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**IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP
Joint Group of Experts on the Scientific Aspects
of Marine Environmental Protection (GESAMP)**

**REPORT OF THE TWENTY-EIGHTH SESSION
Geneva, Switzerland, 20-24 April 1998**

**WORLD METEOROLOGICAL ORGANIZATION
Geneva, Switzerland, 1998**

Notes

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EXECUTIVE SUMMARY

1. GESAMP reviewed the draft of the biennial Report of the State of the Marine Environment and the drafts of selected chapters of the Report on Land-based Sources and Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environment prepared by the Working Group on Marine Environmental Assessment. The Working Group confirmed that the final drafts of these reports will be submitted for consideration to the 29th session of GESAMP.
2. The GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships (EHS) reported on the completion of a major revision of its hazard evaluation procedure which was approved for publication by GESAMP as Reports and Studies No. 64. At its 34th meeting the Working Group evaluated 25 new substances and reviewed 16 existing hazard profiles at the request of industry in addition to reviewing 18 bulk solid compounds for nomenclatural changes. Progress was also made on long-term reviews of hazard profiles of pesticides and vegetable and animal oils carried by ships.
3. GESAMP agreed that aquaculture has a legitimate role in coastal development. In order to assign an appropriate place and to achieve its full potential however, GESAMP felt it important that such activities be considered alongside with other forms of coastal development within a wider coastal management framework. Inclusion of aquaculture within such a framework would also ensure that its further development takes place in a socially and environmentally sustainable manner. Guidelines are currently being prepared.
4. GESAMP started to re-evaluate inputs of oil into the marine environment from shipping and offshore activities.

RÉSUMÉ DIRECTIF

1. Le GESAMP a revu le projet de rapport biennal sur l'état de l'environnement marin, ainsi que le texte provisoire de certains chapitres du rapport sur les sources de pollution d'origine tellurique et les activités connexes préjudiciables à la qualité et l'utilisation du milieu marin et côtier et du milieu dulçaquicole qui lui est associé rédigés par le groupe de travail compétent. Celui-ci a confirmé que la version définitive de ces deux rapports sera présentée à l'examen du GESAMP à sa vingt-neuvième session.

2. Le Groupe de travail sur l'évaluation des risques imputables aux substances nocives transportées par mer, qui relève du GESAMP, a mené à terme la révision complète de la procédure d'évaluation des risques qu'il applique. Ladite procédure a été approuvée, aux fins de publication, par le GESAMP, sous couvert des rapports et études N° 64. A sa trente-quatrième réunion, le Groupe de travail avait évalué 25 nouvelles substances, examiné 16 profils de risques existants, à la demande de la branche d'industrie, et revu 18 composés solides transportés en vrac pour un changement de nomenclature. L'analyse des profils de risques des pesticides et des huiles animales et végétales transportés par bateaux a bien progressé.

3. Le GESAMP est convenu que l'aquaculture avait effectivement un rôle à jouer dans le développement du littoral, mais que pour qu'elle puisse y trouver sa place et donner toute la mesure de ses possibilités, il fallait la replacer dans un cadre global prenant en compte d'autres formes de développement côtier, ce qui permettrait aussi d'en assurer durablement l'essor, du point de vue tant social qu'environnemental. Les principes directeurs applicables en la matière sont en voie d'élaboration.

4. Le GESAMP a entrepris de réévaluer les apports de pétrole dans l'environnement marin provenant de la navigation maritime et des activités au large des côtes.

РЕЗЮМЕ ТЕКУЩЕЙ ДЕЯТЕЛЬНОСТИ

1. ГЕЗАМП рассмотрела проект двухгодичного отчета по состоянию морской окружающей среды и проекты отобранных глав отчета по наземным источникам и видам деятельности, отрицательно влияющим на качество и использование морской, прибрежной и связанной с ними пресноводной среды, подготовленный рабочей группой по оценке состояния морской среды. Рабочая группа подтвердила, что окончательные проекты этих отчетов будут представлены на рассмотрение 29 сессии ГЕЗАМП.
2. Рабочая группа ГЕЗАМП по оценке опасности вредных веществ, перевозимых судами (ОВС), доложила о завершении основного рассмотрения своей процедуры по оценке риска, которая была одобрена ГЕЗАМП для публикации в качестве отчетов и исследований № 64. На своем тридцать четвертом заседании рабочая группа сделала оценку 25 новых веществ и пересмотрела 16 существующих профилей опасности по просьбе промышленности, в дополнение к рассмотрению 18 твердых соединений, перевозимых навалом, для внесения изменений в номенклатуру. Была также проведена успешная работа по долгосрочному рассмотрению профилей опасности пестицидов и растительных и животных масел, перевозимых судами.
3. ГЕЗАМП пришла к соглашению, что аквакультура играет обоснованную роль в прибрежном развитии. Для определения соответствующего места и использования ее полного потенциала ГЕЗАМП считает, однако, очень важным, чтобы такая деятельность рассматривалась наряду с другими формами прибрежного развития в рамках более широкого процесса управления прибрежной зоной. Включение в эти рамки аквакультуры также даст уверенность в том, что ее дальнейшее развитие будет осуществляться устойчивым образом с точки зрения социальной и экологической значимости. Руководящие указания в настоящее время находятся в стадии подготовки.
4. ГЕЗАМП начал осуществлять переоценку поступлений нефти в морскую окружающую среду от судов и от деятельности в открытом море, недалеко от берега.

RESUMEN EJECUTIVO

1. El Grupo mixto de expertos sobre los aspectos científicos de la protección del medio marino (GESAMP) examinó el proyecto de informe bienal sobre el estado del medio ambiente marino y el borrador de ciertos capítulos del informe sobre fuentes de contaminación de origen telúrico y las actividades conexas que afectan la calidad y la utilización del medio ambiente marino, costero y las aguas dulces asociadas, preparados por el Grupo de trabajo sobre evaluación del medio ambiente marino. Éste confirmó que la versión definitiva de sus informes se someterá para consideración a la 29ª reunión del GESAMP.

2. El Grupo de trabajo del GESAMP sobre evaluación de los riesgos que ocasionan las sustancias perjudiciales transportadas por los barcos comunicó que se ha terminado una revisión importante de su procedimiento de evaluación de riesgos, que el GESAMP aprobó para publicación en la serie Reports and Studies N° 64. En su 34ª reunión, el Grupo de trabajo evaluó 25 sustancias nuevas y revisó 16 perfiles de riesgos existentes a petición de la industria, además de estudiar 18 compuestos sólidos transportados a granel para efectuar cambios de nomenclatura. Se realizó también gran progreso en el examen a largo plazo de los perfiles de riesgo de los plaguicidas y los aceites vegetales y animales transportados por barco.

3. El GESAMP convino en que la acuicultura puede cumplir una clara función en el desarrollo de las zonas costeras. Ahora bien, para atribuirle el lugar que le corresponde y que consiga hacer realidad todas sus posibilidades, es importante que se la considere junto con otras formas de desarrollo de las zonas costeras en un marco más amplio de gestión de las costas. La inclusión de la acuicultura dentro de ese marco asegurará también que su evolución futura se efectúa de manera social y ecológicamente sostenible. Se están elaborando las directrices.

4. El GESAMP comenzó la evaluación de los vertidos de petróleo en el entorno marino procedentes de buques de la marina mercante y las actividades frente a las costas.

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1. INTRODUCTION

1.1 The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) held its twenty-eighth session at the Headquarters of the World Meteorological Organization (WMO) in Geneva, Switzerland, under the Chair of Ms H. Yap. Mr P. Wells was Vice-Chairperson.

Opening of the Session

1.2 The Chair of GESAMP, Ms H. Yap, called the XXVIIIth session of GESAMP to order at 14:30 on 20 April 1998.

1.3 Mr M. Jarraud, Deputy Secretary-General of WMO, welcomed the participants on behalf of the WMO Secretary-General. He noted that WMO was one of the founders of this inter-agency and inter-disciplinary scientific advisory group and supported many GESAMP studies especially those where the atmosphere plays an important role. The advice and recommendations of GESAMP have always been appreciated and taken into account by the WMO Members and its Constituent Bodies. He also noted that the broadening of the GESAMP scope to deal not only with marine pollution but also with complex aspects of marine environmental protection has increased the interest of WMO in getting GESAMP's scientific advice because many marine-related activities depend on weather conditions and the ocean-atmosphere interaction. Potential climate changes and the El Niño phenomenon were particularly mentioned in this respect. Mr M. Jarraud stressed the importance of the present session of GESAMP which will deal with an assessment of the state of the marine environment including current major issues of concern and emerging problems, and the effects of land-based activities. In conclusion Mr M. Jarraud wished GESAMP every success in the performance of its tasks.

Adoption of the Agenda

1.4 The participants adopted the provisional agenda as agenda for the session, as reproduced in Annex I. It was agreed that agenda item 7 should be discussed in conjunction with item 3.1. The list of documents considered at the session is given in Annex II, and the list of participants is shown in Annex III.

