GESAMP:
Two Decades of Accomplishments

Herbert L. Windom

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NOTE

This review of GESAMP's origin, working methods and accomplishments during the more than twenty years of its existence (1969-1990) was prepared by Dr. Herbert Windom, Chairman of GESAMP from 1989 to 1990.

The views expressed are those of the author and do not necessarily reflect the views of the Sponsoring Organizations of the IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP).

Additional information on various GESAMP activities can be made available by the Administrative Secretary and the Technical Secretaries of GESAMP.

For additional copies of this publication write to:

The Administrative Secretary of GESAMP
Marine Environment Division
International Maritime Organization
4 Albert Embankment
London SE1 7SR
United Kingdom

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INTRODUCTION

The importance of the oceans has recently received considerable international attention regarding their role in global climate change. The environmental significance of the oceans, however, clearly goes beyond their role in regulating global climate. The oceans serve man in many ways: the living and non-living resources of the oceans are exploited by virtually every maritime nation; international commerce depends on the oceans as routes for the transport of goods; the shorelines of oceans provide centres for human recreation; and the unique plant and animal communities, many not yet discovered or understood, provide the substance which stimulates the human imagination and intellect.

Many of the uses of the oceans by society may lead potentially to the degradation of the marine environment. Human activities on land lead to the inadvertent or deliberate input of contaminants to the oceans which also may result in marine environmental degradation on local, regional or global scales.

Potential impacts on the marine environment of human activities on land and the potential conflicts of society's utilization of the oceans require ongoing global evaluation from a multidisciplinary scientific perspective. This has been recognized for some time by the community of United Nations organizations, eight of which jointly sponsor an interdisciplinary group of scientists to provide independent advice on existing and potential marine pollution problems. This Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) was formed two decades ago to serve as a mechanism for encouraging coordination, collaboration and harmonization of activities related to marine pollution of common interest to the co-sponsoring bodies. More recently, GESAMP has expanded its programme to include consideration of the impacts of other human activities, such as coastal development, on the marine environment.

The purpose of this booklet is to briefly describe what GESAMP is, how it operates and what it accomplishes.

WHAT IS GESAMP?

GESAMP is a multidisciplinary body of independent experts that provides advice to Sponsoring Organizations, at their request, on pollution and other problems that face marine and coastal environments. For the purpose of its earliest deliberations, GESAMP defined marine pollution as **the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water and reduction of amenities.**

This definition has served GESAMP since its inception and has had a major influence on the development of international marine law and policy beginning with its use by the Stockholm Conference on the Human Environment, 1972, for which it had been prepared.

GESAMP has been in existence for two decades, its first meeting being held in March 1969 at IMO Headquarters in London. The sponsors of this first meeting were:

- Inter-Governmental Maritime Consultative Organization (now International Maritime Organization, IMO),
- Food and Agriculture Organization of the United Nations (FAO),
- United Nations Educational, Scientific and Cultural Organization (UNESCO),
- World Meteorological Organization (WMO).

Subsequent to that initial meeting, sponsorship increased to include the following additional organizations:

- World Health Organization (WHO),
- International Atomic Energy Agency (IAEA),
- United Nations (UN),
- United Nations Environment Programme (UNEP).

So that, by 1977, the sponsorship of GESAMP included these eight organizations.

During the existence of GESAMP, its terms of reference have changed in response to the changing needs of the Sponsoring Organizations. As of

1981, however, the terms of reference of GESAMP were established by a Memorandum of Understanding between the Sponsoring Organizations to be as follows:

(a) to provide advice relating to the scientific aspects of marine pollution:

  (i) to the Sponsoring Organizations and to the Inter-governmental 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.

Such advice is given on the scientific aspects of marine pollution, especially those of an interdisciplinary nature, including pollution of the seas as a result of the operation of ships and other equipment in the marine environment; of sea-bed exploration and exploitation; of dumping; of discharge of wastes through rivers, land run-off and pipelines; and the pollution of the sea through the atmosphere. The main subject areas on which advice is given include, *inter alia*;

(a) assessment of the potential effects of marine pollutants;

(b) scientific basis for research and monitoring programmes;

(c) international exchange of scientific information relevant to the assessment and control of marine pollution;

(d) scientific principles for the control and management of marine pollution sources; and

(e) scientific basis and criteria relating to legal instruments and other measures for prevention, control or abatement of marine pollution.

