

UNITED NATIONS
NEW YORK

UNITED NATIONS
ENVIRONMENT
PROGRAMME
NAIROBI

FOOD AND
AGRICULTURE
ORGANIZATION
OF THE UNITED
NATIONS
ROME

UNITED NATIONS
EDUCATIONAL
SCIENTIFIC AND
CULTURAL
ORGANIZATION
PARIS

WORLD HEALTH
ORGANIZATION
GENEVA

WORLD
METEOROLOGICAL
ORGANIZATION
GENEVA

INTERNATIONAL
MARITIME
ORGANIZATION
LONDON

INTERNATIONAL
ATOMIC ENERGY
AGENCY
VIENNA



**IMO/FAO/UNESCO/WMO/IAEA/UN/UNEP
JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS
OF MARINE ENVIRONMENTAL PROTECTION
- GESAMP -**

REPORTS AND STUDIES

No. 51

1993

**REPORT OF THE TWENTY-THIRD SESSION
LONDON, 19-23 APRIL 1993**



INTERNATIONAL MARITIME ORGANIZATION

86# 7-5-37

Reports and Studies No.51

IMO/FAO/Unesco/WMO/WHO/IAEA/UNEP Joint Group of Experts on the
Scientific Aspects of Marine Environmental Protection (GESAMP)

REPORT OF THE TWENTY-THIRD SESSION

London, 19-23 April 1993

IMO 1993

NOTES

- 1 GESAMP is an advisory body consisting of specialized experts nominated by the Sponsoring Agencies (IMO, FAO, Unesco, WMO, WHO, IAEA, UN, UNEP). Its principal task is to provide scientific advice concerning the prevention, reduction and control of the degradation of the marine environment to the Sponsoring Agencies and to the Intergovernmental Oceanographic Commission (IOC).
- 2 This report is available in English, French, Russian and Spanish from any of the Sponsoring Agencies.
- 3 The report contains views expressed by members of GESAMP who act in their individual capacities; their views may not necessarily correspond with those of the Sponsoring Agencies.
- 4 Permission may be granted by any one of the Sponsoring Agencies for the report to be wholly or partly reproduced in publications by any individual who is not a staff member of a Sponsoring Agency of GESAMP, or by any organization that is not a sponsor of GESAMP, provided that the source of the extract and the condition mentioned in 3 above are indicated.

* * *

For bibliographic purposes, this document should be cited as:

GESAMP - IMO/FAO/Unesco/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP): Report of the Twenty-third Session. London 19-23 April 1993. Rep. Stud. GESAMP No.51, 41pp.

CONTENTS

	Page no.
1 Introduction	1
2 Review of the mandate of GESAMP	1
3 Impacts of anthropogenically mobilized sediments in the coastal environment	6
4 Evaluation of the hazards of harmful substances carried by ships	7
5 Indicators of marine ecosystem health	8
6 Environmental impacts of coastal aquaculture	9
7 Sea surface microlayer	10
8 Future work programme	12
9 Other matters	16
9.1 Disposal of radioactive wastes into Arctic Seas	16
9.2 The "Braer" incident	17
9.3 Collapse of the ecosystem of the Black Sea	17
9.4 Other issues that may warrant further consideration	18
10 Date and place of next session	18
11 Election of Chairman and Vice-Chairman	19
12 Consideration and approval of the report of the twenty-third session	19

ANNEXES

I Agenda	20
II List of documents	21
III List of participants	23
IV Summary of the report of the Working Group on the Impacts of Anthropogenically Mobilized Sediments in the Coastal Environment	30
V Summary of the reports of the 27th and 28th meetings of the Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships	32
VI Summary of the report of the first meeting of the Working Group on Indicators of Marine Ecosystem Health	36
VII Proposal for the establishment of the GESAMP Working Group on Sea-Surface Microlayer	39

GESAMP XXIII
(19-23 April 1993)

1 INTRODUCTION

1.1 The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) held its twenty-third session at the Headquarters of the International Maritime Organization (IMO), under the chairmanship of Mr. J. Gray. Mr. O. Osibanjo was Vice-Chairman of the Group.