2. REPORT OF THE ADMINISTRATIVE SECRETARY

2.1 The Administrative Secretary of GESAMP informed the Group on intersessional developments relevant to GESAMP, in particular on the involvement of experts from outside scientific institutions in response to the request to facilitate a dialogue with both intergovernmental bodies and non-governmental groups. He updated the Group on interagency activities dedicated to the 1998 International Year of the Ocean and pointed out that IMO, in cooperation with other sponsoring agencies is currently preparing a WEB site which will provide information on GESAMP, its purpose and achievements, and include the GESAMP Memorandum, its Guidelines for Procedures, and a list of publications. This will be complemented by the texts of GESAMP Report and Studies that have been or will be published.

2.2 The Group further noted information by the Administrative Secretary on recent IMO activities which are related to the GESAMP mandate:

- (i) considerations and assessment of alternatives to the antifouling paints containing tributyltin (TBT) which proved to be hazardous to the sealife and the marine

environment. IMO has adopted a schedule of phasing out these paints between 2002 and 2006 while preparing a mandatory instrument to control their use;

- (ii) designation of North West European waters (part of the North East Atlantic, the English Channel, the Celtic Sea, the North and Irish Seas and their approaches) as a Special Area under Annex I of MARPOL 73/78;
- (iii) designation of the Sabana-camagney Archipelago (Cuba) as a particularly sensitive sea area (PSSA) and revision of guidelines on designating PSSA to make the procedures more simple and to enhance the measures for controlling maritime activities in such areas; and
- (iv) development of legally binding regulations, possibly in the form of a new Annex to MARPOL 73/78 for ballast water management to control introductions of non-indigenous aquatic organisms and pathogens in new locations.

2.3 GESAMP further noted the concern expressed by the Administrative Secretary in connection with the budgetary constraints experienced by some sponsoring agencies as these may have implications on GESAMP's activities and its modus operandi. The need for additional financial resources to carry out GESAMP's MEA activities was underlined as a problem to be dealt with as a priority.

3. MARINE ENVIRONMENTAL ASSESSMENTS

3.1 The UNEP Technical Secretary recalled that the Working Group on Marine Environmental Assessments was established in 1996, at GESAMP XXVI, but no substantive progress was achieved in the intersessional period leading to GESAMP XXVII in 1997. At that session of GESAMP, the Working Group was reconstituted, its terms of reference revised, and the outlines of three reports expected from the Working Group endorsed. Although the Working Group did not meet during the past intersessional period, two outputs of the Working Group are available for consideration of the present session of GESAMP.

3.2 The Chairman of the Working Group reviewed the methodology used in the preparation of the draft documents by the Working Group in the past intersessional period:

(a) The **biennial assessment** (The State of the Marine Environment: Current Major Issues and Emerging Problems). Written inputs were solicited from members of the Working Group and served as a basis for preparation of the first consolidated draft of the report (dated 24 January 1998) prepared by the Chairman of the Working Group. The draft was circulated to all members of the Working Group and GESAMP Technical Secretaries for comments. The received comments were used by the Chairman of the Working Group and the UNEP Technical Secretary for the preparation of the second consolidated draft of the report (dated 29 March 1998). This draft was distributed, as document GESAMP XXVIII/3/1, for the consideration of the present session of GESAMP.

(b) The **LBA report** (Land-Based Sources and Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environment). Five members of the Working Group were identified as "coordinators" for the preparation of the drafts of individual chapters of the report, with inputs from all members of the Working Group and other sources. The latter included a selection of regional reports, particularly those prepared within the framework of the Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities. The first

drafts of three substantive chapters of the report were distributed, as document GESAMP/XXVIII/3/2, for the consideration of the present session of GESAMP.

(c) The **SOME report** (State of the Marine Environment). No attempt has yet been made by the Working Group to carry out the work on this report during the past intersessional period (see also paragraph 3.14 below).

3.3 A summary of the Working Group's considerations as related to preparation of the Biennial and LBA reports is given in Annex IV.

Consideration of a draft biennial assessment report: the state of the marine environment - current major issues and emerging problems (agenda item 3.1)

3.3 In introducing document GESAMP XXVIII/3/1, the Chairman of the Working Group stressed the need to take a firm and final decision at the present session of GESAMP concerning the target audience of the report, as this would have critical bearing on the style in which the report is to be written. GESAMP considered the matter and decided that the report should primarily be addressed to politicians, policy-makers and higher-level managers. Consequently, the report should be relatively short and the language used in the report not too technical. References and explanations which may help in better understanding the main body of the report or which may provide more detailed information on certain issues of potential interest to the readers, should appear on the same page where the relevant issues were raised.

3.4 The contents and design of the draft report were generally considered by the Group as a good basis for development of the final report. A number of general and specific comments on the information and statements contained in the document, and suggestions for addition of certain issues and deletion of some others, were offered by GESAMP members and the Technical Secretaries. The main issues raised were as follows:

- (i) the discernible trends in changing environmental quality, and in levels and inputs of pollutants, should be highlighted in the series of biennial assessments; in doing so, improvements, i.e., positive trends should be specifically emphasized;
- (ii) the impact of land-based activities should receive a more prominent treatment based on the information which is expected to be available in the LBA report, once it was in a more advanced stage;
- (iii) problems associated with growth of coastal population should be emphasized more, although in most cases the expanding coastal population increased the impact and pressure on the marine environment and its resources. The rate of this increase is slower than the rate at which the population is increasing;
- (iv) health effects of deteriorating environmental conditions caused by, for instance, contaminated seafood or exposure to contaminated recreational waters should receive more attention in the report;
- (v) interaction between marine and inland waters relevant to the issues treated by the report, coastal marine waters and aquifers in particular, should deserve more extended considerations;

- (vi) there was a need to include regional analyses;
 - (vii) there was a need to highlight the potential impact of genetically modified organisms;
 - (viii) the role of education and capacity building should be emphasized.
- 3.5 Taking into account the comments and suggestions made by the GESAMP members and the Technical Secretaries, some restructuring of the present layout of the report was recommended in order to:
- (i) present the "impact of land-based activities" in the separate section of the report, emphasizing it as the "focus issue" of the report;
 - (ii) separate "persistent" from "emerging" issues and present them in separate sections of the report;
 - (iii) shift certain issues to the section on "changing perspectives" (i.e., the treatment of "reduction in marine biodiversity", "radionuclides in the marine environment" and "changes in climate conditions") and to section on "implications for science, management and policy" ("global carbon cycle");
 - (iv) include a number of additional topics (e.g., "deep water fisheries", "oil in coastal regions", "coral bleaching and diseases" and "effects of military activities");
 - (v) modify or expand the treatment of some issues and problems;
 - (vi) delete consideration of "remobilization of contaminants from sediments"; and
 - (vii) add a section on "lessons learned".
- 3.6 The revised layout of the report, which reflects the above suggestions, is attached as Annex V.

Consideration of a draft report on land-based sources and activities affecting the quality and uses of marine, coastal and associated freshwater environments (agenda item 3.2)

3.7 When introducing document GESAMP XXVIII/3/2, which consists of the preliminary drafts of three chapters of the future LBA report, the Chairman emphasized that the LBA report was expected to cover land-based activities as considered in the context of GPA and should be based primarily on the analysis of information contained in the best available existing regional reports and documents, or on the regional reports which are being prepared in the framework of GPA/LBA. Eight overviews analyzing the information contained in such regional reports and documents have been prepared, covering the following regions: the Arctic, Baltic, Black Sea, Eastern Africa, Mediterranean Sea, North Sea, Red Sea and Gulf of Aden, and South East Pacific. The structure of the overviews closely followed the outline adopted for the LBA report in order to facilitate their use in the preparation of the LBA report.

3.8 The quality and reliability of information contained in the sources used for the preparation of the overviews, and the relevance of this information for the preparation of the LBA report, varied widely, from excellent to poor. However, even in the case of the best source documents, they did not

cover all issues of relevance in the context of the LBA report. Therefore, in addition to the preparation of new overviews for regions not covered yet, additional sources would have to be identified and used in order to complete the information in existing overviews.

3.9 The preliminary drafts of the individual chapters of the LBA report were introduced by the members of the Working Group who coordinated their preparation. The introductions were followed by discussion during which numerous comments and suggestions for amendments were offered by GESAMP members and the Technical Secretaries.

3.10 Main comments and suggestions relevant to Chapter 4 of the LBA report (Identification and assessment of problems) were as follows:

- (i) a more balanced consideration of atmospheric deposition fluxes should be provided, reducing the relative emphasis on the North Sea and introducing, as examples, flux estimates for the Mediterranean and the Baltic Seas;
- (ii) information on mercury should be introduced in a table showing the global input of heavy metals;
- (iii) the actual or potential effects of various sewage constituents should be better differentiated;
- (iv) the discussion on ecosystem health should be expanded, and the used terms better defined and uniformly used;
- (v) when dealing with hydrocarbons, more attention should be paid to oils derived from land-based activities; in the context of sea-based activities the relevance of coastal infrastructures and the shore-based aspects of offshore exploitation should be highlighted;
- (vi) the use of TBT as an antifouling agent on ship hulls was overemphasized, in the context of the document intended to deal primarily with land-based activities, at expense of its other application (e.g. in aquaculture, wild fisheries, protection of coastal structures);
- (vii) there was inadequate attention to contamination of the coastal marine environment by pathogens in sewage, and to risks to human health associated with consumption of seafood;
- (viii) there was a need to also reflect the multiplicity of issues within individual regions.

