO<sub>2</sub>, the best estimate is that mariculture is likely to be carbon-neutral. One indirect, positive, effect is that the increased consumption of fish at the expense of meat and fowl is the reduction in methane production from ruminants, and terrestrial breakdown of animal wastes.

A negative effect, currently, is that high-value fish is airfreighted to markets. There is an increasing awareness of 'food miles' as factors in global climate change, and this may have profound effects on consumer choices and economic viability of offshore production of fresh seafood in remote locations. More energy efficient means of seafood distribution is desirable. Compared to land-based recirculating systems, offshore mariculture systems will be more energy efficient in terms of power and temperature control, but may require more energy for operation, for example, for moving crews, feed, and fish from the farm to land-based connections. Carbon and energy considerations are unlikely to influence the direction of growth of offshore aquaculture in any significant manner. The dominant driving factor will be the economics of high-value seafood production.

Ocean drifter technology that requires energy to maintain cage position could be highly energy inefficient. The operation of passive ocean drifters is more energy efficient, but presents other problems for delivery of feed, tending of stocks and harvest of product. Furthermore, systems that drift with the current will not.

#### *Future research.*

1. Offshore aquaculture may be responsible for 'secondary carbon sequestration' in producing offshore

blooms of phytoplankton that then sinks to the abyss. This should be investigated through modeling of offshore fish farms, and other mariculture operations.

2. Offshore aquaculture businesses should be evaluated in terms of 'carbon credit' economics.
3. The understanding of the energy demands of offshore fish farms is poor, and needs to be further evaluated. For example, the technologies are not well developed, and the issue of food for the farmed fish needs to be better delineated.
4. The 'Food miles' issue should be evaluated with respect to the effects (health, environmental) of other sources of protein.

#### *Sub-Group 7: Socio-Economic Factors*

**What is Known.** Offshore aquaculture operations are likely to be large, and longlived. They need to be evaluated in terms of a sound business plan, and in terms of their effect on the local community. To be successful, offshore aquaculture operations will have to be 'hi-tech'.

Given that these farms are hi-tech, they will require a highly skilled work force, and will come from outside the local community. That it, the farms will probably generate little direct employment opportunities relative to the initial investment. Therefore, acceptance in the local community and governments will be challenging. On the other hand, aquaculture operations will lead to greater economic activity, overall, in terms of general goods and services, tax levies, education, etc.

Other issues with regard to community relations involve operational risks to local community, and waste disposal. The expected environmental effects have to be perceived from the community perspective. Safety issue on offshore aquaculture initiatives will be of higher concern than on land-based or coastal activities. Liability and insurance costs are expected to be much higher than those related to land-based and coastal operations. Further labor regulations will be required to guaranty safety on offshore aquaculture farms.

New legal and administrative provisions will be required to regulate state, national and international offshore aquaculture activities. Permitting will have to be established, and property rights defined in terms of leasing of publicly owned/ international waters. Relationships will have to be established with navigation, shipping, fishing, and other activities in national and international waters.

**Challenges.** The main challenge will be the development of a competitive and economically feasible offshore aquaculture industry, including the necessary infrastructure, financial services, capacity building and training, and stakeholder participation.

In addition to these, aquaculture companies in their development of good management practices ('inside the cage'), must also conduct 'outside the

cage' monitoring. They should be prepared to produce annual reports on production and harvests, investment and employment, and their success at marketing the product.

Periodically, the farm managers should make an assessment of the environmental impact (see monitoring, below), and a review of the farm's relationship with the local community and community affairs, and in terms of local opinion. A 'Visitor Center' is a good mechanism for retaining the public's interest and appreciation of the farm operations.

#### *Sub-Group 8: Environmental Indicators*

**What is Known.** The question of monitoring offshore aquaculture operations has to do with what to monitor, where, and how often. Many of these are dependent on the methods that can be used in monitoring. Potential indicators of the water column near aquaculture operations include

1. Chlorophyll-a
2. Phytoplankton species composition
3. Bacteria counts
4. turbidity
5. dissolved O<sub>2</sub>

Satellite indicators can also be employed. Although these do not have the same resolution or breadth of measurement as the in situ methods, they can be especially important in less accessible, offshore, operations. What can be observed from satellite includes three basic kinds of data products: ocean colour, sea-surface temperature, and the attenuation of blue light (K(490)). All of these can indicate an effect of the farm on the local environment.

The benthic environment must also be monitored, even though an offshore operation, by definition, will have negligible effect on the bottom. Still, periodic assessment is worthwhile, and the measurements include (1) the presence of uneaten feeds, fouling, and fish feces; (2) macro fauna surveys, (3) redox potential, and (4) total organic carbon.

In addition to these, fish aggregations near the operation should be logged, and if possible, a visual inspection of the cage integrity should be made using cameras, supplemented by a remotely operated vehicle (ROV).

Monitoring should include the possibilities for time- or space-lagged effects on the environment. And this can only be accomplished with close monitoring.

The importance of monitoring the planktonic community is that sometimes certain organisms can serve as early warning of adverse effects. Also, there is the possibility that fish farms can promote the occurrence of harmful algal blooms (HABs).

#### *Needs and Challenges.*

1. The overall question is "How does a fish farm affect the greater ecosystem?" As the industry matures,

governments will no doubt establish criteria for monitoring and for certification of operations. It would be useful in the shorter term to look at a few case studies where environmental monitoring has taken place, and what the results were.

2. Modelling can also be useful, and should also be considered as a form of monitoring. If a workable model of the farm can be constructed, the output can be adjusted or updated with new measurements as a way of testing, but also as a means to provide continuous 'measurement' of the effect of the operation.
3. Escaped fish can be monitored if they have physical or chemical markers.
4. Can gut-content analysis be used to estimate ecosystem effects?

#### *Sub-Group 9: Environmental Description and Site Selection*

What is Known. Prior to the establishment of any offshore aquaculture operation, a site assessment must be conducted to carefully evaluate the parameters related to infrastructure, bathymetry, water quality, environmental and biological information, as well as the legal framework. The main goal is to determine assimilation capacity of the local environment and develop hydrodynamic and environmental modelling for the site. The assimilation capacity refers to whether, ecologically, the environment can accept new inputs of biomass, with attendant increased waste material and respiration. The assimilative capacity of the local environment will depend on many interacting factors, and therefore hydrodynamic and ecosystem models should be developed to aid in predicting how the environment will respond.

Site selection will have to consider physical, chemical, and biological features of a proposed site. Physical considerations will be based on maps and charts, satellite images, depth, bottom type, currents and tides, winds, wave spectra, and hydrography. Much of the chemistry and biology are determined by the physical attributes and dynamics. But, these have to be considered as well, and include dissolved oxygen

- Maps/Charts/Satellite images/GIS/Google Earth information
- Conflicting uses of area (sensitive areas such as reproduction areas, coral reefs, shipping routes, MPAs, marine reserves, etc.)
- Depth profile
- Bottom type
- General hydrographic and hydrologic studies/data
- Currents
- Maximum wave height
- Tides
- Winds
- Dissolved oxygen concentration
- Phytoplankton and zooplankton description, occurrence and distribution
- Flora and fauna studies (coral reefs, general biodiversity background, indicator organisms)
- Identify possible interactions with predators – sharks, birds, seals, etc.