In recent years, as GESAMP has begun to broaden its concerns to include protection and management of marine and coastal environments, it has adopted the concept of sustainable development. This concept implies "that the present use of the environment and its resources shall not prejudice the use and enjoyment of that environment and its resources by

future generations. Past practices that have neglected this principle are the fundamental cause of many current environmental problems'' (GESAMP Reports and Studies No. 40).

GESAMP carries out work proposed by its Sponsoring Organizations at the request of their constituencies. Occasionally, GESAMP has refused proposed work because, in its opinion, the problem to be addressed was not of a sufficient multidisciplinary nature or it involved economic or political considerations that were regarded as outside the scope of GESAMP.

A detailed description of the procedures used in the operation of GESAMP is attached in Annex I. The following description is more general and from the perception of a GESAMP member.

HOW DOES GESAMP OPERATE?

For the purpose of conducting the work of GESAMP, each of the eight Sponsoring Organizations appoints a Technical Secretary to represent its constituency. In addition, IMO assigns an Administrative Secretary who, together with the eight Technical Secretaries, form a Joint Secretariat.

The Joint Secretariat is responsible for establishing the subjects to be considered by GESAMP during its working sessions. This is accomplished by correspondence intersessionally and during Intersecretariat meetings that are conducted just before and after GESAMP sessions and at other times during the sessions as needed. The Chairman and Vice-Chairman of GESAMP participate in these meetings.

GESAMP normally holds sessions annually at the headquarters of one of the Sponsoring Organizations on a rotating basis (Annex II). The sessions are conducted usually over a five-day period.

The individual scientists who serve on GESAMP are nominated by the Sponsoring Organizations, each of which can select up to four Experts. The Chairman and Vice-Chairman are elected from this group.

During the GESAMP sessions the Chairman presides, following an agenda prepared by the Intersecretariat and adopted, following modifications if needed, by the Experts. The major portion of the time during GESAMP sessions is spent on the presentation and discussion of reports of the intersessional activities of Working Groups (discussed further below) and the Future Work Programme.

The Future Work Programme includes new topics introduced by Technical Secretaries, which reflect concerns of their Organizations' constituencies and on which advice is sought. The topic is discussed by the entire GESAMP membership and, if deemed appropriate, an intersessional programme of work is recommended. Often, new concerns or problems submitted to GESAMP can be dealt with sessionally. In such cases, advice, conclusions and/or recommendations resulting from sessional consideration of the subject is reported in the Report of the Sessions, which is published in the GESAMP Reports and Studies series (Annex III).

For those items discussed under Future Work Programme that require more detailed consideration, a Working Group is established to carry out the work intersessionally. In every case, the Working Group is given specific

terms of reference to guide them and a Lead Organization among the eight is identified to provide technical support. Frequently, several organizations support the work of a given Working Group.

By far, the bulk of the work of GESAMP is carried out intersessionally by Working Groups. The Chairman of each Working Group is always a member of GESAMP, but most of the other members of the Working Group usually are not. To fulfill the terms of reference, members of the Working Group may meet one or more times during the intersessional period and/or conduct their work by correspondence.

During the two decades of its existence, thirty-two GESAMP Working Groups have been formed (Annex IV). In most cases, the tasks of a Working Group are completed within two to three intersessional periods, although an effort is under way to establish Working Groups that can accomplish their task in one intersessional period. The terms of reference for some Working Groups, however, require continued intersessional work. For example, Working Group 1, on the Evaluation of the Hazards of Harmful Substances Carried by Ships, has continued its work since its inception at the second session of GESAMP.

Progress of each Working Group is presented at GESAMP sessions by the Working Group Chairman. When the GESAMP Experts have agreed that the terms of reference have been met or that the work has proceeded to a point where little further can be accomplished, the Working Group is requested to present a final report. This report can be considered simply as a report to GESAMP, to be summarized along with associated recommendations in the GESAMP Session Report, or GESAMP can approve the report for publication in the GESAMP Reports and Studies series (Annex III). The decision is made solely by the Experts.

WHO SERVES ON GESAMP?

In the first 20 years of GESAMP, there have been 103 members who have served during one or more sessions (Annex V). These Experts have come from 36 countries on six continents and have represented virtually every field of marine environmental science.