Opening of the session

1.2 Mr. O. Khalimonov, Administrative Secretary of GESAMP and Director of the Marine Environment Division of IMO, on behalf of the Secretary-General of IMO, welcomed the Group to this session. Mr. Khalimonov emphasized the importance of the Group as a multidisciplinary and independent advisory scientific body. Since its establishment in 1969 the Organization has benefited from the work of GESAMP, in particular with regard to the development of scientific bases for regulating maritime transport of oil and other hazardous substances, and the disposal at sea of wastes and other matter. Mr. Khalimonov noted further that many of the recommendations of Agenda 21 of the United Nations Conference on Environment and Development (UNCED) convened in 1992, have a direct bearing on the future work of all the sponsoring agencies of GESAMP and that the role of GESAMP as their advisory body on marine pollution aspects would have to be reviewed accordingly. Finally, Mr. Khalimonov wished the Group every success during this session.

1.3 The Chairman thanked Mr. Khalimonov on behalf of the participants for his good wishes for the success of this session.

Adoption of the agenda

1.4 The agenda for this session as adopted by the Group is reproduced in Annex I. The list of documents considered at the session is given in Annex II. The list of participants is shown in Annex III.

2 REVIEW OF THE MANDATE OF GESAMP

Introduction

2.1 GESAMP was established in 1969 with a view to providing scientific advice on marine pollution problems to the Sponsoring Agencies. The terms of reference for the Group as established in 1969 and amended in 1977 are as follows:

- (a) to provide advice relating to the scientific aspects of marine pollution:
 - (i) to the Sponsoring Organizations and to the Intergovernmental Oceanographic Commission (IOC) on specific questions referred to it;
 - (ii) to the other organizations of the UN system and to member states of the UN organizations on particular problems referred to it through a Sponsoring Organization; and
 - (iii) to the executive heads of one or more of the Sponsoring Organizations on such other specific questions within the competence of the Joint Group which may be put to it;

- (b) to prepare periodic reviews of the state of the marine environment as regards marine pollution and to identify problem areas requiring special attention.

2.2 For several years GESAMP has recognized that management deficiencies, and not necessarily the limitations of science, are responsible for the continued degradation of marine and coastal environments. It has further pointed out that part of the problem was the way in which science was interpreted and applied for management purposes. Accordingly, the Group, when discussing the large variety of different subjects related to human activities in coastal areas, repeatedly raised questions as to the relationship between fundamental scientific findings and environmental protection and management generally and with integrated coastal zone management specifically. In this connection, the Group agreed that direct linkages between scientific research results and management decisions are essential.

2.3 The need of the Sponsoring Agencies for advice on management-related scientific issues makes it necessary to review the future role of GESAMP, particularly in light of the outcome of the United Nations Conference on Environment and Development (UNCED).

2.4 GESAMP recalled its earlier discussions on the future of GESAMP (GESAMP Reports and Studies No.49, report of the 22nd session, paragraph 10.3) and it noted that there had been a number of important developments since that time. In particular, Agenda 21 of UNCED contained specific recommendations for the acquisition and application of scientific advice for marine environmental protection. It also strongly endorsed science-based management of the marine environment. The Chairman and several members of GESAMP had corresponded intersessionally to develop proposals on how the Group might evolve in response to changing needs and circumstances. The informal papers resulting from this correspondence were provided to GESAMP by the IMO Technical Secretary (GESAMP XXIII/2).

2.5 The Group was informed that a meeting of the Inter-Secretariat for GESAMP, convened in advance of this session, had considered the above developments and had accepted that a broadening of the scope of GESAMP would now be appropriate and it decided on a change in the title of GESAMP - replacing the word "Pollution" in the title of the Group by the words "environmental Protection". It was noted that this change, by itself, did not necessarily imply any substantive alteration in the primary mandate of GESAMP. There were, however, clear implications for its composition (i.e., specialties represented among its members) and the nature and scope of its products.

Request by the sponsoring agencies

2.6 The Group was asked to consider its terms of reference in the light of the proposed change in scope and title. It was also asked to consider the utility of a definition or explanation of the word "protection". Finally, it was asked to examine UNCED Agenda 21, in particular its Chapters 17 and 35, to determine tasks to which GESAMP could make an important contribution to assist the UN agencies in follow-up activities to the Conference.