3.11 Main comments and suggestions relevant to Chapter 5 of the LBA report (Emerging and foreseeable problems) were as follows:

- (i) a number of problems included in the chapter were recognized as “persistent” rather than “emerging” (e.g., “expanding coastal population and tourism”, “marine litter”, “aquaculture and agriculture”, “anoxia of shallow coastal waters”);
- (ii) a number of issues which were not deemed to be the results of land-based sources and which were thus removed from this chapter included “improved analytical capability for synthetic organic compounds” and “offshore drilling in deep waters” (although high-capacity pipelines and their associated terminals were a concern);
- (iii) some issues were considered as more appropriate for consideration in preparation of the

biennial report (e.g., “decommissioning of offshore structures”, “purposeful tracers and other scientific interventions”, and “military activities as marine pollution issue”);

- (iv) the issue of the “increasing need for international cooperation” could best be addressed in Chapter 6 of the LBA report; likewise, the discussion of “current perspectives on the global carbon cycle” should not be in Chapter 5, but no suggestion was made where it should go;
- (v) a new section should be prepared on “invasive species”; and
- (vi) in the section on “coastal eutrophication and the role of atmospheric nitrogen input”, the atmospheric nitrogen input should be stressed as the emerging issue.

3.12 When introducing Chapter 6 (Strategies and measures), the coordinator of the Chapter's preparation explained that his key consideration in planning the style and content of the Chapter had been: (a) the nature of the intended audience, (b) the level of detail that should, and could, be provided in the space available, and (c) the documentation that should be consulted. Pending advice from the Working Group on these matters, he had opted to address the issues identified in the outline for Chapter 6 agreed by GESAMP (GESAMP Rep. Stud. No 63, Annex 7) within the context of a cohesive global strategy for marine environmental protection with a special focus on the Global Programme on Action for the Protection of the Marine Environment from Land-Based Activities (GPA/LBA) and the process of integrated coastal management (ICM). He recognized that the final section of the Chapter, dealing with the success of measures, was most unsatisfactory but noted that it was largely due to a serious lack of information on this matter in the regional assessments received to date.

3.13 Whilst acknowledging the merits of the approach taken by the chapter coordinator, several GESAMP members felt that the present text should be reorganized and expanded so that it would adhere more closely to the LBA Chapter 6 outline. The UNEP Technical Secretary confirmed that the Chapter should specifically address each of the issues mentioned in that outline. Although one Technical Secretary and one expert of GESAMP felt that there should be some flexibility with regard to the coverage of individual issues, it was nevertheless important that the Chapter clearly address the various *options* for strategies and measures, *achievements* of measures applied to date, and possible *solutions* to problems identified in preceding chapters. A number of members offered to provide additional documentation relevant to these topics. The co-ordinator agreed that it should be possible to reorganize the text as suggested by GESAMP.

3.14 Suggestions, applicable to all chapters of the LBA report were related to:

- (i) the level of details given in the descriptions of various problems and issues should be more even;
- (ii) a summary in front of each chapter would be helpful; and
- (iii) in future work on the chapters, regional specificities and peculiarities should be distinctly identified.

Review of preparations for a global report on the state of the marine environment (agenda item 3.3)

3.15 Because of the relevance of the GEF-funded project Global International Waters Assessment (GIWA) in the context of preparation of the SOME report, and the agreement reached at GESAMP XXVII to establish cooperative arrangements between GIWA and the SOME report (see the report of

GESAMP XXVII), the UNEP Technical Secretary briefed the Group on progress in developing GIWA. The project was approved by the GEF Council in November 1997 for about US\$ 7 million, subject to acquisition of co-financing for the remaining funds (about US\$ 6 million). To this end, several potential donors have been approached for co-funding. Sweden offered to host the GIWA core team in the city of Kalmar.

4. EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS (Working Group 1)

4.1 The IMO Technical Secretary introduced the activities of the Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships, carried out during the intersessional period, drawing particular attention to the need of publishing the revised hazard evaluation procedures annexed to the Working Group's report (GESAMP XXVIII/4) as soon as possible. IMO is currently revising legally binding provisions set out in MARPOL 73/78, Annex II, concerning the bulk transport of chemicals by ships and as part of such a revision, an updated hazard evaluation procedure should be included.

4.2 The IMO Technical Secretary felt that it was also important to recognize the importance of cooperation with OECD which had been assigned by the relevant United Nations agencies to establish a clearing house with the task of harmonizing the categorization and labelling of chemicals. In this connection it was very pertinent to publish as soon as possible the revised GESAMP hazard evaluation procedure.

4.3 The Chairman of the Working Group reported on progress achieved at OECD on the harmonization of chemical classification systems, including the classification of substances hazardous to the aquatic environment. He noted that OECD had proposed a core set of criteria and cut off points. With both the OECD harmonized scheme and the revised GESAMP hazard evaluation procedure nearing completion, it is evident that there was substantial agreement between both the environmental parameters and the cut-off points proposed for the future. Any remaining discrepancies in cut-off point values would be brought into line through correspondence with the Working Group members, prior to publication.

Revised GESAMP hazard evaluation procedure

4.4 In order to finalize the revised hazard evaluation procedure, as requested by GESAMP, the Working Group had reviewed the individual columns and a number of refinements were discussed and agreed upon as set out below:

- (i) Column A1: Bioaccumulation (log Pow and BCF). Regarding the use of a log Pow of >7 to denote substances with a "0" rating in the column, i.e. "no potential to bioaccumulate", it was felt by the Working Group that the broad majority of substances transported by sea would indeed be non-bioaccumulating at log Pow values of above 7. The Working Group was aware that some highly persistent substances, e.g. some PCB and PCDD congeners with log Pow values of between 7 and 8 do still bioaccumulate; the Working Group will apply expert judgement in such cases.
- (ii) Column A2: Biodegradation. After some rediscussion of soil and inherent aquatic biodegradation, the Working Group confirmed the column as originally proposed.
- (iii) Column B1: Acute aquatic toxicity. This column was confirmed.
- (iv) Column B2: Chronic aquatic toxicity. The Working Group had agreed that this should be evaluated separately from acute aquatic toxicity as these criteria represent separate hazards.

For this reason it felt that it was not appropriate to overrule acute toxicity by chronic toxicity data in order to up-rate or down-rate a substance. The Working Group re-iterated that substances known to cause significant chronic effects should be prevented from entering the sea.

- (v) Column C: Acute mammalian toxicity by swallowing, skin penetration and inhalation. This column and its three sub-columns were confirmed.
- (vi) Column D: Irritation, corrosivity and evidence for specific health concerns. The Working Group reconsidered the revised column D1 and D2 ratings for skin and eye irritation in order to combine the largely quantitative (mammalian test data) end points and cut-off values proposed by OECD with the procedure adopted by GESAMP as an expert group, based on clinical signs. In order to allow direct comparison with the OECD proposals, similar bands of hazard were adopted and conversion tables were developed.
- (vii) Column E1: Tainting of seafood was reviewed on the basis of a detailed study of the GESAMP Composite List entries. It was felt that proposed new ratings based on odour threshold were not sufficiently robust to be included in the revised hazard evaluation procedure; there was insufficient evidence to connect odour threshold directly to tainting of seafood. The Working Group decided to rate in future on the basis of tainting tests where available, or on the basis of structural analogy, severe smell and other organoleptic properties. The Working Group noted that very few compounds have in fact been tested for tainting.
- (viii) Column E2: Effects on marine wildlife and benthic habitats. The Working Group rediscussed the inclusion of melting points in determining the behaviour of substances in water, and concluded that this could prove to be technically difficult. It was decided to use viscosity at 20°C as the parameter with which to determine the physical state in seawater, i.e. for the rating of "liquid persistent floaters" (Fp).
- (ix) Column F: Remarks. The remarks column was confirmed.
- (x) Glossary: In response to comments from GESAMP, some amendments to the definitions in the glossary will be included.

Evaluation of substances

4.4 The Chairman of the Working Group in reporting on the progress made regarding the routine evaluation of chemical substances noted that correspondence with 16 chemical manufacturers had been addressed. A total of 18 compounds in the GESAMP Composite List had been reviewed and the profiles altered or confirmed. Additionally, nomenclatural changes for some 16 solid bulk solids were evaluated and approved, where appropriate. A total of 25 new substances were evaluated.

Review of the hazard profiles

4.6 GESAMP noted that a review of the hazard profiles of pesticides and of vegetable and animal oils were carried out by the Working Group.

4.7 The Composite List contains ca 150 pesticide active ingredients and the columns are being reviewed on a step by step basis. Columns C (acute mammalian toxicity) and D (irritation, corrosivity and specific health concerns) of the hazard profiles of 22 organophosphate and carbamate pesticides and herbicides having anticholinesterase activity, were reviewed and confirmed. A review of Column B ratings (acute aquatic toxicity) of "4" and higher ($\leq 1 \text{ mg l}^{-1}$) started several years ago. Nearly 100 substances have been reviewed to date.