The effort made by Sponsoring Organizations to achieve adequate interdisciplinary coverage is supplemented by a need to cover a broad geographic distribution within the GESAMP membership. Members or Experts are appointed to GESAMP because of their particular scientific expertise and the particular interests of the Sponsoring Organization at that time. Each member is expected to act on his/her own behalf, as a scientist, not as a representative of either the Sponsoring Organization or his/her country. The major role of the Experts is to interact with the other members during discussions and to express their views concerning the various topics considered.

In most cases, agenda items that have been proposed by one or more of the Sponsoring Organizations as an issue of concern provide the major subject for discussion. On occasions, however, issues are raised for discussion by the Experts and these discussions can lead to intersessional work, subject to the provision of financial support by one or more of the Sponsoring Organizations.

Because of the multi-disciplined nature of GESAMP, topics brought up for discussion are often outside the specific area of expertise of any individual member. Most members usually participate in one or more of the intersessional Working Groups and there is a tendency for them to contribute only to discussions of agenda items that pertain to those activities. Nevertheless, every member is encouraged to participate in every discussion to broaden the Group's interdisciplinary and international perspective.

Although the overall work programme of GESAMP is formulated, scheduled and reviewed at the annual sessions by the Experts in concert with the Joint Secretariat, most of the work is conducted during the intersessional period by Working Groups. As pointed out above, most Working Group members are not members of GESAMP but are scientists chosen for their specific expertise given the task at hand. During the intersessional period between GESAMP XIX and XX, for example, 42 scientists from 15 countries participated in Working Groups in addition to GESAMP members.

During the two decades of GESAMP, approximately 350 scientists from more than 50 countries have participated in one or more GESAMP Working Groups (Annex VI). This list of contributors to GESAMP includes many of the most outstanding marine scientists in the world.

Historically, GESAMP has functioned as a scientific fraternity in which ideas, experiences and opinions are freely and candidly exchanged. The future success of GESAMP depends on the continuation of this practice and the mutual willingness of scientists to contribute their time to this effort.

WHAT HAS GESAMP ACCOMPLISHED?

Over its lifetime GESAMP has provided advice on many aspects of marine pollution. Often it has been called upon to provide detailed reviews of various subjets pertaining to marine environmental quality. Such advice and reviews are summarized in GESAMP Session Reports and Working Group Reports published in the GESAMP Reports and Studies series (Annex III). These reports are widely used by member countries of the Sponsoring Organizations, but many of the reports, which present comprehensive reviews of specific subjects in marine science, are used by the general marine scientific community as well.

A major accomplishment of GESAMP, of course, is that it minimizes the duplication of effort of UN organizations seeking advice on scientific aspects of marine pollution and on protection and management of marine and coastal environments. If this was not the case, GESAMP would clearly cease to exist. Its major advantage, in this regard, is that it provides for a continuity of attention to persistent marine problems or those that require ongoing consideration.

GESAMP's contributions to improving our scientific understanding of marine pollution have ranged widely. It is, therefore, difficult to measure its success by a single achievement. Instead, the value of GESAMP must be judged by the cumulative improvements in understanding that have been, and continue to be, gained through its efforts. Although contributions have addressed a wide area of concern, an attempt will be made to summarize some of the more important ones.

Ongoing Evaluations and Reviews

Potential marine pollution problems associated with the transport of hazardous materials by ships has been an ongoing concern of the International Maritime Organization (IMO). In the course of preparing for an International Conference on Marine Pollution, the Sub-Committee on Marine Pollution of the then Inter-Governmental Maritime Consultative Organization (IMCO) experienced considerable difficulty in categorizing pollution hazards of substances carried by ships in a way in which control measures could be developed. To solve this problem, the Sub-Committee on Marine Pollution requested GESAMP to consider the hazards posed to the marine environment of a list of chemicals and products. In 1972, GESAMP proposed methods for assessing the hazards likely posed by

substances carried by ships and these methods were incorporated in the International Convention for the Prevention of Pollution from Ships which was adopted in 1973 at the International Conference on Marine Pollution.

Subsequently, GESAMP agreed to undertake the ongoing task of establishing hazard profiles (ratings) for additional substances carried by ships. This has been accomplished through the establishment of a Working Group which, in addition to evaluating new substances, continually revises ratings of previously evaluated substances as new information becomes available. This work continues to be an important contribution to the regulation of the shipping of hazardous materials. The latest evaluation of the hazards of harmful substances carried by ships was published as GESAMP Reports and Studies No. 35 in 1989.