- Security/Safety
- Accessibility to the site – roads, transportation, airport, port, etc.
- Infrastructure – security, communication, electricity, freshwater
- Land-based facilities (dockage, comfortable accommodations for staff)
- Potential for expansion - availability of adjacent area
- Gather physical and chemical water quality parameter data (Chl-a, TSS, turbidity, particulate N and P, dissolved organic and inorganic N and P, TOC, organic matter) to plug/validate a proposed generalized environmental model that can be adapted / applied to any offshore site
- Potential danger of red tides, plankton blooms, bio-fouling
- Continuing environmental assessment/monitoring as operation expands and biomass increases to determine if/when there will be a threshold level where significant cumulative footprint is detected (the assimilation capacity of the site is identified just prior to this stage)
- Establish/propose possible mitigation measures
- Legal framework - regulations, licenses, permits, concessions, etc.
- Public and government acceptance of project

#### *Sub-Group 10: Local Community Interactions*

This sub-group discussed the recommendations on best practices to interact with local communities and market affairs. Probably the most important attribute is the size of the project. This will determine the annual production volume, and will affect local requirements in terms of infrastructure resources, employment, taxes and duties, and environmental impacts. Secondary considerations include the promotion of employment opportunities, employment of disadvantaged people, and educational opportunities.

An aquaculture operation can incur negative reactions with respect to the local community, in terms of enhanced risks to employees and waste disposal, animal welfare issues, and other expected environmental effects as perceived from the local community.

Local projects are going, by necessity, to be subject to national and international markets and market forces, and aquaculture operations will have to be aware of these. Related to this is the marketing of the operations own products, and their certifiability.

Aquaculture operations should be required to report to their community, annually, on their production and harvests, investment and employment, and how the products are being marketed.

The local community's representatives must also provide their own oversight to the operation in terms of its environmental impact, a review of the project's relations with the local community, and public opinion, with suggestions regarding improved performance.

# APPENDIX 1

## WG36 Attendees at the 1st Meeting, 24-27 September 2007

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# ANNEX IX

## REPORT FROM WORKING GROUP 38

### WMO Precipitation Chemistry Data Synthesis and Community Project

#### 1. Introduction:

Working Group 38 (WG 38) was established by GESAMP to assess the atmospheric input of chemicals to the ocean. One of the charges to WG 38 was as follows: "Work with the WMO Sand and Dust Storm Warning Advisory and Assessment System and with the WMO Precipitation Chemistry Data Synthesis and Community Project to evaluate the needs of the marine community and assist in clearly articulating them in the development of these WMO efforts."

During its first meeting in Tucson, AZ, United States, from 11-14 December, 2008, WG 38 members identified a number of issues relevant to global atmospheric nutrient inputs and their effects on the oceans. WG 38's effort will result in two advisory reports to WMO (one related to the WMO Precipitation Chemistry Data Synthesis and Community Project as indicated above, and a second to the WMO Sand and Dust Storm Warning Advisory and Assessment System), as well as several targeted scientific papers. The charge related to the WMO Precipitation Chemistry Data Synthesis and Community Project is to advise that group on the types of measurements of wet deposition over the ocean that should be included in a potential database, and to identify where such measurements are needed. This report addresses that charge.

Our recommendations are based on the growing evidence that significant quantities of a number of chemicals enter the global ocean from the atmosphere. We show as examples Figures 1 and 2, which present model estimates of the annual atmospheric deposition

of nitrogen species and mineral dust, respectively, to the global ocean. These figures clearly demonstrate that over large areas of the global ocean deposition is directly linked to, and dominated by, continental sources.

In general WG 38 recognizes a critical need for coastal and open ocean measurements of wet deposition. Such data are essential if we are to improve our knowledge on the input and impact of chemicals into the oceans. Our advice here pertains primarily to measurements of precipitation chemistry. However, we also recognize that our understanding of ocean deposition would be greatly augmented by matching measurements of dry deposition and atmospheric concentrations of the species of interest.

#### 2. Recommendations for Precipitation Measurements

##### 2.1 Locations

Although WG 38 recognizes that measurements on the continents provide useful information on natural and pollution sources, it recommends that to properly characterize the inputs of chemicals into the ocean, we must obtain measurements at coastal and open-ocean sites (ideally, a few 100 km or more from the continents). Ship-borne measurements could also be potentially useful. At present wet deposition measurements are highly concentrated in polluted continental regions. Coastal and open ocean measurements would provide information on the magnitude of continental outflow and the input into the oceans. WG 38 is aware of a number of past and ongoing wet deposition measurements that could be included in the WMO data compilation. We can

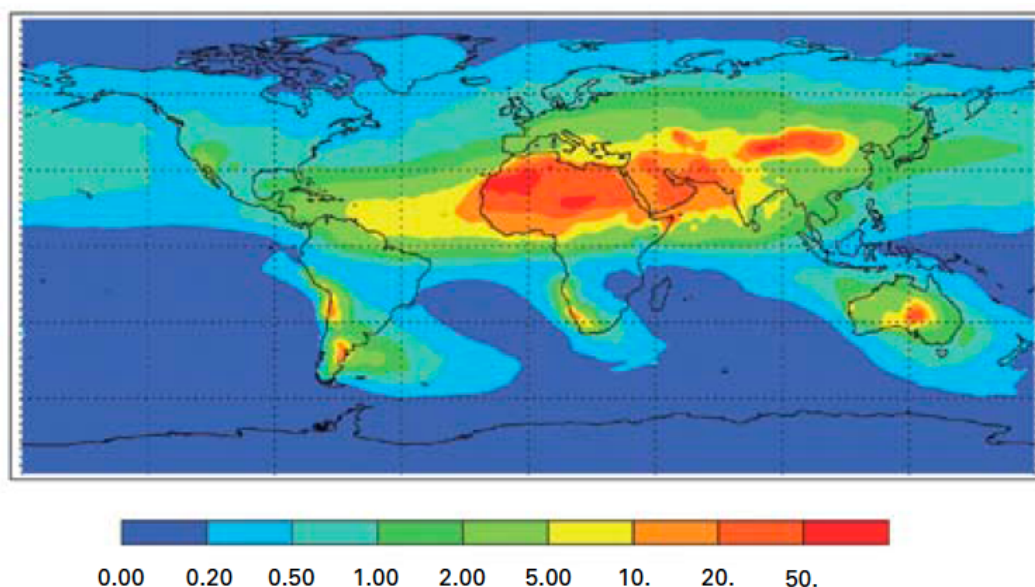


Figure 1. Atmospheric reactive nitrogen deposition to the world ocean in 2000 in  $\text{mg m}^{-2} \text{yr}^{-1}$ . Total atmospheric reactive nitrogen deposition to the ocean in 2000 was  $\sim 67 \text{ Tg N yr}^{-1}$ , of which  $44 \text{ Tg N yr}^{-1}$  was anthropogenic. (From Duce et al., 2008)