Conclusions of the Group's deliberations

2.7 The Group felt that its experience and competence with respect to complex scientific problems would be a solid point of departure to new challenges in marine environmental management and associated socio-economic issues. In this sense, the Group acknowledged the need for re-direction of its tasks and deliberations within new terms of reference.

2.8 GESAMP agreed to the change of its name from the "Group of Experts on the Scientific Aspects of Marine Pollution" to the "Group of Experts on the Scientific Aspects of Marine environmental Protection". However, it believed that it would be useful, and perhaps essential, to provide some explanation of the meaning of the word "protection" in this context. Such an explanation would enable the users of GESAMP Reports and Studies to comprehend the scope within which the Group operates.

2.9 Based on the wording of paragraph 17.22 of Agenda 21, the Group concluded that "protection", specifically marine environmental protection for the purposes of GESAMP, requires the acquisition and application of scientific knowledge to the prevention, reduction and control of the degradation of the marine environment to sustain its life support systems, resources and amenities.

2.10 The Group also agreed to propose slight amendments of its Terms of Reference by deletion of references to pollution in section (b). The Terms of Reference of the Group then would become:

- (a) to provide advice relating to the scientific aspects of marine environmental protection:
 - (i) to the sponsoring organizations and to the Intergovernmental Oceanographic Commission (IOC) on specific questions referred to it;
 - (ii) to the other organizations of the UN system and to Member States of the UN organizations on particular problems referred to it through a sponsoring organization; and
 - (iii) to the Executive Heads of one or more of the sponsoring organizations on such other specific questions within the competence of the Joint Group which may be put to it;
- (b) to prepare periodic reviews and assessments of the state of the marine environment and to identify problems and areas requiring special attention.

2.11 Accordingly, the primary role of GESAMP would be to provide scientific advice on the protection of the marine environment, as specified above, and to devise and conduct periodic reviews and assessments of the state of the marine environment.

2.12 The Group then examined the provisions and recommendations of UNCED Agenda 21, particularly Chapters 17 and 35, to determine the nature and extent of GESAMP activities that might usefully contribute to the process of implementing UNCED recommendations.

2.13 Chapter 17 of Agenda 21 of UNCED on "Protection of the Ocean, All Kinds of Seas, including Enclosed and Semi-enclosed Seas, and Coastal Areas and the Prevention, Rational Use and Development of their Living Resources" identifies seven programme areas, and associated objectives and activities, that have both explicit and implicit requirements for scientifically-based management action. The Group noted that topics such as hazard and risk assessment, uncertainties related to contaminant effects and climate change, identification of critical habitats, design of systematic approaches to measuring marine environmental quality (including causes and effects of marine degradation), development of predictive tools and environmental quality criteria, and "state of the environment" reporting had been, and should continue to be, major components of GESAMP's work programme.

2.14 Chapter 35 entitled "Science for Sustainable Development" specifies four scientific programme areas which harmonize with the conclusions and recommendations of the International Conference on

the Agenda for Science for Environment and Development into the 21st Century (ASCEND 21). These are:

- (a) Strengthening the scientific basis for sustainable management;
- (b) Enhancing scientific understanding;
- (c) Improving long-term scientific assessment; and
- (d) Building up scientific capacity and capability.

2.15 The descriptions of the above programme areas, particularly the first three, contain objectives and activities that are directly relevant to GESAMP's interests and responsibilities both in the context of its historical mandate and any revision of its mandate and direction.

Potential topics for specific future activities of GESAMP

2.16 The following list of topics derived from Agenda 21 is given as an illustration of issues that could be addressed by GESAMP. This list represents a selection of issues on which GESAMP could potentially make a significant contribution. These topics are categorized under four major headings comparable with those in Agenda 21.

Sustainable development of coastal areas

- a) the scientific basis for the application of preventive and precautionary approaches in project planning and implementation, including prior assessment and systematic observation of the impacts of major projects;
- b) the development of methods for environmental accounting of coastal and marine areas in relation to pollution, marine erosion, loss of resources and habitat destruction;
- c) determination of criteria for the identification of critical areas for preparation of coastal profiles;
- d) development of scientifically sound recommendations and methodologies for preparing contingency plans for climate change effects in coastal zones, and for effects of degradation and pollution including oil spills;
- e) the scientific basis for conservation and restoration of altered critical habitats;
- f) development of environmental indicators for the coastal zone;
- g) development of a format for regular environmental assessments of the coastal zone;
- h) assessments of inputs from terrigenous and atmospheric sources.