At its second session in 1970, GESAMP took on the task of reviewing potentially harmful chemical substances in response to UN General Assembly Resolution 2566 (XXIV) in which such a review was considered important to promoting effective measures for the prevention and control of marine pollution. GESAMP regarded this as a continuing project as the potential hazards of additional substances are recognized. Thus, the ongoing reviews conducted by GESAMP for the sponsoring organizations have included petroleum and synthetic hydrocarbon compounds, specific heavy metals and metalloids, nutrients and numerous other natural and synthetic chemical substances. Effects on marine biota as well as on human health are considered. Specific reviews are given in GESAMP Reports and Studies Nos. 2, 22, 28, 29, 34 and 42 and in the GESAMP session reports.

Evaluation of Natural Transport Pathways of Contaminants to the Marine Environment

For a proper evaluation of the potential for pollution of the marine environment, GESAMP recognized that entry pathways of contaminants from land-based sources must be understood. GESAMP Working Groups have reviewed the existing knowledge on atmospheric and riverine transport of contaminants with the aim of:

1. evaluating the relative importance of these pathways for the entry of specific contaminants to the marine environment;

2. identifying the parts of the marine environment most affected by a given transport pathway; and

3. assessing the quality of the data on which the present knowledge is based.

From these reviews GESAMP has been able to recommend ways of improving the existing degree of understanding and many of these

recommendations have been implemented by the Sponsoring Organizations in the form of case studies, training and intercalibration workshops, and the development of reference methods.

The results of the combined efforts of two Working Groups have resulted in the most comprehensive reviews of the relative importance of atmospheric and riverine inputs to the oceans. These are summarized in GESAMP Reports and Studies Nos. 32 and 38.

Biological Effects of Marine Pollution

GESAMP has recognized the importance of biological monitoring in the marine environment and the evaluation of lethal and sub-lethal effects of pollutants on marine organisms. The feasibility and scientific requirements of such monitoring and evaluations have been and continue to be extensively analyzed by GESAMP (Reports and Studies Nos. 6, 12, 16 and 20). Again the recommendations made by GESAMP concerning monitoring of biological variables related to marine pollution have been used by Sponsoring Organizations in establishing specific expert groups and training workshops.

More recent activities of GESAMP concerning biological effects have addressed specific effects of thermal effluents and long-term ecological consequences of low-level contamination of the marine environment. These activities are also aimed at providing advice to the Sponsoring Organizations (GESAMP Reports and Studies Nos. 24 and 40).

Pollution Dispersion Models

In response to the needs of several Sponsoring Organizations regarding the dumping or discharge of contaminants to the marine environment, GESAMP has reviewed oceanographic models and their usefulness in evaluating the dispersion of wastes. Specific models for dispersion of wastes disposed of in the deep sea have been recommended (GESAMP Reports and Studies No. 19) and coastal models incorporating biological, chemical and physical processes have been reviewed (GESAMP Reports and Studies No. 43).

Guidelines for Evaluating Potential Impacts of Industrial Developments on the Marine Environment

GESAMP has been called upon often to give advice on ways of evaluating the impact of industrial developments on the marine environment. For example, methodology has been proposed by GESAMP for determining the implications of coastal area development activities on the marine environment (GESAMP Reports and Studies No. 11). The advice

provided in the methodology includes criteria for site selection in relation to environmental characteristics of the area. Guidelines for acquiring proper environmental information are also provided.

Potential impacts of various ocean energy development schemes, such as Ocean Thermal Energy Conversion (OTEC), have been assessed by GESAMP and results have indicated the potential for both positive and negative impacts. Based on this assessment, GESAMP recommended measures to minimize impacts and identified additional research needs (GESAMP Reports and Studies No. 20).

The most recent advice from GESAMP on the prevention of marine pollution considered the environmental capacity concept (GESAMP Reports and Studies No. 30). This concept was reviewed by GESAMP to evaluate its application in assessing, with the ultimate aim of protection, the impacts of contaminants on the marine environment. Guidelines and methodologies were established for the use of this concept and their applicability demonstrated by a number of practical examples.