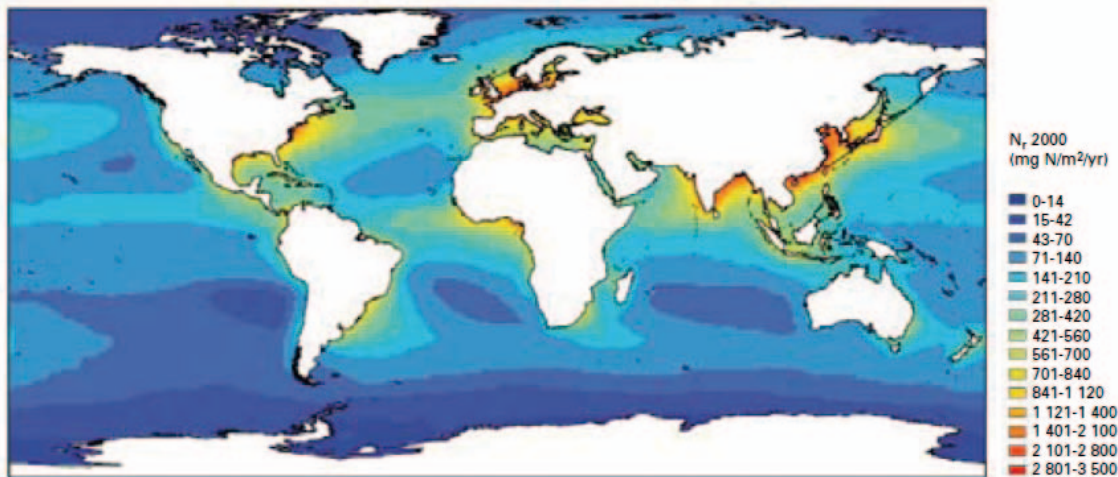


Figure 2. Mineral dust deposition to the world ocean, in  $\text{g m}^{-2} \text{yr}^{-1}$ , based on a composite of three published modeling studies that match satellite optical depth, in situ concentration, and deposition observations. Total atmospheric dust deposition to the ocean =  $\sim 450 \text{ Tg yr}^{-1}$ . (From Jickells et al., 2005)

also identify a suite of potential locations that could help to improve our knowledge concerning the atmospheric input of particles and chemical species into the ocean.

The precipitation network initiated by the University of Virginia (James Galloway - (jng@virginia.edu) in the early 1980s at Amsterdam Island, Bermuda, and Barbados provided unique information on wet deposition to the oceans; if these were to be reestablished they would provide valuable information, including evidence of trends that occurred since the 1980s. Rainfall studies were carried out at a number of locations carefully chosen by the AEROCE network, which operated from the late 1980s until the mid-1990s by the University of Miami (Joseph Prospero - jprospero@rsmas.miami.edu). Some of these sites continued the work of the University of Virginia group who were participants in AEROCE.

Consideration should be given to re-establishing some of these stations. Among the sites in this network that would be most useful are:

- Mace Head, Ireland (53.32N, 9.85W): data from 1988 to 1994
- Davids Head, Bermuda (32.35 N, 64.65W); data from 1992 to 1998
- Tudor Hill, Bermuda (32.27N, 64.87W); data from 1988 to 1998
- Miami, Florida, USA (25.75N, 80.25W); data from 1974 to 1998
- Ragged Point, Barbados (13.17N, 59.43W); data from 1972 to 1998

Other possible locations include:

#### North Atlantic:

- Sao Vicente, Cape Verde Atmospheric Observatory (16.51N, 24.52W); The SOLAS field station
- Irafoss, Iceland (64.0N, 21.0W); This is an EMEP precipitation station
- Mediterranean:
- Crete, Greece; Finokalia station (35.20N, 25.40E); operating discontinuously since 1997)
- Corsica, France; operating discontinuously since the 1990s

#### South Atlantic:

- Ascension / St. Helena, South Georgia / Falkland Islands; The University of Miami group operated an aerosol station in the Falklands (51.7S, 57.8E) from 1987 to 1996

#### North Indian Ocean:

- Port Blair, Andaman Islands, Bay of Bengal
- Hanimadu, Maldives Islands, Arabian Sea (6.75S, 73.15E); This was a station in the INDOEX program and is now (we believe) a part of the ABC program

#### South Indian Ocean:

- Amsterdam Island (37.47S, 77.31E); precipitation data from 1980-1987, since then operating discontinuously – probably has the longest DMS dataset, atmospheric observations continuous since 1987
- Reunion Island (21.2S, 55.83W); The University of Miami group had an aerosol station here from 1990 to 1996
  - Mauritius (20.2S, 57.5E)

#### North Pacific:

- Hawaii, Hawaii (19.4N, 155.2W); NADP operated sites here at Mauna Loa and Volcano National Park but they are no longer active
- Oahu, Hawaii (21.35 N, 157.68 W); The University of Hawaii and Texas A&M University have operated an air sampling station here intermittently since 1966
- Midway (28.22N, 177.4W); The University of Miami group operated here from 1981 to 2001

#### South Pacific:

- American Samoa (14.3S, 170.6W); US NADP operated a site at the NOAA facility on Tutuila from 1980 to 1992 but it is no longer active
- Cape Grim, Tasmania (40.68S, 144.68E); Australian background monitoring station

#### Western North Pacific:

- Ogasawara (Bonin Islands), Japan; Chichi-Jima Island (27.05N, 142.13E); data available since 2001



- Okinawa, Japan; Cape Hedo (26.52N, 128.15E); data available since 2001

## 2.2 Substances, Concentrations, and Precipitation Amounts

The variables of primary interest to the oceanographic community that is concerned with atmospheric deposition to the ocean include:

- Precipitation amount (rainfall or snowfall)
- Atmospheric concentrations and/or deposition of:
  - All ions needed to obtain ion balance; (See GAW Report No. 160 for protocols for major ions)
  - NO<sub>3</sub><sup>-</sup>; NH<sub>4</sub><sup>+</sup>, organic nitrogen; nss (non sea-salt) SO<sub>4</sub><sup>=</sup>; MSA (methane sulfonic acid); phosphorus (speciated in phosphate/total phosphorus if possible); Fe and other trace metals; organic compounds (if possible speciated into acidic component, organic nitrates and methylamines and others);
  - Insoluble components (organics; elemental carbon; mineral dust)

## 2.3 Quality criteria

WG 38 recommends that in some cases the low concentration levels of micro-nutrients, such as phosphorus, iron, and possibly other trace metals, would require specific attention to measurement quality assurance beyond that normally accorded to precipitation studies. In particular, this concerns the instrumental and analytical analysis of trace metals, which because of their lower concentrations requires a special effort to avoid contamination in collection and storage. In a supplemental paragraph below WG 38 provides recommendations for the collection of trace metal rainfall samples. WG 38 is aware that it is not always possible for stringent data quality criteria to be met. All samples should be accompanied by metadata that provide information about the procedures when the protocol criteria were not fully met.

## 2.4 Sample time resolution

Seasonality is important and monthly datasets are useful. There is a difference between sample time resolution and analysis averaging time. The former is needed for sample integrity and should be on a daily or at most weekly mean. However, this may be difficult at some remote marine sites.

## 2.5 Data source

Data should always include the names addresses and other contact information for contact persons for any further information.

## 3. Interaction

Between WG 38 and the WMO Precipitation Chemistry Data Synthesis and Community Project WG 38 has identified several products that could be provided to the WMO Precipitation Chemistry Data Synthesis and Community Project to aid their work. These include:

- A compilation of wet deposition measurements made during extensive ship cruises in the Atlantic - Alex Baker, United Kingdom (alex.baker@uea.ac.uk) A similar compilation of atmospheric

concentrations and fluxes from Pacific cruises and the EANET ground sites in East Asia - Mitsuo Uematsu, Japan (uematsu@ori.utokyo.ac.jp)

- A database of wet deposition measurements made during oceanic ship cruises is currently being compiled (EU COST Action 735 initiative - Alex Baker, United Kingdom (alex.baker@uea.ac.uk)
- A data set is being developed for aerosol composition and deposition over the Bay of Bengal - Manmohan Sarin, India (sarin@prl.res.in)

The atmospheric and marine community concerned with atmospheric deposition to the ocean critically depends on the various data compilations that will be provided by the WMO Precipitation Chemistry Data Synthesis and Community Project. GESAMP WG 38 believes that the brief recommendations outlined above will enable this WMO project to enhance significantly the usefulness of the information that it can provide.