Evaluation of risks and conduct of environmental assessments

- a) the scientific basis for local, national and regional monitoring programmes, water quality criteria and standards for sewage and other effluent discharges, including atmospheric inputs;

- b) development of criteria for risk and environmental impact assessments;
- c) development of guidelines for assessing the state of eutrophication of coastal areas and the need for remedial action;
- d) devising guidelines for the systematic observation of marine environmental quality;
- e) hazard assessments of chemical substances carried by ships.

Sustainable use and conservation of marine living resources

- a) scientific criteria for the assessment of the potential for sustainable aquaculture in marine and coastal areas;
- b) development of monitoring and assessment programmes for marine ecosystems for areas of high biodiversity and/or critical habitats.

Critical uncertainties

- a) advising on the scientific utility of observation programmes for coastal and near-shore phenomena related to climate change;
- b) contributing to the development of globally accepted methodologies for assessment of coastal vulnerability and response strategies to climate change;
- c) assessing the scientific needs and programme necessary to study effects of ultraviolet radiation on marine biological systems;
- d) organization of periodic review and assessments of status and trends in oceans and all seas and coastal areas;
- e) assessment of the systematic observations that are necessary to measure the role of the oceans as sources and sinks of carbon and other substances.

2.17 It was evident that two of the most important elements of a revised mandate for GESAMP would be to increase the relevance and utility of GESAMP's advice for management purposes and, to the extent possible, to tailor this advice to the needs of countries and regions where the conditions and problems addressed were most acute.

2.18 Under the new mandate, GESAMP's activities will fall into two broad categories:

- a) evaluations of specific scientific issues, processes, and methodologies relevant to management actions for the protection of the marine environment; and
- b) periodic reviews and assessments of the state of the marine environment.

2.19 As regards (a) above, GESAMP firmly believed that preservation of independence and scientific integrity and the retention of its current expertise to compile, synthesize and review the science relevant to the identified topics were paramount. However, additional expertise would be needed to enable GESAMP to prepare advice on policy and managerial options taking into account technological and socio-economic factors.

2.20 As regards the preparation of reviews and assessments, GESAMP recalled the continuing difficulties in obtaining comparable data and information from all regions and the associated problems of data relevance and quality. It was clearly necessary to develop guidance on the design and content of marine environmental reviews and assessments in order to facilitate global scale comparison and interpretation. GESAMP is well-suited to this task and, bearing in mind that much of the necessary advice already existed, should be able to respond quickly to any request from the Sponsoring Organizations to prepare the guidance required.

2.21 In summary, the Group is of the opinion that, subject to an appropriate level of support, there are no substantive reasons why the GESAMP framework for preparing scientific advice cannot be adapted to meet the requirements of the UN Sponsoring Organizations for advice in relation to the implementation of Agenda 21 that is more directly relevant and useful to the management and protection of the marine environment.

3 IMPACTS OF ANTHROPOGENICALLY MOBILIZED SEDIMENTS IN THE COASTAL ENVIRONMENT

3.1 The Unesco Technical Secretary recalled that the Working Group on the Impacts of Anthropogenically Mobilized Sediments in the Coastal Environment had been established by a decision of GESAMP XIX in Athens in 1989 and that a first report of the Working Group (the so-called Penang report) produced under its Chairman, Mr. J. Gray, had been discussed during the twenty-second session of GESAMP.

3.2 As a result, new terms of reference were defined and approval was given for an additional meeting of the Working Group to allow for a holistic view of the problem, to take into account land-based activities in the watershed and the harmful effects of decreased sediment input to coastal areas due to anthropogenic activities.

3.3 These terms of reference were used by the Working Group meeting held in Savannah, USA, from 11 to 15 January 1993 under the chairmanship of Mr. H. Windom, who introduced the report of the meeting. He explained that a group of five experts had contributed to producing the report based on their personal experiences and a vast literature review and that the report of the Penang meeting had provided useful insights, particularly on related regional problems and issues. He added that the title of the report, "Anthropogenic influences on sediment discharge to the coastal zone and environmental consequences" accurately reflects the contents of the report which derived from the new terms of reference.