4.8 It was further noted that there were many hundreds of types of vegetable and animal oils and derivatives, and that the GESAMP data files generally contained insufficient environmental data on

these products. Industry has been requested by the Bulk Liquids & Gases Sub-Committee of IMO to provide data on these products to the GESAMP Working Group in order to allow evaluation of the hazard profiles. The Working Group considered that the best approach was for industry to group the substances on the basis of comparable composition and to present them for initial review. Following this initial review of the data the Working Group would make a recommendation as to the provision of the appropriate environmental data.

GESAMP composite list database of hazard profiles

4.9 The database containing the data covering approximately 2200 substances of the Composite List was handed over to IMO for the purposes of maintenance and updating, having previously been developed and maintained by the University of Trondheim, Norway. The Group was informed that the re-design of the database as a piece of up-to-date software was underway. Making provision for internet access to the database was discussed and considered as an attractive option for the future.

4.10 GESAMP approved the revised hazard evaluation procedures for publication as GESAMP Report and Studies No. 64. It further requested the Working Group to continue its activities in evaluating the hazards of chemicals. A summary table reflecting the revised environmental criteria and the Terms of Reference of the Working Group are set out in Annex VI.

5. ENVIRONMENTAL IMPACTS OF COASTAL AQUACULTURE (Working Group 31)

5.1 The FAO Technical Secretary of GESAMP reported that the Working Group met in Bangkok Thailand, from 1-5th December 1997. The Working Group prepared the document "Integration of Aquaculture into Coastal Management" (GESAMP XXVIII/5 and XXVIII/5.1). The document was presented to the present session of GESAMP for discussion and comments.

5.2 In introducing the document, John Hambrey (Chair of the Working Group), described the process by which the report had been drafted and commended the hard work of the other group members in assimilating an enormous range of information. He then reviewed some of the key points in the document and solicited comments from GESAMP members on specific issues.

5.3 In particular he drew attention to the classification of different types of coastal management and to the different models or frameworks for approaching integrated coastal management (ICM). He noted that in reviewing experience the Working Group had found rather few examples of successful integration of aquaculture into comprehensive integrated coastal management. However, there are several good examples of "enhanced sectoral management" which follow the basic principles of ICM. Important lessons are that any attempt at planning and management of aquaculture should be participatory, iterative and adaptive. In reviewing the section on specific planning and management tools, it was noted that there was an emphasis on zoning and environmental capacity, and rather less on socio-economic aspects. This was justified on the basis that much has been written elsewhere on the socio-economic issues, and these apply to all forms of coastal development. Zoning and environmental capacity on the other hand can be discussed specifically in relation to the particular features of aquaculture. It was noted that the recommendations were written rather rapidly with limited input from the group as a whole, and further comments would be welcome.

5.4 The GESAMP members generally felt that the document was thorough and useful, but were concerned on several counts. Firstly, the tone of the document was rather negative in relation to integrated coastal management. It was questioned as to whether ICM was really so complex, costly and

difficult. Although full integration may be difficult, much more effective co-ordination is quite possible, and the philosophy of ICM may be applied to many of the individual components. There was also concern about the overall structure of the report, and the target audience. As it stands, it was neither a full review, nor did it contain guidelines.

5.5 The following more specific points were also raised:

- (i) there should be more emphasis on assessing aquaculture as only one of many possible options - for example, what is the trade off with mangrove destruction or conservation?;
- (ii) there was a need to strengthen the rationale for integration - and indeed the rationale for aquaculture development itself;
- (iii) more guidance on procedures - i.e. how does one actually go about assessing aquaculture within a wider coastal management framework was needed;
- (iv) all stakeholders - not just resource users should be considered;
- (v) section 3.6.5 (GESAMP XXVIII/5) on "markets and labelling" is important and might be strengthened by reference to other issues of quality standards for international trade;
- (vi) section 4 is rather weak and might be incorporated in a more succinct form elsewhere;
- (vii) increased attention should be paid to effective editing before presentation of the report to GESAMP.

These points were noted, and fully accepted/agreed, by the Working Group Chairman and the Working Group members present. Members agreed to provide more detailed comments in writing.

5.6 The structure, scope and target of Document GESAMP XXVIII/5 was then discussed in more detail. Most GESAMP members felt that the core of the Document should comprise guidelines addressed to policy makers and higher level decision makers, to the governments and the aquaculture sector, supported by a more detailed presentation of the tools available, and their scientific basis, targeted at a broader audience, including practitioners of aquaculture and coastal management, and scientists involved in the field.

5.7 During the session a draft conceptual summary of the proposed document was presented and agreed to in principle by the GESAMP members (see Annex VII).

6. ESTIMATES OF OIL ENTERING THE MARINE ENVIRONMENT FROM SEA-BASED ACTIVITIES

6.1 The Technical Secretary of IMO introduced this topic, recalling that the Marine Environment Protection Committee (MEPC) of IMO at its 35th session in 1994 had requested GESAMP to evaluate all available data sources of input of oil into the marine environment from sea-based activities, i.e., those related to shipping and offshore activities, and to develop approaches that might in future be used for the provision of input data.

6.2 The first meeting of the GESAMP Working Group was held in London in November 1997. A description of this meeting and its outcome was provided by the Chairman of the Working Group (GESAMP-XXVIII/6). He described in detail the proposed Terms of Reference and scope of the Working Group's task, and the progress made at the meeting on 6 topics - transportation sources, exploration and production, coastal refineries, reception facilities, waste material dumped at sea and natural seeps. The Working Group has initiated discussion of the topics, collection of relevant data and consideration of specific topics, e.g., uncertainties around estimates of oil volumes delivered by tankers.

6.3 The report solicited the following major comments for consideration by the Working Group, others were also noted and will be considered. These are not in order of priority:

(i) The work of the Working Group is primarily a scoping exercise for estimating inputs, not necessarily a definitive exercise;

(ii) As part of the context of the study, consideration should be made of the institutional framework in which the study is conducted and to which the study provides data, analysis and insight, i.e. the MARPOL 73/78 Convention. A broad view of the topic of oil releases to the sea was valuable for public understanding and an examination of institutional arrangements at a range of levels. Mechanisms for conducting the evaluation of inputs comprehensively should be made;

(iii) It is very important to make estimates of the uncertainties of input quantities (e.g., tanker cargos losses, size of spills) at the start of the project. Data sources will be evaluated and an approach for making input estimates should be developed, taking these uncertainties into account;

(iv) The long-term data requirements for the task of estimating inputs should be determined during the project. The location and arrangements of data storage and access should be considered at an early stage;

(v) There was an important geographic aspect to the task, hence it is worth considering developing a GIS in support of the project. This would allow an analysis of the distribution, size and trends of oil inputs around the globe;

(vi) Natural oil seeps should be considered by the Working Group, although they are not strictly "an activity". Seeps can contribute substantial amounts of oil to the sea, their presence is often being confused with ship-based sources, and their relative importance may vary geographically;

(vii) Other sources of oil or hydrocarbon inputs to the sea, such as those from land-based activities and from aviation should be mentioned for context but not evaluated in detail.

6.4 GESAMP approved the Terms of Reference as recommended by the Working Group. They are set out in Annex VIII.

7. MATTERS OF PARTICULAR CONCERN REGARDING DEGRADATION OF THE MARINE ENVIRONMENT

7.1 This topic is considered by the Group during each session as part of its regular agenda. For 1998, the International Year of the Ocean provides additional justification for addressing emerging or urgent issues. The agenda item opened with short submissions on "Matters of particular concern" that had been made by GESAMP members prior to, or during, this session. Each contribution was then discussed to clarify the basis on which they were being proposed as topics of concern and to resolve any immediate questions. It was noted that there was a great deal of commonality among the outputs of these discussions and the biennial assessment report that GESAMP commenced recently.

7.2 Following the presentations and clarifications, the Group embarked on a broad-ranging discussion of priorities and urgent issues contained in the various contributions. It became evident rather quickly that there was a widespread conviction that there were two issues of general concern that might justify statements from GESAMP addressed to two different and distinct audiences. These were as follows:

- (i) A statement addressed to the policy and management community dealing with the inadequate attention which is being paid to long-term marine surveillance and monitoring (Annex IX). This should stress that the shortcomings of contemporary surveillance activities will continue to prejudice the ability to determine trends in the condition of the marine environment and, therefore, to evaluate the effectiveness of measures undertaken to protect it.
- (ii) A statement addressed to a broader, more general audience in an attempt to promote a more balanced public appreciation of the diverse human activities that may result in damage or risks of damage to the marine environment (Annex X). This statement would attempt to place "pollution" associated with the introduction of substances into the marine environment in balanced context with other activities such as coastal infrastructure development, tourism, fishing and mineral resource extraction, and their consequences, in terms of prejudice to the oceans, their resources and amenities.

7.3 The GESAMP Intersecretariat will undertake to finalize the distribute these documents as appropriate. Annex X will be circulated through the GESAMP home page on the world wide web site being planned by IMO, as a pamphlet, and will be made available to the UN General Assembly via appropriate mechanisms. Annex IX will also be made available to the UN General Assembly and relevant monitoring bodies such as the Global Ocean Observing System (GOOS). However, both of these documents will be circulated to GESAMP members and Technical Secretaries for approval before final release.