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### *Supplemental Recommendation on Procedures to be Used for Trace Metal Rainwater Collection*

Funnels and bottles for trace metal sampling should be soaked for at least 48 hours in 10% v/v HNO<sub>3</sub> and rinsed with ultrapure water, and bottles stored filled with ultrapure water acidified with 1 mL/L concentrated Aristar HNO<sub>3</sub>. All rain sampling equipment should be stored in double, sealed plastic bags until use and funnels kept in plastic bags between rain events. Just before sampling the contents of a collection bottle are used to rinse the inner surfaces of the funnel, and excess liquid shaken off the funnel. The bottle is then attached to the funnel and the funnel plus bottle assembly is deployed in the mount. Funnels are periodically blanked by collecting ~50 mL of rinse water in 125 mL low-density polyethylene bottles. Trace metal rain samples should be acidified as soon as possible after collection with 1 mL/L concentrated Aristar HNO<sub>3</sub>. If sample volume permits and this can be done within a few hours of sample collection, an aliquot may be filtered (preferably 0.2 µm pore filter) before acidification. Both the filtered and unfiltered aliquots can then be acidified and stored as described above.

### *WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)*

#### 1. Introduction:

WG 38 was established by GESAMP to assess the atmospheric input of chemicals to the ocean. One

of the charges to WG 38 was as follows: "Work with the WMO Sand and Dust Storm Warning Advisory and Assessment System and with the WMO Precipitation Chemistry Data Synthesis and Community Project to evaluate the needs of the marine community and assist in clearly articulating them in the development of these WMO efforts." During its first meeting in Tucson, AZ, United States, from 11-14 December, 2008, WG 38 members discussed a number of issues relevant to global atmospheric nutrient inputs and their effects on the oceans. WG 38's effort will result in two advisory reports to WMO (one related to the WMO Sand and Dust Storm Warning Advisory and Assessment System [SDS-WAS] as indicated above, and a second to the WMO Precipitation Chemistry Data Synthesis and Community Project), as well as several targeted scientific papers. The charge related to the SDS-WAS is to advise that group on issues related to atmospheric dust transport over and into the ocean. This brief report addresses that charge. The activities of the SDS-WAS and the ocean deposition research community as represented by WG 38 are mutually supportive. The SDS-WAS can provide detailed information on sources, on specific dust events, and on the temporal-spatial distribution of dust and related species. Such information is not readily available to the ocean deposition research community. Conversely, activities carried out by members of the ocean deposition research community can help SDS-WAS by providing data that can be used to test the SDS-WAS dust models. In this way the community can contribute to the improvement of the dust models which in turn would improve dust transport and deposition estimates.

## 2. Specific Recommendations

- Cross-representation on regional steering groups or the scientific steering committee of the SDS-WAS and the ocean deposition research community should be arranged.

At the present time the ocean deposition research community has no formal organizational structure, but until that is developed WG 38 can serve in that capacity. It is suggested that SOLAS (the Surface Ocean/Lower Atmosphere Study) of IGBP should be encouraged to formulate such a group. For planned ocean deposition field programs, the ocean deposition research community should develop a convenient and efficient mechanism for notifying SDSWAS of proposed field activities. Those SDS-WAS participants whose models cover the ocean deposition research community's field study domains could then interact with the field scientists: SDS-WAS would provide forecast data from their models during the field campaign phase and post-analysis products. In return the ocean deposition research community would use the forecasts as guidance and also provide verification of the forecasts and post-analyses.

Model intercomparisons are needed to improve models. AEROCOM is currently carrying out aerosol (including dust) model inter-comparisons. SDS-WAS and the ocean deposition research community should

interact with AEROCOM to emphasize the need to focus on emission scenarios and the improvement thereof along with improved wet and dry deposition parameterizations. Large and unusual dust events are of particular interest because they provide an opportunity to test modeling capabilities on a larger scale and because the movement of the dust is more readily detectable both by remote sensing and in situ instruments.

- SDS-WAS should identify and catalog interesting dust events and related case studies and it should establish a mechanism whereby SDS-WAS can notify the ocean deposition research community and their global-scale modeling collaborators of these studies. The objective is to link the regional scale SDS-WAS models to the global-scale, the scale of greatest interest of the ocean deposition community.

SDS-WAS is inventorying all types of measurements made in their community. SDS-WAS should make this information available to the ocean deposition research community. In return the ocean deposition research community might be able to make suggestions for changes to the protocols that might improve the modeling products of both SDS-WAS and the ocean deposition research community.

It is desirable to have a uniform metric with which to assess model dust prediction skill. Does SDS-WAS have a skill metric that they are using or plan to use? If so, the ocean deposition research community should interact with SDS-WAS to include in the metric those factors relevant to ocean deposition research community interests.

The Barcelona Center SDS-WAS group is carrying out a 45-year reanalysis of dust emissions along with estimates of transport to the North and Tropical Atlantic. The ocean deposition research community would like to be informed of progress with this activity and the availability of the products.

- The ocean deposition research community should make an inventory of GAW station protocols in ocean and ocean-impacted environments to ascertain which measurements might be of use to the ocean deposition research community.

Of greatest interest are the measurements of aerosol concentration and composition and of precipitation chemistry. Particularly important here are GAW reports No. 153, Aerosol Measurements and No. 160, Precipitation Chemistry Measurements. Also important are ancillary measurements such as sun photometer data. Of particular interest are multispectral measurements such as those made in AERONET. LIDAR data are also of great interest. Where are LIDARS located and what data are available? Of importance here are GAW Report No. 178, GAW LIDAR Observing Network and Report No. 162, WMO/GAW Experts Workshop on a Global Surface-based Network for Long Term Observations of Column Aerosol Optical Properties.

- The ocean deposition research community should identify a prioritized measurement protocol for ocean and remote coastal sites.

The minimum protocol would include the collection of bulk aerosol samples which, at the very least, would be analyzed for dust components and important associated N, Fe, and P species. The next highest priority would be the collection of precipitation. The ocean deposition research community should establish a priority system for sharing these samples with the wider community and work to conform with GAW Report No. 160 protocols.

- The ocean deposition research community should contact oceanographic data centers (e.g., NODC,

ORSTOM, etc.) to ascertain what data they have that is relevant to our ocean deposition interests. This activity should become part of a greater effort to bridge the gap between the atmospheric chemistry community and the ocean chemistry community.

### 3. Conclusions

WG 38 believes that if these recommendations are carried out it would strengthen the activities of the WMO SDS-WAS and greatly benefit the ongoing efforts to better understand the importance of the atmospheric deposition of chemicals, including mineral dust and its associated nutrients, to the ocean.