3.4 The Group expressed its view that the report represented an example of how science can provide a basis for formulating rational management decisions. The Group recommended that the report would benefit from the addition of an Executive Summary which should emphasize that its application goes beyond marine environmental protection to issues relating to deforestation, watershed management and environmental management in small islands.

3.5 The Group approved the document for publication under the GESAMP Reports and Studies series following acceptance by the Chairman of the Working Group to integrate in the final version of the report comments made by the Group at this session. The report will be published as Reports and Studies No.52. A summary and outline is shown in Annex IV.

3.6 With regard to the report of the Working Group considered at GESAMP XXII entitled "The Impacts of Anthropogenically Mobilized Sediments in the Coastal Environment" (Penang Report)

which contained, in particular, information on the biological effects of anthropogenically mobilized sediments in coastal areas, the Group agreed that an editorial group, including the Chairman of GESAMP, should review the relevant sections of the report and that after due consideration during GESAMP XXIV this could then be published as an addendum to the final report GESAMP Reports and Studies No.52.

4 EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS

4.1 The IMO Technical Secretary informed GESAMP that the twenty-seventh and the twenty-eighth sessions of the Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships had been held during the intersessional period. The results of the Working Group are being used by a number of IMO bodies in developing requirements for the maritime transport of individual hazardous substances and for operational discharges of their residues at sea, as well as in considerations related to liability and compensation for hazardous and noxious substances in cases of accidental damages to property or the environment. The IMO Technical Secretary then provided a summary of the main achievements made by the Working Group during its recent sessions as outlined in its session reports (GESAMP XXIII/4).

4.2 The Chairman of the Working Group, Mr. P.G. Wells, drew attention to the following issues considered by his Group:

- .1 Copper-based antifouling paints are increasingly used to replace organotin-based paints and the Working Group upon request by IMO has started to consider the hazards related to the release of copper and copper-compounds from such paints into the marine environment. A number of national institutions are currently carrying out relevant laboratory tests and the Working Group had received some data for evaluation. Additional information will be submitted to the Working Group during the next intersessional period for evaluation at its twenty-ninth session in February 1994.
- .2 In the absence of data from tests to identify the potential of many chemicals to taint seafood, the Working Group considered methods on how to evaluate tainting thresholds of substances by using known or calculated sensory detection thresholds of chemicals in water and air. In this connection, the Working Group estimated tainting properties of aliphatic ketones, and these were in good agreement with values derived from tainting tests. The procedure also worked well for straight chain alkanes. Sensory detection thresholds in water of alkyl benzenes were also predicted, but in this case there was no good agreement with the few values that were available.
- .3 Due to varying compositions of mixtures transported under the name "White Spirits", a wide range of hazards could be presented. The Working Group agreed to collect information from industry on the composition of mixtures actually transported under the common name "White Spirits" and to evaluate separately the hazards of groups of "White Spirits" mixtures.
- .4 No evidence could be found that there would be damage to marine organisms caused by the bioaccumulation of fluoride compounds. The respective hazard profiles were revised accordingly.
- .5 It was agreed to pay more attention to substances of low acute toxicity, low volatility and high viscosity which, after release from chemical tankers, may float on the sea

surface, affecting coastlines and damaging wildlife. They therefore need to be regulated. The hazards of these substances, including many of vegetable and animal origin, will be evaluated in the near future.

- .6 The hazard assessment procedure and working methodologies as currently contained in GESAMP Reports and Studies No.35 will be reviewed and updated, including more detailed advice on laboratory testing methodologies and reporting methods.
- .7 In response to a proposal made by GESAMP at its twenty-second session in March 1992, the Working Group will establish a new category 5 in the toxicity ratings, viz. "extremely toxic", i.e. with 96hr LC50 of less than 0.01 mg/l; the existing category 4 will be modified accordingly.

4.3 The Group endorsed the reports of the twenty-seventh and twenty-eighth meetings of its Working Group for the Evaluation of the Hazards of Harmful Substances Carried by Ships and, in particular, approved the hazard profiles that had been reviewed or established during the intersessional period.