8. OTHER MATTERS

8.1 GESAMP was informed that the GEF Coordinating Unit asked the attention of GESAMP be brought to the intention to prepare a GEF "B" grant proposal on assessment of Persistent Toxic Substances (i.e., Persistent Organic Pollutants - (POPs) with the purpose to:

- (i) demonstrate the transboundary nature and importance of persistent toxic substances;
- (ii) analyse the nature and comparative importance of the major transport mechanisms;
- (iii) identify by economic sector and sub-sector, the major sources resulting in the production and emission of substances of concern;
- (iv) characterize the nature of exposure to humans and the potential risks arising there from;
- (v) identify and quantify the ecological implications of persistent toxic substances in the environment;
- (vi) analyse the socio-economic implications of the risks and problems; and
- (vii) identify, where possible, less harmful alternative chemicals and alternative practices and management methods that reduce the risks posed by such chemicals.

8.2 The execution of this study, if approved, will require participation by a broad range of experts with, hopefully, some expertise drawn from GESAMP and/or its working groups. Cooperation with GESAMP and coordination of respective related activities would be welcome.

8.3 A GESAMP member pointed out that in July 1998 the negotiations on a global agreement under UNEP on POP's would start in Montreal, Canada and that it would be based on an Agreement planned to be finalized in 1998 under UN/ECE/LRTAP. This agreement considers all the aspects mentioned in the GEF proposal and consequently there was large scope for cooperation and synergy between the two processes.

9. FUTURE WORK PROGRAMME

9.1 Environmental impacts from sea-bed exploration and exploitation

The Technical Secretaries of IMO and UNESCO-IOC tabled a proposal for future work on the above issue (GESAMP XXVIII/8). Noting that the International Sea-bed Authority has very recently set up a small working group on the same issue, the GESAMP Intersecretariat recommended that the outcome of the Sea-bed Authority Working Group should be awaited before a decision concerning the future involvement of GESAMP on this issue could be reached. The IMO and IOC will inform GESAMP at its next session in 1999 on the state of this development. In the meantime, any comments would be welcome. The IMO Secretariat further undertook to evaluate the possibility of including the potential impact of exploitation and exploration activities in relation to hydrocarbons in increasingly deeper sea areas.

9.2 Intersessional work

Taking into account the above considerations, GESAMP noted the intersessional work planned, as follows:

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

Lead Agency:	IMO
Co-sponsor:	UNEP
Chair:	T. Bowmer
Member:	P. Wells

The next meeting of the working group will be held from 1 to 5 February 1999.

2. Marine environmental assessments (Working Group 26)

Lead Agency:	UNEP
Co-sponsors:	IMO, FAO, UNESCO-IOC, WMO, WHO, IAEA, UN
Chair:	S. Keckes
Members:	M. Bewers, R. Boelens, S. Charmasson, R. Duce, D. Elder, R. Engler, M. Huber, D. Insull, H. Yap

Subject to the availability of adequate financial support, the Working Group plans to finalize the drafts of the Biennial and LBA reports for consideration by GESAMP XXIX. Members of GESAMP and the Technical Secretaries were invited to provide in writing their comments on the drafts considered at present sessions to the Chairman of the Working Group by the end of May 1998. Pending the development of GIWA project, no work is planned on the SOME report during the forthcoming intersessional period.

The schedule of meetings has tentatively been set as follows:

one meeting in November 1998; and
one meeting in March 1999

3. Environmental impacts of coastal aquaculture (Working Group 31)

Lead Agency:	FAO
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Co-sponsors: UNEP, UNESCO-IOC, WHO, and with support of IUCN
Chair: J. Hambrey
Members: P. Menasveta, Ong Jin-Eong

The next meeting will held in Bangkok, Thailand in Spring 1999

4. Estimates of oil entering the marine environment from sea-based activities
(Working Group 32)

Lead Agency: IMO
Co-sponsor: UNESCO-IOC*
Chair: P. Wells

A meeting will be convened from 5 to 8 May 1998, another meeting is planned to be held in late 1998.

5. Endocrine disrupting substances in the marine environment: impacts on marine life and human health (Working Group 27)

Lead Agency: IMO
Co-sponsors: WHO*, FAO, UNEP*
Chairman: P. Wells

10. DATE AND PLACE OF NEXT SESSION

10.1 GESAMP noted that its twenty-ninth session would be hosted by the International Maritime Organization at the IMO Headquarters in London, UK, and agreed that it would be held from 23 to 27 August 1999.

10.2 On behalf of the Group the Administrative Secretary expressed appreciation to WMO for having arranged the twenty-eighth session of GESAMP in an outstanding manner.

11. ELECTION OF CHAIRPERSONS

11.1 GESAMP unanimously elected Mr P. Wells as Chairman and Mr R. Duce as Vice-Chairman for the next intersessional period and the twenty-ninth session of GESAMP.

11.2 The meeting unanimously expressed its gratitude to the outgoing chairperson Ms H. Yap for her outstanding service to the Group during her term of chairmanship.

12. REPORT OF THE TWENTY-EIGHTH SESSION

12.1 The report of the twenty-eighth session of GESAMP was considered and adopted by the Group on the last day of the session. It contains in Annexes IV-VIII summaries of draft reports prepared by GESAMP Working Groups and their updated Terms of Reference. The summaries are included for information and were not considered by the Group with a view of their approval.

12.2 The twenty-eighth session was closed by the Chairman at 16:30 on 24 April 1998.

* pending agreement of the Headquarters

AGENDA

1. Adoption of the agenda
2. Report of the Administrative Secretary
3. Marine environmental assessments:
 - 1 consideration of a draft biennial assessment report: the state of the marine environment - current major issues and emerging problems;
 - 2 consideration of a draft report on land-based sources and activities affecting the quality and uses of marine, coastal and associated freshwater environments;
 - 3 review of preparations for a global report on the state of the marine environment
4. Evaluation of the hazards of harmful substances carried by ships
5. Environmental impacts of coastal aquaculture
6. Estimates of oil entering the marine environment from sea-based activities
7. Matters of particular concern regarding degradation of the marine environment
8. Other matters
9. Future work programme
10. Date and place of next session
11. Election of Chairpersons
12. Report of GESAMP XXVIII

Annex II

LIST OF DOCUMENTS

Agenda	Document	Submitted by	Title
1.	GESAMPXXVIII/1	Admin. Sec.	Provisional agenda
3.	GESAMPXXVIII/3/1	UNEP	The state of the marine environment-current major issues and emerging problems
	GESAMPXXVIII/3/2	UNEP	Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environment
4.	GESAMPXXVIII/4	IMO	The evaluation of the hazards of harmful substances carried by ships
5.	GESAMPXXVIII/5	FAO	Integration of aquaculture into coastal management
	GESAMPXXVIII/5.1	FAO	Appendix to "Integration of..."
6.	GESAMPXXVIII/6	IMO	Estimates of oil entering the marine environment from sea-based activities
7.	GESAMPXXVIII/7	Chairman	Consideration of matters of particular concern for the future
8.	GESAMPXXVIII/8	IOC, IMO	Future work programme – proposal for future work regarding "environmental impacts of sea-bed exploration and exploitation"

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MARINE ENVIRONMENTAL ASSESSMENTS - MEA
Considerations of the MEA Working Group as related to preparation of the
Biennial and LBA Reports

The MEA Working Group was charged at GESAMP XXVII to prepare three reviews of the state of the marine environment:

- (i) The state of the marine environment - current major issues and emerging problems (Biennial Report);
- (ii) Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environment (LBA Report); and
- (iii) The state of the marine environment (SOME Report).

The impact of land-based activities of the marine, coastal and associated freshwater environment is the issue of primary focus during the current activities of the Working Group. The major pressures on the oceans and their ecosystems stem from population growth, urbanization, industry, agriculture, fisheries, transport, energy production and tourism among which land-based activities are the most important.

The Working Group has taken the view that for the immediate tasks of the Biennial and LBA Reports, both of which are planned for completion in 1999, issues relating to the degradation of the marine environment fall into two major categories:

- (a) long-standing or recurring issues that have been long perceived include eutrophication; threats associated with the introduction of non-indigenous species; the status of fisheries; contaminants in the ocean; and the consequences of military activities; and
- (b) emerging issues in the sense that they have been recently perceived or appreciated, are currently provoking concern at various levels, or which relate to adverse effects or threats of an extent which have been previously underappreciated. Such issues include increased atmospheric nitrogen influxes to the ocean; the exploration and development of mineral resources beyond the continental shelves, deep water fisheries; new classes of marine contaminants and toxins; input and accumulation of persistent organic compounds; coral bleaching and diseases; the ocean as a potential carbon repository; enhanced UVB and its effects on the marine environment and other climate change effects.