# ANNEX X

## Scoping paper for GESAMP 36

Microplastics and associated contaminants – occurrence and potential impact in the oceans

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(Final version - 30/04/09)

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### Contents

1	Background
2	Sources of plastics
2.1	Plastics production and marine litter
2.2	Sources of microplastics
3	Occurrence
4	Potential impacts
4.1	Direct impacts
4.2	Indirect impacts – associated contaminants
	Conclusions
5.1	General conclusions
5.2	Conclusions from NOAA workshop on microplastics
6	Recommendations
7	References
	Appendix Findings from the NOAA workshop on microplastics

## 1. Background

A number of emerging issues were discussed at GESAMP 35 and it was agreed some of these warranted further investigation, hence the proposal to prepare short scoping papers for consideration at GESAMP 36. This paper deals with the occurrence and potential impact of microplastics in the marine environment, both due to the intrinsic properties of the particles (size, shape, composition) and as a vector for contaminants.

Plastics form a large proportion of marine litter, and the widespread occurrence of macroscopic plastic debris and the direct impact this can have both on marine fauna and legitimate uses of the environment, sometimes remote from industrial or urban sources, has been well documented (e.g. (Derraik 2002), cited by 61 other publications). In general, plastic debris comes in a wide variety of sizes and compositions and has been found throughout the world ocean, carried by ocean currents and biological vectors (e.g. stomach contents of fish, mammals and birds).

Plastics degrade extremely slowly in the open ocean, partly due to UV absorption by seawater and relatively low temperatures.

Litter was one of the categories incorporated in the 1995 Washington Declaration concerning a Global Programme of Action (GPA) for the protection of the environment from land-based sources (UNEP 1995). It was listed as being of concern in the GESAMP 71 report on land-based activities (GESAMP 2001). More recently, the problem of marine debris, and the need for increased national and international control, was dealt with at the 60th session of UNGA within the Oceans and the law of the sea session ((UNGA 2005); paragraphs 65-70). A more definitive assessment was provided by the analytical overview of marine litter, initiated by UNEP with input from IOC, IMO and FAO (UNEP 2005). This provided a useful overview of the issue, including type, source and distribution of litter, and measures to combat the problem. FAO has expressed concern over lost, abandoned or otherwise discarded fishing gear and has addressed this issue through a correspondence group with IMO and in a joint study with UNEP (Macfadyen et al. 2009). UNEP has pursued this issue within the Regional Sea Programme and is about to publish a review of their global initiative on marine litter (UNEP 2009).

In recent years the existence of microplastics and their potential impact has received increasing attention (e.g. (Betts 2008)). Microplastics have a range of compositions and can be demarcated by usage and source as: i) 'primary' microplastic pellets used as a feedstock in the plastics industry, and in certain applications such as abrasives; and, ii) 'secondary' microplastics resulting from the degradation and breakdown of larger items, including so-called biodegradable plastics. Particles as small as ~ 1 µm have been identified with an arbitrary upper bound of ~ 5 mm. Often particles are recovered during biological sampling so the size range is limited by the collection efficiency of the sampling device (e.g. 330 µm mesh neuston net for sampling zooplankton; muslin screens of the Continuous Plankton Recorder [www.sahfos.ac.uk](http://www.sahfos.ac.uk))

There is increasing evidence that such particles can be ingested by marine organisms, with the potential for: physical disruption and abrasion; toxicity of chemicals in the plastic; and, toxicity of absorbed persistent organic pollutants, including endocrine-disrupting chemicals. In recognition of this increasing concern, an international workshop was organised by NOAA (National Oceanic & Atmospheric Administration) in the USA in September 2008, entitled: The occurrence, effects and fate of microplastic marine debris. The Proceedings have been published (Arthur et al. 2009). To date most results suggest chronic rather than acute effects, but there is a lack

of quantitative data on distribution, composition and effects (Annex 1).

## 2. Sources of plastics

### 2.1 Plastics production and marine litter

Plastics are man-made, non-metallic polymers of high molecular weight, made up from repeating macromolecules (Zheng et al. 2005). The term plastic encompasses a wide range of materials, with some 200 plastics families in production including polyethylene, polypropylene, polystyrene, nylon, polyvinyl alcohol and acrylonitrile butadiene styrene (Ng & Obbard 2006). A relatively recent invention, they were first created in the 19th century (Gorman 1993), yet plastic has swiftly become a familiar and indispensable part of the modern world (Gregory 1999). This is because plastics have several advantages over other materials. They are cheap to produce, lightweight, durable, strong and extremely versatile (Laist 1987). However, the increasing consumption of disposable plastic products over time is coupled to escalating levels of plastic in the global marine environment via industrial discharge, littering and terrestrial runoff (Ng & Obbard 2006). The hazardousness of plastics as a waste material is associated with the excellent outdoor durability of thermoplastics that are resistant to hydrolysis and biodegradation in the environment. Properly compounded polyethylene is only moderately photodegradable and is relatively resistant to biodegradation (Andrady 1990).

The scale of the problem can be appreciated by the fact that plastic product production was estimated at 2.63 million tonnes in 2004 in the United States alone (Schlechter 2005), and 60 million tonnes in 2006 in the EU from fossil feedstock (Bowmer, pers. comm.). Much of this material is discarded as waste (approximately half of annual EU production is discarded each year) and a proportion of this is introduced directly or indirectly into the oceans. It has been reported that the proportion of human-related marine debris comprised of plastic materials is between 60 and 80 percent (UNEP 1995, Gregory & Ryan 1997), with plastic making up to 90 percent of floating debris in the ocean (California Coastal Commission, (CCC 2006)). Chronic plastic pollution has become a global problem (e.g. (Carpenter et al. 1972, Kartar et al. 1973, Kartar et al. 1976, Gregory 1978, Dixon & Dixon 1981, Gregory 1983, Fry et al. 1987, Moser & Lee 1992, Kanehiro et al. 1995, Galgani et al. 1996, Gregory 1999, Baird & Hooker 2000, Jackson et al. 2000, Barreiros & Barcelos 2001, Moore et al. 2001a, Cade?e 2002, Cliff et al. 2002, Convey et al. 2002, Kuriyama et al. 2002, Me?ndez et al. 2002, Aliani et al. 2003, Barnes & Fraser 2003, Copello & Quintana 2003, Cunningham & Wilson 2003, Maso et al. 2003, Abu-Hilal & Al-Najjar 2004, Auman et al. 2004, Claereboudt 2004, Edyvane et al. 2004, Lattin et al. 2004, Barnes & Milner 2005, Casey 2006, CCC 2006, Ng & Obbard 2006, Hartwig et al. 2007, Ivar do Sul & Costa 2007, Katsanevakis et al. 2007, Martinez-Ribes et al. 2007, Morishige et al. 2007, Yamashita & Tanimura 2007, Bauer et

al. 2008, Browne et al. 2008, Copello et al. 2008, Koutsodendris et al. 2008, Mallory 2008, Moore 2008, Abu-Hilal & Al-Najjar 2009, Colabuono et al. 2009, Corcoran et al. 2009, Defeo et al. 2009, Hinojosa & Thiel 2009).

Plastic litter can be placed into four broad, size-based categories (Gregory 1999) : i) microplastics - finely granulated plastic detritus which can be passed through a 500 $\mu$ m sieve, ii) mesoplastics - typically small rounded, cylindrical or rod shaped granules and virgin plastic pellets used in the production of plastic items, up to 5mm across, but occasionally up to 1cm; iii) macroplastics - often fragmented from larger items, but readily seen by the naked eye during shoreline surveys; and, iv) megaplastics - easily identifiable larger items, generally decimetres and larger. The environmental impact associated with plastic debris in the marine environment is a highly topical subject. Studies have shown that plastic materials of different sizes have been found in a variety of habitats globally, including beaches, neuston, open oceans and seabed (e.g. (Kanehiro et al. 1995, Galgani et al. 1996, Moore et al. 2001a, Moore et al. 2002, Lattin et al. 2004, McDermid & McMullen 2004, Reddy et al. 2006)).