4.4 The Group welcomed the progress of work achieved as outlined above. With regard to the methodologies developed for the identification of the potential of chemicals to taint seafood (paragraph 4.2.2 above), the Group suggested that in cases where data on new products were submitted for evaluation by the Group, the chemical manufacturer should be requested to include physical data necessary for the estimation of tainting properties, i.e. vapour pressure, solubility, air/water partition coefficient, and octanol/water partition coefficient.

4.5 With regard to the evaluation of copper-based antifouling paints (paragraph 4.2.1 above), members of GESAMP undertook to submit any information or new test data that becomes available to them, to the IMO Technical Secretary.

4.6 The Chairman of the Working Group noted that Mr. Paul Jeffery and Mr. Roy Blackman, who had been involved in the work of the Group for many years, had asked to be released from their duties. The Group expressed appreciation for their outstanding work and wished them luck and success in the future.

4.7 A summary of the above intersessional reports is shown in Annex V.

5 INDICATORS OF MARINE ECOSYSTEM HEALTH

5.1 The UNEP Technical Secretary recalled the discussion on this item which took place at the twenty-second session. At that session it was agreed to establish a working group which should focus on biological responses that are detectable in relation to environmental change, emphasizing their potential and limitations. He stressed the importance of the outcome of this working group for the UNEP's Regional Seas Programme and Earthwatch.

5.2 Outlining the achievements of the first meeting of a task force that was held in Geneva at the UNEP Regional Office for Europe from 23 to 27 November 1992, the UNEP Technical Secretary underlined the importance of the ecosystem approach in order to assess large scale effects and to compare the health of different ecosystems.

5.3 The Chairman of the Working Group, Mr. John Gray, introduced a document (GESAMP XXIII/5) which had been prepared at the Geneva meeting, by a task force of six scientists.

He explained that the document was only an outline and much work needed to be done on the detail by a working group.

5.4 Members of GESAMP commented on the above document "Indicators of marine ecosystem health". Their comments and suggestions were as follows:

- .1 The document is well structured. The final version of the document should not be much longer than the preliminary one.
- .2 The section of the report relating to chemical analyses and bioassays needs substantial redrafting.
- .3 The contents of the section concerned with procedures to correlate physico-chemical environmental variables to the pattern in structures of assemblages of organizations needs redrafting.
- .4 The report should reflect relations between natural variability and anthropogenically introduced variability.
- .5 In the introduction, the interpretation of the mandate of the Working Group and definitions should be included, in particular the term "marine ecosystem health" should be discussed. Similarly, relations of this report to international programmes and Agenda 21 of UNCED should be added.
- .7 Under Global Scale Indicators, it was pointed out that some local indicators can be used to assess the health of ecosystems on the global scale. The report should consider such indicators and redraft this section accordingly, perhaps deleting the present aspects.

5.5 The Group noted that substantial progress has been made by the Working Group and recommended that it should convene during the intersessional period in order to finalize the report for submission to the next session of GESAMP for approval. Some additional expertise will be required to cover gaps identified in the report.

5.6 The Group emphasized that a good working relationship with the Oslo and Paris Commissions should be established, taking into account similar activities carried out by these Commissions and their well advanced monitoring programmes. The IMO Secretariat undertook to inform them accordingly.

5.7 A summary of the report prepared by the task force is shown in Annex VI.

6 ENVIRONMENTAL IMPACTS OF COASTAL AQUACULTURE

6.1 In the absence of Mr. Chua Thia-Eng, Chairman of the Working Group on Environmental Impacts of Coastal Aquaculture, the FAO Technical Secretary informed the Group of the current situation. Heavy workload and additional commitments by the Chairman and other Working Group members resulted in little progress made since the twenty-second session of GESAMP. However, several high-priority issues, requiring urgent expert advice, have been emphasized by the active

Working Group members in consultation with the FAO Technical Secretariat. The following tasks were strongly recommended for future work of this Working Group:

- .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;
- .2 the preparation of review and guidance documentation for the safe use of chemicals in coastal aquaculture; and
- .3 the review of concepts and experiences related to the integration of aquaculture into coastal area management schemes.