**THE STATE OF THE MARINE ENVIRONMENT
CURRENT MAJOR ISSUES AND EMERGING PROBLEMS**
(revised layout of the biennial report)

1. INTRODUCTION
2. OVERALL ASSESSMENT
 - Pressure and their effects
 - Changing perspectives^{/1}
 - Need for action
 - Major steps reflecting the increased global concerns for the marine environment
 - Problem areas
3. ISSUE IN FOCUS: IMPACT OF LAND-BASED ACTIVITIES
4. PERSISTENT PROBLEMS
 - Status of fisheries
 - Aquaculture as source of environmental problems
 - Threats from introduction of alien species
 - Impact of trade on marine resources
 - Oil in coastal regions
 - Effects of military activities
 - Eutrophication
5. EMERGING ISSUES
 - Deep sea accumulation of persistent organics
 - New classes of marine contaminants and toxins
 - New threats to human health
 - Ocean as potential carbon repository
 - Exploration and development of mineral resources^{/2}
 - Consequences of scientific interventions
 - Deep-water fisheries
 - Coral bleaching and diseases
 - UV in the marine environment
 - Genetically modified organisms
6. IMPLICATIONS FOR SCIENCE, MANAGEMENT AND POLICY^{/3}
 - Shifts in direction and scope of ocean related-studies
 - Science as the rational basis for ocean management
 - Reducing uncertainties
 - Minimizing risk
 - Support from science to policy initiatives
7. RECOMMENDATIONS

ANNEX: GESAMP AND THE PREPARATION OF THE PRESENT REPORT

REVISED GESAMP HAZARD EVALUATION PROCEDURE

1. Introduction

1.1 In the early 1970's, the International Maritime Organization (IMO) turned to GESAMP for advice in determining the hazards posed by chemicals carried by ships, when released into the sea, either in the form of tank washings from chemical tankers, or due to accidental spillages. The subsequent methods developed by GESAMP were approved by the International Conference on Marine Pollution in 1973, and incorporated in to the International Conference for the Prevention of Pollution from Ships (MARPOL 73/78). The hazard evaluation procedure adopted in 1973 is still being used by the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships (EHS) which, since its establishment in 1974, has met thirty-four times to evaluate new chemicals and to revise previous assessments in the light of new data. Nearly 2200 substances have been evaluated to date, including liquids intended for bulk carriage on chemical tankers (Marpol 73/78 Annex II) and many other substances which are transported as packaged goods (Marpol 73/78, Annex III).

1.2 The results of the environmental hazard evaluation of a given substance are laid down in hazard profiles, i.e. a fingerprint allowing detailed scientific data on the intrinsic properties of a chemical substance to be widely published, without breaching the manufacturers requirement for confidentiality. These are published (bi) annually by IMO in the form of the composite list of GESAMP hazard profiles and are used by IMO to assign chemicals to pollution categories. The hazard profiles do not take exposure conditions and probabilities of release into the environment into account, i.e., considerations essential for a full environmental risk assessment of accidental spillages or intentional discharges.

1.3 In 1992 the United Nations Conference on Environment and Development (UNCED) through Agenda 21, Chapter 19, "Environmentally Sound Management of Toxic Chemicals, including prevention of Illegal, International Traffic in Toxic and Dangerous Products" established a programme concerned with "harmonization of classification and labelling of chemicals. In 1995, relevant international organizations in this field established the Inter-Organization Programme for the Sound Management of Chemicals (IOMC). This Programme requested OECD to act as a clearing-house for the harmonization process. The findings of the relevant OECD working groups on the classification of hazard, in particular to the **aquatic environment**, have been followed closely and taken into account throughout the revision of the GESAMP hazard evaluation procedure.

2. A revised hazard profile

2.1 In the early 1990s the Marine Environment Protection Committee (MEPC) of IMO began to review MARPOL 73/78, Annex II, which regulates the control of pollution by noxious liquid substances carried by ships. At the same time, environmental groups and some administrations requested that the hazard evaluation procedure, developed more than twenty years previously, should include additional criteria, e.g. physical characteristics, chemical persistence, chronic toxicity and biodegradation. It was also the opinion of many GESAMP scientists involved in the hazard evaluation of chemicals that the system was in need of review in order to take account of major advances in environmental sciences in the intervening years.

2.2 The familiar five columns of the original hazard profile (A to E) have been divided into 14 sub-columns to separate the underlying information and make it clearer to the reader; with two exceptions (E2 & E3), each sub-column represents one environmental or human health parameter or “effect” category. The revised hazard profile consists of the following data columns:

COLUMN	ENVIRONMENTAL PARAMETERS
Biaccumulation and biodegradation A1A A1B A2	log Pow BCF Ready biodegradability
Aquatic toxicity B1 B2	Acute aquatic toxicity (Sub) Chronic aquatic toxicity
Acute mammalian toxicity C1 C2 C3	Peroral Percutaneous Inhalation
Skin & eye irritation and corrosion; specific health concerns D1 D2 D3	Skin irritation & corrosivity Eye irritation & corrosivity Specific health concerns (details contained in remarks column)
Interference with other uses of the sea E1 E2 E3	Tainting of seafood Effects on wildlife and bottom habitats (behaviour in seawater based on solubility, vapour pressure, specific gravity & viscosity) Interferences with coastal amenities (e.g. necessity of closing beaches due to physical hazard, specific health concerns, etc, related to the substance)
F	Remarks column

3. Terms of Reference of the Working Group

To examine and evaluate available data and to provide such other advice as maybe requested, particularly by IMO, for evaluating the environmental hazards by harmful substances carried by ships, in accordance with the rationale approved by GESAMP for these purposes.

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PLANNING FOR SUSTAINABLE COASTAL AQUACULTURE DEVELOPMENT
(A conceptual summary of the report being prepared by the Working Group on
Environmental Impacts of Coastal Aquaculture)

1. Coastal aquaculture has a long and well established tradition in many parts of the world, especially in Asia. It has great potential for the production of food, alleviation of poverty and generation of wealth for people living in coastal areas, many of whom are among the poorest in the world. Despite this, aquaculture often falls short of its development potential, and is sometimes associated with social and environmental problems.
2. In many ways aquaculture is a classic example of why more integrated coastal management is needed. Aquaculture may be seriously affected by water quality and habitat degradation caused by other activities. It may itself affect environmental quality and the interests of other users through conversion of natural habitat; through pollution of recipient waters with nutrients, organic substances, and hazardous chemicals; and through the spread of disease. Poorly sited or planned aquaculture may result in negative feed-back and self pollution. Resource ownership or rights allocation, and related administration, is often complex or ambiguous in prime aquaculture locations. This set of documents aims to meet a range of needs related to these issues.
3. Part 1 (Guidelines for Planning of Sustainable Coastal Aquaculture) provides policy makers and higher level decision makers with a set of guidelines and general principles to meet the challenge of sustainable coastal aquaculture development through broader policy initiatives.
4. Part 2 (Planning and Management Tools for Coastal Aquaculture) provides more detailed technical information on the various tools available to implement these guidelines in practice. This is targeted at project managers, government agencies, commercial and producer organisations, and others directly involved in coastal aquaculture development.
5. Part 3 (Case Studies in Coastal Aquaculture) presents a range of examples of the planning and management of aquaculture development in practice, from tropical and temperate regions throughout the world, and ranging from limited sectoral approaches to comprehensive integrated coastal management. These case studies provide a detailed insight into the success or failure of different approaches to aquaculture development planning in a wide range of physical, ecological and development contexts, and serve as the underpinning for the general principles presented in Part 1. They will be of interest to professionals involved in coastal management, and will be of particular value to trainers and teachers of coastal management.
6. Several core principles are emphasised in Part 1. Integration or co-ordination is essential: with other sector activities or plans; with national sector plans; and with wider coastal management initiatives where these exist.
7. Participation and consultation of all stakeholders should be a key principle in policy development and objective setting.
8. A thorough assessment of costs and benefits (financial, economic, social, environmental) of aquaculture development, and alternative resource uses in a specific area, is also required.

9. An assessment of the capacity of the environment - preferably for a specific coastal, estuarine or lagoon system - to assimilate organic matter, nutrients and chemicals from aquaculture activities is highly desirable.
10. In order to cope with the complexity and subjectivity of more integrated planning, participatory, iterative and adaptive approaches should be used, both with respect to the overall planning exercise, and with respect to specific tools or procedures used during plan development and implementation. This will promote "ownership"; help to focus information collection; and allow for the steady refinement and adaptation of management tools.
11. The use of financial and economic incentives and regulations, whether these derive from markets, fiscal measures, or the provision of infrastructure, should be used in preference to regulation wherever possible;
12. Emphasis on the control of effects, rather than the scale of activity is important. This should stimulate more environmentally friendly technology and management, rather than limit production *per se*;
13. Appropriate institutions, including resource user representative organisations, must be identified or created: to promote integration and co-ordination; to ensure effective implementation of planning measures; and to allow for effective monitoring and feedback.
14. A framework is also presented in Part 1 to facilitate the application of these principles in practice. This is based mainly on the concepts associated with integrated coastal management. The main tools for implementing these concepts, and their specific application to aquaculture, are briefly introduced. They include tools and techniques for institution building and issues identification; consultative and participatory techniques; the assessment and description of natural and human resources; social and environmental impact assessment; comparative economics; decision making; zoning; environmental capacity assessment; and a variety of approaches to the implementation of plans, including economic, regulatory, market, and voluntary approaches. These tools, and their application in practice, and are described in more detail in Part 2.
15. The processes involved in applying these principles and deploying appropriate techniques is also briefly described, with particular emphasis on institutional needs, monitoring and feedback.