### 2.2 Sources of microplastics

It has been recognised for some decades that plastic pellets have become a component of marine ecosystems (e.g. (Shiber 1979, Gregory 1983, Shiber 1987, Zitko & Hanlon 1991, Sciences 1992)). More recent studies have started to examine the potential impact of pellets and microplastic debris in more detail ( e.g. (Thompson et al. 2004, Browne et al. 2007, Browne et al. 2008)). Pre-production plastic resin pellets (alternatively called nurdles, virgin pellets, feed-stock, granules, resin beads and nibs) are the raw material for the manufacture of plastic products. Their sizes usually vary from 2–6 mm, though occasionally much larger ones can be found (Gregory 1978). They are found in large quantities on some beaches (Gregory 1978, Shiber 1979, Gregory 1983, Shiber 1987, Redford et al. 1997), and end up in the marine environment through accidental spillage during transport, handling and manufacturing processes - not as litter or waste as other forms of plastics (Gregory 1978, Shiber 1979, Sciences 1992, Gregory & Ryan 1997). Other microplastics released pre-formed into the marine environment include so-called plastic 'scrubbers'. These are small fragments of polyethylene and polystyrene (typically between 75  $\mu$ m and 500  $\mu$ m across) derived from hand cleaners, cosmetic preparations and air-blast cleaning media (Zitko & Hanlon 1991, Gregory 1996).

Microplastic fragments are derived from the physical and chemical fragmentation of larger plastic debris in the coastal environment. Most polymers are highly persistent in the marine environment and only degrade slowly via photocatalysis when exposed to ultra-violet radiation (Dixon & Dixon 1981). However, only limited quantities of UV radiation can penetrate seawater (Whitney et al. 1993). Thus the degradation

of polyolefin plastic items occurs at a much slower rate in the sea compared to on land. The lifetime of plastics at sea is not accurately known, but is estimated to range from years to decades, depending on the physical and chemical properties of the polymer (Gregory 1978). Plastics at sea eventually undergo fragmentation, leading to the formation of microscopic particulates of plastic or so called 'microplastics'. Due to their buoyant and persistent properties, microplastics have the potential to become widely dispersed in the marine environment via hydrodynamic processes and ocean currents (Ng & Obbard 2006, Browne et al. 2007). Plastic pellets and plastic fragments have been collected in trawls in the North Pacific central gyre in a ratio of 6:1 plastic to plankton mass (Moore et al. 2001b). The time taken for such plastic fragments in the marine environment to fully degrade (mineralise) back to their constituent components (carbon and hydrogen) through oxidative or biological degradation is not currently known (Andrady 1990, Palmisano & Pettigrew 1992, Andrady 2000). Fragmentation is likely to be more rapid for plastics stranded on coastlines, where higher temperatures and exposure to UV irradiation will lead to embrittlement.

The problems associated with increasing amounts of plastic in the marine environment have been recognized by a variety of governments and agencies who have responded with initiatives ranging from voluntary measures, to new legislation designed to control and reduce the amounts of disposable plastics used by society.

### 3. Occurrence

There have been limited efforts to quantify the distribution of microplastics on a global scale. Instead a whole series of individual studies have revealed a distribution ranging from the Antarctic (Auman et al. 2004) to the Bering Sea (Vlietstra & Parga 2002), and in every major ocean basin. Most studies have been in coastal environments, including mid-ocean islands, but there have been reported occurrences of microplastics in the Pacific gyre (Rios et al. 2007) and Atlantic water flowing between Iceland and Scotland (Thompson et al. 2004). One more concerted attempt to record occurrences systematically has been the International Pellet Watch (<https://www.tuat.ac.jp/~gaia/ipw/index.html>). There is limited evidence of time trends in the composition of microplastics, but one study has reported a decrease in 'industrial' primary pellets and an increase in 'user' plastic, from the 1970s to the late 1990s, based on the stomach contents of shearwaters in the Bering Sea (Vlietstra & Parga 2002).

### 4. Potential impacts

#### 4.1 Direct impacts

Initial studies focused on the detrimental impacts of mega- and macro-plastics on organisms such as fish, seabirds, marine mammals and marine reptiles (e.g. (Carpenter et al. 1972, Anon 1975, Fry et al. 1987, Moser & Lee 1992, Baird & Hooker 2000, Bugoni

et al. 2001)). These studies have shown that the mistaken ingestion of pieces of plastic occurs in seabirds, fish and various planktivores and can have harmful effects, such as diminished food consumption, loss of nutrition, internal injury, intestinal blockage, starvation and death (Derraik 2002). It has been reported that marine debris, including plastics, has injured or killed representatives of at least 267 species worldwide, primarily through ingestion and entanglement. (California Coastal Commission, (Casey 2006, CCC 2006)). More than 1 million seabirds, 100,000 marine mammals, and countless fish have died annually in the north pacific from ingesting or becoming entangled in marine debris (Casey 2006).

The large quantities and longevity of floating plastic debris in the marine environment also means that plastics may act as vectors for transporting invasive species from one region to another and represents a massive and historically unparalleled opportunity for the dispersal of sessile marine organisms (Barnes 2002, Aliani & Molcard 2003, Maso et al. 2003, Barnes & Milner 2005).

The environmental impact of these particles, as well as similar sized flakes from the degradation of larger plastic litter has not been properly established yet (Derraik 2002). However, recent research has shown that there is the potential for some filter- and deposit-feeding species to take up micro-plastics from the environment (Thompson et al. 2004, Teuten et al. 2007, Browne et al. 2008).

#### 4.2 Indirect impacts - associated contaminants

In addition to potential physical damage to marine organisms, plastics may consist of polymers with toxicological properties and may act as vectors for additional persistent organic pollutants. For example, pre-production pellets and post-consumer plastic fragments found in marine debris may have high levels of persistent organic pollutants (including PCBs, PAHs, organochlorine pesticides, such as DDTs and their metabolites, and aliphatic hydrocarbons) associated with them (Mato et al. 2001, Endo et al. 2005, Rios et al. 2007). Marine plastic pellets and fragments consist of various types of polymers (e.g., polypropylene, polyethylene, polystyrene) having different surface structures and, therefore, different affinities to pollutants. Plastic surfaces with a low polarity (hydrophobic) may adsorb hydrophobic chemicals (e.g. PCBs) from the marine environment and act like hydrophobic adsorbents in the sea (Mato et al. 2001). In one study, PCBs and DDE were found to accumulate in plastic pellets in concentrations up to 105-106 times higher than surrounding seawater. Another potential source of pollutants related to plastics is the leaching of plastic additives once ingested (e.g. plasticizers such as bisphenol A) and other related chemicals used in the initial manufacture of plastics. Despite the potential for plastics to act as agents in the transport of hydrophobic contaminants to marine organisms following ingestion, there is a lack of studies in this area. A positive correlation between the

mass of ingested plastics and PCB concentrations in fat tissue of Great Shearwaters *Puffinus gravis* has been documented (Ryan et al. 1988, Teuten et al. 2007) developed a theoretical model using the equilibrium partitioning method which indicated that the addition of as little as 1 µg of contaminated polyethylene to a gram of sediment would give a significant increase in phenanthrene accumulation by the marine polychaete *Arenicola marina*. If plastics can act as transfer agents making high concentrations of POPs bioavailable to marine organisms, because of their hydrophobic and persistent nature, these chemicals may become bio-concentrated and biomagnified through the food web (Schartzenbach et al. 2003), thereby potentially affecting species at all trophic level. Currently there is a lack of evidence for acute effects from ingested microplastics. But, concern has been expressed that the delivery of POPs into organisms by microplastic ingestion may lead to chronic of cumulative impacts, an additional stressors that will affect the resilience of populations in response to other factors such as disease and climate change, and may have impacts at higher trophic levels.