6.2 It was suggested that the Working Group should first concentrate its efforts on the preparation of a report on the requirements and procedures for the monitoring of coastal aquaculture pollutants. This report would be discussed and finalized during a Working Group meeting to be convened in January/February 1994. The Working Group would, however, continue to compile and review relevant information on other priority issues, in particular on above items .2 and .3 which would need to be discussed at that Working Group meeting.

6.3 GESAMP agreed to the activities proposed above by the FAO Technical Secretary.

7 SEA SURFACE MICROLAYER

7.1 The WMO Technical Secretary introduced a proposal to establish a Working Group on the Sea-Surface Microlayer (GESAMP XXIII/7). He recalled that at its twenty-second session the Group had expressed concern about the surface microlayer as a source of contaminant accumulation, its modification and significance for biological processes and air/sea exchanges. In line with this concern a meeting of an ad hoc group of experts chaired by Mr. R. Duce was convened by WMO to determine whether an in-depth review was warranted, and if so, to determine the scope, objectives and nature of such a review. The opinion of the ad hoc group was that there was a real need for an in-depth review of physical, biological and chemical processes that occur at the sea-surface microlayer and their relevance to global change and effect on the marine environment and its living resources; it accordingly proposed that this work should be carried out by a GESAMP Working Group.

7.2 The scientific justification for the proposed study had been prepared by Mr. J. Hardy, a member of the ad hoc group, (summarized in Annex VII to this report). Mr. Hardy explained in some detail what is known and what is not known about the biology of the microlayer:

- .1 microbiological studies indicate that microlayers are generally greatly enriched in the abundance (density) of microorganisms compared with subsurface water. A few studies suggest high biochemical activity in surface films. However, the effects of this microbial activity on air-sea exchange rates of radiatively important gases or other materials is unknown;
- .2 phytoneuston (microalgae) of many species occur in high densities compared with phytoplankton in most ocean areas examined. A few studies have shown higher rates of photosynthetic carbon fixation in microlayers compared with subsurface water. Blooms of neustonic *Trichodesmium* (possibly fixing atmospheric N₂) are common in the tropics. However, the overall regional or global importance of phytoneuston on CO₂ (or other gas) exchange from the atmosphere to the ocean is not known.

Furthermore, the effects of ultraviolet radiation or microlayer contamination on phytoneuston is unknown; and

- .3 with regard to ichthyoneuston, many pelagic fish species of commercial importance have floating egg and/or larval stages, that develop in contact with the microlayer. Experience in the laboratories has shown that contaminated microlayers can have toxic effects on fish embryos and larvae. Also, a few studies have shown that neustonic fish embryos, collected in surface skimming nets, from contaminated areas, have a higher incidence of chromosome abnormalities compared with those from less contaminated areas. However, the effects of microlayer contamination on fisheries recruitment at the population level remain unknown.

7.3 Mr. P. Liss, another member of the ad hoc group, commented that from multidisciplinary perspectives the time was now opportune for establishing the proposed Working Group. For example, there is evidence that the lower temperature of the sea-surface microlayer compared with the bulk water can lead to a significant increase in our estimates of the ability of the oceans to take up atmospheric carbon dioxide. Further, the current controversy over the magnitude of the transfer rate for gas exchange across the sea-surface may be resolved by the existence of specific catalysts for carbon dioxide transfer occurring at enhanced concentrations in the microlayer.

7.4 In the discussion following presentation of the proposal, GESAMP members raised a number of additional issues which should be considered. Specifically, relevant information should be gathered and evaluated regarding the following:

- .1 temporal and spatial variability of chemical and biological enrichment in the microlayer;
- .2 intercomparability of microlayer samples collected by different investigators using different techniques;
- .3 the actual exposure hazard in situ of indigenous neuston species to microlayer contamination;
- .4 quantitative estimates of how natural microlayers alter air-sea transfer compared with models which do not include a microlayer;
- .5 biology and chemistry of surface layers in freshwater environments;
- .6 exposure of aquatic surface layer communities to ultraviolet-B radiation and its implications for global change;
- .7 the horizontal transport of surface slicks and their deposition in coastal zones; and
- .8 physico-chemical data on the behaviour of micelles and data on engineering flotation processes.