Terms of Reference of Working Group 31

The following tasks for future work of Working Group 31 were recommended by GESAMP XXIII:

1. the establishment of scientifically based monitoring requirements and procedures for aquaculture pollutants leading to the assessment of the environmental capacity of existing and planned coastal aquaculture operations (published as Rep. Stud. GESAMP No. 57);
2. the preparation of review and guidance documentation for the safe use of chemicals in coastal aquaculture (published as Rep. Stud. GESAMP No. 65); and
3. review of concepts and experiences related to the integration of aquaculture into coastal management (dealt with in this study).

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Annex VIII

ESTIMATES OF OIL ENTERING THE MARINE ENVIRONMENT FROM SEA-BASED ACTIVITIES (Working Group 32) Amended Terms of Reference

The Working Group recommended its Terms of Reference, which were approved by GESAMP, as follows:

1. to estimate current annual amounts of oil entering the marine environment from sea-based activities, taking into account that:
 - 1.1 "oil" would be defined as in MARPOL 73/78, Annex I (see annex 2 to this report);
 - 1.2 sea-based activities would include all forms of shipping, especially in oil tankers and carriers, other commercial and non-commercial ships, as well as transportation through marine pipelines. They would further include offshore and coastal exploration and production, atmospheric emissions from such sea-based activities, coastal refineries and storage facilities, oil contaminated material disposed of at sea, and natural marine oil seeps;
 - 1.3 the annual input estimates would consider both historical and extant data, methods for deriving those estimates and associated uncertainties; and
 - 1.4 the annual input estimates would consider the amounts of oil entering the sea through operational discharges and accidental spillages in relation to quantities transported by ships, through pipelines, etc., or in relation to offshore and coastal oil exploitation, and related industrial operations.
2. to focus particularly on improving the estimates of oil entering the marine environment from transportation sources, as one test of the efficacy of the MARPOL 73/78 Convention, and other conventions where appropriate, pertaining to the prevention of marine pollution from oil, and the safety of life at sea.

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Annex IX

SURVEILLANCE AND ASSESSMENT OF MARINE ENVIRONMENTAL CONDITIONS

In a synopsis of current problems facing the world's oceans and the progress made in addressing them, the report of GESAMP's XXVIIIth session notes that, despite some localised successes, degradation of the oceans continues on a global scale. Persistent problems include pollution by sewage (especially pathogens), chemicals and nutrients as well as unrestrained coastal development and over-exploitation of marine resources. On the other hand, concerted action at national and international levels has reduced the quantities of oil discharged from ships and there is convincing evidence that in certain areas better management of land-based activities has led to cleaner beaches and bathing water and seafood that is safer to eat. Nevertheless, accurate information on trends with respect to specific qualities and conditions in different sea areas is difficult to obtain. Clearly, a continuing shortage of scientific information will impede understanding of changing conditions, the priorities for action and the effectiveness of protection measures introduced to date.

If strategies for marine environmental protection are to be effective, ongoing surveillance to detect trends, especially trends that carry threats for marine life and/or human health, is imperative. It is equally important that the results of scientific measurements are compiled and assessed on a regular basis for the benefit of managers, policy-makers, scientists and relevant national and international bodies. These assessments, which are primary sources of information on the success or failure of protection measures, should also evaluate relationships between the observed environmental conditions and prevailing social and economic circumstances.

GESAMP, in responding to requests for periodic reviews on the state of the oceans, depends to a significant extent on assessments prepared within the frameworks of regional agreements on marine environmental protection to provide material for such reviews. However, experience shows that many regions have difficulties in preparing such assessments and that the reports produced differ considerably with respect to the scope and detail of information provided. This severely restricts GESAMP in its efforts to provide factual and up-to-date summaries of marine environmental quality in different sea areas and to present balanced and accurate assessments of conditions worldwide. For this reason, in 1994 GESAMP prepared guidelines for the conduct of marine environmental assessments (Reports & Studies No.54) explaining the purpose and value of these reports and encouraging a standard approach to their scope and content that would improve their comparability. Unfortunately, recently issued reports (UNEP, 1997/98) focusing on the effects of land-based activities in most cases lacked sufficient information on how conditions had changed since the regions last reported in 1990. It is not known whether this reflects a shortage of scientific data or the lack of appropriate mechanisms for the compilation and review of such data.

Clearly, there are important questions to be answered regarding the adequacy of regional marine surveillance programmes, the kinds of information they generate and the reasons why environmental data are apparently not available for assessment purposes. It would also be useful to know why GESAMP's guidance on the conduct of assessments is not being applied within UNEP's regional seas programmes.

Whatever the underlying causes, the shortage of information on marine environmental conditions and trends is a serious matter which, in the opinion of GESAMP, outweighs in

importance many of the issues currently being addressed by those responsible for marine environmental protection. It needs to be recognised that selective long-term monitoring is vital for trend assessment. For some important environmental variables, periods of several decades or more may be required to detect trends with any degree of reliability. Thus, the sooner measurements begin, the sooner trends will be apparent. Similarly, improved records of trends in human uses of the marine environment, i.e., coastal demography, resource use, growth rates in fishing, tourism, marine transport etc., on appropriate geographic and temporal scales, will allow governments to take account of changing anthropogenic pressures when attempting to interpret environmental trends.

Should it emerge that countries or regions require assistance with the design and implementation of surveillance programmes, international agencies and their respective scientific advisory bodies could provide such assistance and mechanisms to facilitate this should be found as quickly as possible. The Global Ocean Observing System (GOOS) is preparing for such long-term operational observation programmes as part of an Integrated Global Observing Strategy.

In summary:

- Many reports on the state of the marine environment in particular regions of the world have failed to provide sufficient scientific information for a proper analysis of problems and priorities or the assessment of trends in specific environmental conditions. It is not known whether this reflects misunderstanding of the importance of trend measurements, a lack of appropriate scientific data or an absence of mechanisms for compiling and reviewing such data.
- This deficiency impedes efforts to evaluate the effectiveness of existing policies and measures for marine environmental protection and to identify needs for further initiatives.
- Concerted efforts are urgently required to improve surveillance of marine environmental trends and conditions and to facilitate the preparation of regular, harmonised regional assessments. Such assessments need to include reliable and detailed information on trends and conditions that have particular relevance for marine life and ecology, human health and the social and economic welfare of coastal communities.

OCEANS AT RISK ?

Degradation of the oceans continues on a global scale, despite progress made during the last three decades in some places and on some issues. This impedes development and diminishes human welfare. A fundamental solution to many of the sea's environmental problems lies in scientifically informed management that integrates the range of uses of the marine environment to ensure that their benefits are sustained. Such management regimes, when effectively implemented, have produced concrete benefits for society and the environment, but they have not been widely applied. This is largely due to a lack of informed constituencies, appropriate institutional structures, and political will.

1. *The Problems: Pollution in Context*

Changing circumstances, better information, and a broader global perspective have given us a much better appreciation of the comparative threats posed by different human activities. Where marine environmental concerns once centered on pollution, we now recognise that pollution is neither the only nor necessarily the most severe threat to the health of oceans and coasts.

1.1 Marine Pollution

Several decades ago a series of incidents gave global prominence to the problem of marine pollution. After tracing a crippling, sometimes fatal, disease in Japan to industrial mercury discharges, scientists discovered that even in the open ocean large fishes sometimes contained high levels of mercury. The crash of certain seabird populations was found to result from widespread pesticide pollution. Major spills in the United States and Europe focused public attention on the problem of oil pollution. Many other marine pollution issues have since been raised.

Pollution control initiatives have focused on regulating pollution sources, banning the use of certain chemicals, such as PCB's, and prohibiting the ocean disposal of entire categories of waste including industrial waste and radioactive materials. Most countries have also entered into agreements for regional and global marine environmental protection measures.

1.1.1 Successes. These measures, when applied and enforced, have often succeeded in curbing marine pollution. Reducing lead in automobile fuel, for example, has led to lower levels of lead in ocean surface waters, especially in the North Atlantic. International maritime regulations have greatly reduced operational discharges of oil from ships. Many localities have controlled their sewage and industrial discharges, giving them safer seafood and bathing waters, cleaner beaches, and healthier coastal habitats. Seabird populations decimated by pesticides have made dramatic recoveries, and in some places levels of contamination in marine life have fallen. Stringent controls on discharges and bans on atmospheric testing and ocean disposal of radioactive waste have reduced radionuclide contamination of the marine environment.

1.1.2 Continuing pollution problems. Nonetheless, pollution continues to damage the marine environment. Despite gains in some regions, sewage is still a major problem, especially when it includes industrial wastes. In some countries, particularly developing ones, sewage is the single largest source of coastal contamination. Many contaminant chemicals are inadequately regulated, and the regulations that exist are frequently violated. New chemicals are produced faster than their

environmental risks can be assessed. Some, such as those that disrupt animal hormone systems, may result in long-term effects on marine organisms that are as yet poorly understood. Marine litter continues to be a problem.