## 5. Conclusions

### 5.1 General conclusions

1. Macroplastics are an established threat to a variety of organisms in the marine environment, and interfere with legitimate users of the sea;
2. Microplastics are widespread in the marine environment, either as a consequence of degradation processes, or introduction in that form as pre-production feedstock pellets or components of cosmetic and industrial scrubbers;
3. Plastic resin pellets and post-consumer plastic fragments can serve as carriers of toxic chemicals in the marine environment, and can be ingested by a wide variety of marine organisms;
4. There is currently a lack of quantitative information about the distribution of these particles and the potential physical impacts these materials may have on marine organisms;
5. Of particular concern are potential chronic or cumulative impacts which may compromise a population's resilience to disease or other stressors;
6. There is a lack of information on trophic transfer;
7. Given the ubiquity and prevalence of microplastics in the marine environment further ecotoxicological investigations are needed into the potential mobilization of toxic pollutants from plastics into marine organisms;
8. It will important to compare the potential impacts from microplastic ingestion with other vectors (e.g. fish consumption by birds).

### 5.2 Conclusions from the NOAA workshop

1. Estimates of the quantity of microplastics in the ocean are highly uncertain due to the lack of consistent, verified sampling and analytical methods;
2. oceanographic factors and chemical composition and durability control the movement and weathering

of plastic particles, although very little fully degrades in the marine environment;

3. There is a paucity of data linking microplastic debris to demonstrable impacts on the marine environment;
4. To date only a few types of plastic polymers and organic pollutants have been examined, and further work is warranted into the ability of plastics to absorb contaminants and release these to the marine environment and to organisms upon ingestion;
5. The current estimated inventory of microplastics means it is unlikely to represent a significant reservoir of POPs, but they could influence POPs' biogeochemical cycles;
6. Determining the mobility of labile plastic components is key to addressing the risk that microplastics pose to food webs and biogeochemical cycles.

## 6. Recommendations

1. GESAMP should consider whether it has a role to maintain recent initiatives (e.g. UNEP, NOAA) to facilitate a global and ecosystem-based assessment of the potential impact of microplastics and associated contaminants on the marine environment.
2. The discussion on the potential role for GESAMP should be informed by the conclusions, key knowledge gaps and recommendations of the NOAA workshop, published literature and any additional national, regional or international initiatives.

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## Appendix I to Annex X

Key information gaps identified by participants at the NOAA Workshop September 2008 – adapted from Baker et al. (2009)

1. Sources of microplastics to the marine environment
  1. The relative importance of primary and secondary microplastics is unknown. It is important to begin addressing this gap as different sources will require different control strategies;
  2. The physical and chemical composition of primary microplastics and their production volume has not been catalogued in a way that allows their potential importance to be estimated. The weathering characteristics of primary microplastics, especially the release of component chemicals, are largely unstudied;
  3. Predicting the rate of secondary microplastic production is very difficult, as no systematic study of the disintegration process of microplastics under realistic conditions has been conducted;
  4. At present there are no methods to characterise microplastic particles by source location.
2. Measuring microplastics in the marine environment
  1. Improved methods are needed to recover and identify microplastics, as present methods are time-consuming and may be biased;
  2. No attempt has been made to compare or inter-calibrate measurement techniques.
3. Routes of exposure and potential vulnerabilities
  1. Only one study has examined the uptake of microplastics by zooplankton;
  2. No studies have examined interactions between microplastics and larval fish or pelagic tunicates.
4. Effects of microplastics on marine organisms
  1. No dose-response relationships have been established between specific types of microplastics and vulnerable species or life stages;
  2. Protocols for conducting realistic laboratory exposure experiments are needed.
5. Role of microplastics in the cycling of POPs
  1. Very little is known about the chemical composition and rates of leaching of plastics in seawater, so it is not possible to assess the relative importance of microplastics as a source, for example of plasticisers or flame retardants;
  2. Although microplastics are known to accumulate POPs, and some organisms ingest microplastics, the importance of this pathway is unclear.

# ANNEX XI

## GESAMP REPORTS AND STUDIES

The following reports and studies have been published so far. They are available from the GESAMP website: [www.gesamp.org](http://www.gesamp.org)

1. Report of the seventh session, London, 24-30 April 1975. (1975). Rep. Stud. GESAMP, (1):pag.var. Available also in French, Spanish and Russian
2. Review of harmful substances. (1976). Rep. Stud. GESAMP, (2):80 p.
3. Scientific criteria for the selection of sites for dumping of wastes into the sea. (1975). Rep. Stud. GESAMP, (3):21 p. Available also in French, Spanish and Russian
4. Report of the eighth session, Rome, 21-27 April 1976. (1976). Rep. Stud. GESAMP, (4):pag.var. Available also in French and Russian
5. Principles for developing coastal water quality criteria. (1976). Rep. Stud. GESAMP, (5):23 p.
6. Impact of oil on the marine environment. (1977). Rep. Stud. GESAMP, (6):250 p.
7. Scientific aspects of pollution arising from the exploration and exploitation of the sea-bed. (1977). Rep. Stud. GESAMP, (7):37 p.
8. Report of the ninth session, New York, 7-11 March 1977. (1977). Rep. Stud. GESAMP, (8):33 p. Available also in French and Russian
9. Report of the tenth session, Paris, 29 May - 2 June 1978. (1978). Rep. Stud. GESAMP, (9):pag.var. Available also in French, Spanish and Russian
10. Report of the eleventh session, Dubrovnik, 25-29 February 1980. (1980). Rep. Stud. GESAMP, (10):pag.var. Available also in French and Spanish
11. Marine Pollution implications of coastal area development. (1980). Rep. Stud. GESAMP, (11):114 p.
12. Monitoring biological variables related to marine pollution. (1980). Rep. Stud. GESAMP, (12):22 p. Available also in Russian
13. Interchange of pollutants between the atmosphere and the oceans. (1980). Rep. Stud. GESAMP, (13):55 p.
14. Report of the twelfth session, Geneva, 22-29 October 1981. (1981). Rep. Stud. GESAMP, (14):pag.var. Available also in French, Spanish and Russian
15. The review of the health of the oceans. (1982). Rep. Stud. GESAMP, (15):108 p.
16. Scientific criteria for the selection of waste disposal sites at sea. (1982). Rep. Stud. GESAMP, (16):60 p.
17. The evaluation of the hazards of harmful substances carried by ships. (1982). Rep. Stud. GESAMP, (17):pag.var.
18. Report of the thirteenth session, Geneva, 28 February - 4 March 1983. (1983). Rep. Stud. GESAMP, (18):50 p. Available also in French, Spanish and Russian
19. An oceanographic model for the dispersion of wastes disposed of in the deep sea. (1983). Rep. Stud. GESAMP, (19):182 p.
20. Marine pollution implications of ocean energy development. (1984). Rep. Stud. GESAMP, (20):44 p.
21. Report of the fourteenth session, Vienna, 26-30 March 1984. (1984). Rep. Stud. GESAMP, (21):42 p. Available also in French, Spanish and Russian
22. Review of potentially harmful substances. Cadmium, lead and tin. (1985). Rep. Stud. GESAMP, (22):114 p.
23. Interchange of pollutants between the atmosphere and the oceans (part II). (1985). Rep. Stud. GESAMP, (23):55 p.
24. Thermal discharges in the marine environment. (1984). Rep. Stud. GESAMP, (24):44 p.
25. Report of the fifteenth session, New York, 25-29 March 1985. (1985). Rep. Stud. GESAMP, (25):49 p. Available also in French, Spanish and Russian
26. Atmospheric transport of contaminants into the Mediterranean region. (1985). Rep. Stud. GESAMP, (26):53 p.
27. Report of the sixteenth session, London, 17-21 March 1986. (1986). Rep. Stud. GESAMP, (27):74 p. Available also in French, Spanish and Russian
28. Review of potentially harmful substances. Arsenic, mercury and selenium. (1986). Rep. Stud. GESAMP, (28):172 p.
29. Review of potentially harmful substances. Organosilicon compounds (silanes and siloxanes). (1986). Published as UNEP Reg. Seas Rep. Stud., (78):24 p.
30. Environmental capacity. An approach to marine pollution prevention. (1986). Rep. Stud. GESAMP, (30):49 p.