7.5 In general, it was agreed that the work should be broadly scoped, include information on the aquatic surface layer with regard to both air-sea exchange and living marine resources and assess how each of these might be altered by human activities.

7.6 After detailed discussion of the proposal and the clarifications thereto, GESAMP decided to establish a Working Group on the Sea-Surface Microlayer with the following terms of reference:

To prepare a report on current understanding of the physics, chemistry and biology of the sea-surface microlayer with particular reference to its role in global environmental changes and as a marine habitat, including:

- .1 a review of physical processes in the microlayer and their relation to changes in heat, momentum and mass exchange;
- .2 a critical assessment of interaction of the biology and chemistry (including radiochemistry) in the microlayer including reference to the effects on living marine resources;
- .3 a quantitative consideration of the effects of the sea-surface microlayer on air/sea exchange of gases;
- .4 an assessment of the effects of solar radiation and photochemical reactions on the chemistry and biology of the microlayer; and
- .5 an evaluation of existing and potential new techniques for investigating the surface layer of the ocean.

8 FUTURE WORK PROGRAMME

The ecosystem of the Black Sea

8.1 The UNEP Technical Secretary recalled the concern of the Group expressed at its twenty-second session on the state of the Black Sea. Further information regarding a devastation of the ecosystem of the Black Sea is reflected in section 9 of this report. The UNEP Technical Secretary requested that a small Task Force be established to study causes that might have led to changes in the ecosystem, in particular those caused by the population explosion of a ctenophora species.

8.2 The Group agreed that work should be carried out by a small group of experts under the following terms of reference:

- .1 To assess the probable causes of the ctenophore outbreaks and their connection with other destabilizing factors and developments;
- .2 To assess the reproductive biology and physiological features of the intruder ctenophore, its ability to compete for food with pelagic fish, and control of its population by predators in its natural habitat;
- .3 To develop a strategy, and to recommend measures, to overcome the ctenophore and similar invasions, using the Black Sea as an example.

Guidance for the design of assessments of marine environmental conditions

8.3 Several members of the Group proposed that intersessional work be carried out with a view to preparing guidance on the design and conduct of assessments of marine environmental conditions. The background, rationale, purpose and terms of reference as proposed to the Group are reflected below.

Background

8.4 Periodic assessments of the condition of marine environments at regional and sub-regional levels are required by many international agreements established for the protection of the marine environment. Experience has shown that the quality and value of these assessments may be seriously restricted by a paucity of relevant and reliable data that are amenable to comparison and interpretation and by a lack of uniformity in the assessments themselves.

8.5 The timetable for review of the implementation of Agenda 21 makes it necessary to consider the preparation of status reports on the condition of regional sea areas within the next three to four year period. With this in mind, and taking into account the Group's experience in conducting global assessments as well as a knowledge of previous assessments at regional level, there is an urgent need for a uniform approach to both the design and conduct of scientific investigations that generate data for assessment purposes. A case for the involvement of GESAMP in the preparation of guidance that would facilitate improvements in the quality and uniformity of marine environmental assessments is presented as follows.

Rationale

8.6 Marine environmental assessments require physical, chemical and biological information from all environmental compartments and must include evaluations of spatial and temporal variability. The measurements required are sometimes complex and often demanding in terms of time and resources. Thus, the choice of variables to be measured, the locations, frequencies and methods of measurement must be linked to clearly-defined objectives and must yield data that are amenable to interpretation.

8.7 The reliability and precision of data must always be known. Otherwise it may not be possible to compare data sets, to ascertain spatial distributions or to elucidate temporal trends. Quality assurance specifications are accordingly essential.

8.8 Data interpretation is strongly dependent on signal:noise ratios and the requirement for the detection of significant variability in environmental terms. For these reason, considerable care is needed in the selection of variables to be measured. Not all environmental variables thought to be of relevance or interest will be amenable to measurements that are useful for either scientific or management purposes.

8.9 The international scientific community has begun to develop detailed guidance on the design and conduct of assessments that reflects up-to-date scientific knowledge, methodologies and capabilities. However, most of this guidance has so far been directed at assessment activities in specific marine regions. GESAMP should recognize that the time is opportune to develop guidance for global application.