The threats to the ocean posed by land-based activities including agriculture, forestry, coastal construction, urban development, and tourism are sometimes overlooked. Such activities are major sources of plant nutrients and sediments, which are not widely recognized outside of scientific circles as major threats to the health of marine and coastal environments. They are also sources of more widely publicised contaminants such as pesticides and oil.

1.1.3 Improved scientific perspective. Sometimes new information has allayed concerns. Mercury in large oceanic fish, for example, was found to come mostly from natural sources. More importantly, improved scientific knowledge has allowed us to evaluate the relative threats posed by different pollutants. We now recognise, for example, that sewage discharge and the runoff of nutrients, sediments, and pesticides present greater risks to human health and the marine environment than radioactivity and heavy metals, given existing controls.

1.2 Other Activities that Threaten the Marine Environment

Better understanding also enables us to place marine pollution in the broader context of the range of human activities. As severe as pollution may be, the routine modification and exploitation of marine and coastal environments, and the widespread habitat damage and loss that result, probably pose even greater threats.

1.2.1. Coastal development. We are increasingly a coastal species. Some 44% of the world's population lives within 150 km of the coast - more people than inhabited the entire planet in 1950. Mass migration to the coasts will continue in the decades ahead. This population growth is concentrated in large coastal cities.

Coastal population growth and the activities that accompany it not only increase pollution, they radically alter coastlines. Clearing, land reclamation, and channelisation of flood and tidal waters destroy coastal wetlands. Port development, road building, coastal construction, and the mining of beach sand for construction material obliterate shoreline habitats. These activities often increase coastal erosion and damage habitats, such as seagrass beds and coral reefs, away from the development site. In some countries, mining of coral reefs has destroyed them. Exotic species introduced with ships' ballast water and by other means threaten human health, marine ecosystems, and fisheries.

Coastal and marine tourism is one of the largest and fastest-growing sectors of the global economy. Like other forms of development, tourism brings population pressure and physical changes. The impacts can be especially severe, however, because developers often build tourist facilities too close to the water and other attractions. Areas attractive for tourism are often highly vulnerable. Visitor numbers frequently exceed the carrying capacity of the environment, for example water supplies, available space, and the ability of habitats to absorb visitor impacts and provide an enjoyable experience. Coastal erosion, pollution, habitat destruction, and social decay are common consequences. Tourist boats, curio collectors, reef walkers, snorkelers, and scuba divers have damaged coral reefs in many tropical countries. Operators may even destroy ecologically important habitats including seagrass beds, mangroves, and wetlands that they consider unattractive to tourists. On the other hand, in a market that is increasingly aware of environmental

issues and demands pristine habitats, tourism can create strong economic incentives for, and subsidise the cost of, effective environmental management.

Mariculture, the farming of shellfish and finfish, can contribute to coastal degradation by destroying habitats and producing waste. Shrimp culture in particular has often led to the indiscriminate destruction of mangrove forests. This practice has declined, but persists in several countries.

Both at the coast and in upstream catchment areas, water is diverted for power generation, urban and industrial development, and irrigation. This alteration of freshwater flows can result in increased coastal erosion, the loss of critical habitat, salt intrusion, and other environmental problems.

1.2.2. Over-exploitation of renewable resources. Coastal population growth and development bring not only the direct physical destruction of coastal habitats, but enormous pressure on renewable resources. Increased demand for fish, and often more fishers, has led to the over-exploitation, often severe, of most coastal fisheries. Industrial fishing fleets have heavily exploited stocks farther offshore, and the majority of the world's fishery stocks are now fully or over-exploited.

Associated with over-fishing are problems of by-catch and destructive fishing methods. The total global by-catch, the incidental harvest of non-target organisms, is some 29 million tonnes, about a third as much as the global marine catch. Largely in response to public concern, by-catch of seabirds, marine mammals and turtles has been significantly reduced, though it still occurs. Of greater concern now, perhaps, is the mass by-catch mortality of less charismatic but ecologically important marine organisms, including the juveniles of many commercially important species. Destructive techniques ranging from the small-scale use of explosives and poisons to inappropriate industrial gears and methods destroy the very habitats and stocks that support the industry.

Over-exploitation is not limited to fisheries. Large commercial enterprises destroy mangroves and other coastal forests, for example, on a massive scale. In many countries these forests are also cut down by poor people seeking farm land, timber, and firewood. Much of the world's mangrove forest has been lost, and the loss continues at a worrying pace.

2. *Why Should We Care?*

We should care about the continuing environmental degradation of our oceans and coastal areas because it is detrimental to human health, economic development, and our planet's store of biodiversity.

2.1 Human Health

The contamination of seafood and seawater with harmful microorganisms and chemicals is an important cause of disease in many coastal communities. There is growing concern that eutrophication - algal growth in response to elevated nutrient input - may be causing increases in toxic or otherwise harmful phytoplankton blooms on a global scale.

2.2 Economic Costs

Marine environmental degradation often results from short-term economic considerations, but at great long-term cost. Degraded fisheries mean lower catches and lost revenue. Investment in excess fishing capacity to harvest a declining catch, often driven by politically expedient subsidies, costs tens of billions of dollars annually. Seafood contamination reduces the value of many catches, or even renders them worthless. Coastal erosion, flooding, saltwater intrusion, and other consequences of short-sighted coastal development impose high costs in damages and mitigation. Habitat degradation threatens tourism in many countries, sometimes at the hands of the tourist industry itself. Alleviating the poverty and disease that result from environmental degradation also imposes costs upon society.

2.3 Food Security

Poverty is the primary threat to food security, and economic losses due to marine environmental degradation engender poverty. Beyond this, reduced catches resulting from overfishing, habitat destruction, and pollution threaten the food security of coastal populations that depend upon seafood for dietary protein. These are often the poorest of coastal people, with few alternatives. Seafood contamination is another threat to global food security.

2.4 Loss of Ecosystem Functions and Services

Coastal and marine habitats also provide indirect benefits such as filtering nutrients and sediment, detoxifying certain contaminants, and providing barriers to storm damage and coastal erosion. Wetlands and coral reefs are critically important as spawning and nursery grounds for valuable finfish and shellfish species. Marine and coastal environments also have great aesthetic and recreational value, and support much of the planet's biodiversity. These and other intrinsic services are worth some \$20 trillion annually, more than the entire global GDP.

3. What can we do?

Scientists believe that many answers to the oceans' environmental problems lie in expanded public environmental awareness and integrated, sustainable management based on sound scientific information.

3.1 Examples of Management Successes

A quarter century ago, Jacques Cousteau predicted the imminent demise of his beloved Mediterranean Sea. Had nothing changed, he may have been right. The United Nations, however, in partnership with countries bordering the Sea, adopted an aggressive plan - the Mediterranean Action Plan. While acute problems remain and continuing action is needed, the severe overall degradation of the Mediterranean that Cousteau predicted has been averted, or at least postponed. Similar action has led to marked environmental improvement in Chesapeake Bay and other large estuaries. Improved environmental quality in the Thames River in England, Boston Harbor in the United States, and Xiamen Harbor in China show that determined, coordinated action can produce benefits even in large urban areas, where development and population pressures are concentrated.

Such successes are not confined to the industrialised world. In Namibia, for example, innovative management measures appropriate to local circumstances have enhanced the

sustainability of the hake fishery and its economic benefits. Coastal communities on Apo Island in the Philippines have established marine reserves, leading to better catches for local fishers.

3.2 A Constituency for the Oceans

A common feature of these success stories is the existence of a constituency that is aware of the issues and committed to a collaborative *process* of solving environmental problems. Building this constituency requires clear communication and sharing of information among governments, industry, the international community, scientists, and most importantly the public. New technologies increasingly empower individuals and organisations to inform themselves and express their views, if they wish to do so.

3.3 Governance, Institutions, and Political Will

Unfortunately, the implementation of sound sustainable management of oceans and coasts remains the exception rather than the rule. Sometimes critical scientific information is lacking, or it is available but poorly communicated and not used. Without a clear understanding of the sources, severity, and distribution of environmental problems it is impossible to make wise, realistic policy decisions.

Governance issues are a more common barrier. Successful coastal management requires integrated, collaborative action by national and regional agencies, the participation of local citizens and industry, and even agreements among nations. When, as often happens, this collaboration is viewed as an infringement of institutional or national sovereignty, rational environmental management suffers. Even when collaborative agreements exist there may be little will to implement them.

While the resolution of these issues is neither simple nor easy, in most cases the nature of the ocean's environmental problems is understood, the knowledge needed to solve them is available, and the necessary management tools exist. What is lacking is the determination and political will to act. The active involvement of an aware, informed citizenry can be a powerful force for change on behalf of the oceans.

GESAMP can provide in-depth, authoritative, scientific analysis of the state of marine and coastal environments, of the relative threats posed by various human activities, and of the management options available to address these threats and rectify past damage. GESAMP welcomes increased dialogue with governments, non-governmental organisations, and the public in order to foster improved measures to protect the oceans for contemporary society and future generations.

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