31. Report of the seventeenth session, Rome, 30 March - 3 April 1987. (1987). Rep. Stud. GESAMP, (31):36 p. Available also in French, Spanish and Russian
32. Land-sea boundary flux of contaminants: contributions from rivers. (1987). Rep. Stud. GESAMP, (32):172 p.
33. Report on the eighteenth session, Paris, 11-15 April 1988. (1988). Rep. Stud. GESAMP, (33):56 p. Available also in French, Spanish and Russian
34. Review of potentially harmful substances. Nutrients. (1990). Rep. Stud. GESAMP, (34):40 p.
35. The evaluation of the hazards of harmful substances carried by ships: Revision of GESAMP Reports and Studies No. 17. (1989). Rep. Stud. GESAMP, (35):pag.var.
36. Pollutant modification of atmospheric and oceanic processes and climate: some aspects of the problem. (1989). Rep. Stud. GESAMP, (36):35 p.
37. Report of the nineteenth session, Athens, 8-12 May 1989. (1989). Rep. Stud. GESAMP, (37):47 p. Available also in French, Spanish and Russian
38. Atmospheric input of trace species to the world ocean. (1989). Rep. Stud. GESAMP, (38):111 p.
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40. Long-term consequences of low-level marine contamination: An analytical approach. (1989). Rep. Stud. GESAMP, (40):14 p.
41. Report of the twentieth session, Geneva, 7-11 May 1990. (1990). Rep. Stud. GESAMP, (41):32 p. Available also in French, Spanish and Russian
42. Review of potentially harmful substances. Choosing priority organochlorines for marine hazard assessment. (1990). Rep. Stud. GESAMP, (42):10 p.
43. Coastal modelling. (1991). Rep. Stud. GESAMP, (43):187 p.
44. Report of the twenty-first session, London, 18-22 February 1991. (1991). Rep. Stud. GESAMP, (44):53 p. Available also in French, Spanish and Russian
45. Global strategies for marine environmental protection. (1991). Rep. Stud. GESAMP, (45):34 p.
46. Review of potentially harmful substances. Carcinogens: their significance as marine pollutants. (1991). Rep. Stud. GESAMP, (46):56 p.
47. Reducing environmental impacts of coastal aquaculture. (1991). Rep. Stud. GESAMP, (47):35 p.
48. Global changes and the air-sea exchange of chemicals. (1991). Rep. Stud. GESAMP, (48):69 p.
49. Report of the twenty-second session, Vienna, 9-13 February 1992. (1992). Rep. Stud. GESAMP, (49):56 p. Available also in French, Spanish and Russian
50. Impact of oil, individual hydrocarbons and related chemicals on the marine environment, including used lubricant oils, oil spill control agents and chemicals used offshore. (1993). Rep. Stud. GESAMP, (50):178 p.
51. Report of the twenty-third session, London, 19-23 April 1993. (1993). Rep. Stud. GESAMP, (51):41 p. Available also in French, Spanish and Russian
52. Anthropogenic influences on sediment discharge to the coastal zone and environmental consequences. (1994). Rep. Stud. GESAMP, (52):67 p.
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54. Guidelines for marine environmental assessment. (1994). Rep. Stud. GESAMP, (54):28 p.
55. Biological indicators and their use in the measurement of the condition of the marine environment. (1995). Rep. Stud. GESAMP, (55):56 p. Available also in Russian
56. Report of the twenty-fifth session, Rome, 24-28 April 1995. (1995). Rep. Stud. GESAMP, (56):54 p. Available also in French, Spanish and Russian
57. Monitoring of ecological effects of coastal aquaculture wastes. (1996). Rep. Stud. GESAMP, (57):45 p.
58. The invasion of the ctenophore *Mnemiopsis leidyi* in the Black Sea. (1997). Rep. Stud. GESAMP, (58):84 p.
59. The sea-surface microlayer and its role in global change. (1995). Rep. Stud. GESAMP, (59):76 p.
60. Report of the twenty-sixth session, Paris, 25-29 March 1996. (1996). Rep. Stud. GESAMP, (60):29 p. Available also in French, Spanish and Russian
61. The contributions of science to integrated coastal management. (1996). Rep. Stud. GESAMP, (61):66 p.
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66. Report of the twenty-eighth session, Geneva, 20-24 April 1998. (1998). Rep. Stud. GESAMP, (66):44 p.
67. Report of the twenty-ninth session, London, 23-26 August 1999. (1999). Rep. Stud. GESAMP, (67):44 p.
68. Planning and management for sustainable coastal aquaculture development. (2001). Rep. Stud. GESAMP, (68):90 p.
69. Report of the thirtieth session, Monaco, 22-26 May 2000. (2000). Rep. Stud. GESAMP, (69):52 p.
70. A sea of troubles. (2001). Rep. Stud. GESAMP, (70):35 p.
71. Protecting the oceans from land-based activities - Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environment.(2001). Rep. Stud. GESAMP, (71):162p.
72. Report of the thirty-first session, New York, 13-17 August 2001. (2002). Rep. Stud. GESAMP, (72):41 p.
73. Report of the thirty-second session, London, 6-10 May 2002. (in preparation). Rep. Stud. GESAMP, (73)
74. Report of the thirty-third session, Rome, 5-9 May 2003 (2003) Rep. Stud. GESAMP, (74):36 p.
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77. Report of the thirty-fourth session, Paris, 8-11 May 2007 (2008), Rep. Stud. GESAMP, (77):83 p.
78. Report of the thirty-fifth session, Accra, 13-16 May 2008 (2009), Rep. Stud. GESAMP, (78):73 p.
79. Pollution in the open oceans: a review of assessments and related studies (2009). Rep. Stud. GESAMP, (79):64 p.
80. Report of the thirty-sixth session, Geneva, 28 April - 1 May 2009, Rep. Stud. GESAMP, (80): 83 p.



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