Review of the State of the Marine Environment

Periodically, GESAMP produces a review of the state or health of the marine environment. For this purpose it draws information from international organizations including the Sponsoring Organizations and the world marine science community and from results of past GESAMP activities. This is a true culmination of the work of GESAMP, as it provides benchmarks of the problems facing the marine environment and the success of science, engineering and management in dealing with them.

The most recent Review of the State of the Marine Environment (GESAMP Report and Studies No. 39) concludes that:

> at the end of the 1980s, the major causes of immediate concern in the marine environment on a global basis are coastal development and the attendant destruction of habitats, eutrophication, microbial contamination of seafood and beaches, fouling of the seas by plastic litter, progressive build-up of chlorinated hydrocarbons, especially in the tropics and the subtropics, and accumulation of tar on beaches. However, concerns may differ from region to region, reflecting local situations and priorities. Furthermore, throughout the world, public perception may still accord greater importance to other contaminants such as radionuclides, trace elements and oil. These were highlighted in the 1982 GESAMP Review and are considered again in the present report, but we now regard them as being of lesser concern.

While no areas of the ocean and none of its principal resources appear to be irrevocably damaged, and most are still unpolluted, while there are encouraging signs that in some areas marine contamination is decreasing, we are concerned that too little is being done to correct or anticipate situations that call for action, that not enough consideration is being given to the consequences for the oceans of coastal development, and that activities on land continue with little regard to their effects in coastal waters. We fear, especially in view of the continuing growth of human populations, that the marine environment could deteriorate significantly in the next decade unless strong, co-ordinated national and international action is taken now. At the national level in particular, the concerted application of measures to reduce wastes and to conserve raw materials will be essential. The efforts will be great and the costs high, but nothing less will ensure the continued health of the sea and the maintenance of its resources.

WHAT IS THE FUTURE OF GESAMP?

GESAMP's past success does not ensure its future. This is clearly recognized by the Joint Secretariat as well as the Experts themselves. GESAMP must continue to be flexible and responsive to the changing needs for protection and management of the global marine environment.

Recently the World Commission on Environment and Development (1987) stated that the ultimate goals of development and environmental protection should be the maintenance of ecosystems and ecological processes essential to the functioning of the biosphere and preservation of biological diversity while observing the principle of optimum sustainable yield in the use of living natural resources and ecosystems. To meet this challenge, GESAMP has concluded that existing marine environmental protection and management strategies must be reconsidered.

For this purpose, two new GESAMP Working Groups were established, one on scientifically based strategies for marine environmental protection and management (Working Group 28) and another on the comprehensive framework for the assessment of waste disposal in the marine environment (Working Group 29). These Working Groups are evaluating recent developments in various fields of marine and environmental sciences and their potential application in new approaches to marine environmental protection and management. Various existing regulatory mechanisms are being evaluated to determine their advantages and limitations. The ultimate goal is to identify (1) frameworks that would provide greater opportunities for the application of developing scientific understanding to marine environmental management and (2) components of current pollution control and prevention mechanisms that are best suited for implementation for the purpose of achieving sustainable use and protection of the marine environment.

It is fully understood within GESAMP that, in view of the global nature of environmental problems facing man, concern for the marine environment cannot be considered in isolation. The land, sea and air must be considered components of a unified system. In this regard, the protection and management of marine and coastal environments must take a "holistic" approach. As stated by GESAMP (GESAMP Reports and Studies No. 41):

> In order to prevent the transfer of environmental problems from one sector of the environment to another, all sectors need to be managed and protected on a holistic basis that minimizes the impact of anthropogenic activities on the environment as

a whole. It is both scientifically unsound and ethically wrong to take measures to protect one sector of the environment without considering the implications of that action to other sectors or the costs and benefits attendant on that action. Thus, protection of the marine environment must include mechanisms for the comparison of benefits and detriments associated with options in other sectors.

ANNEX I

Procedure

To implement the terms of reference, the Joint Secretariat of GESAMP agreed to the following procedural guidelines for conducting GESAMP activities:

Secretariat

IMO assigns an Administrative Secretary and each Sponsoring Agency provides a Technical Secretary to form a Joint Secretariat.

Each Sponsoring Agency should inform the Administrative Secretary and the Technical Secretaries of the other Sponsoring Organizations of the name and title of its Technical Secretary.

Membership of the Group (GESAMP)

Each Sponsoring Organization nominates one to four experts according to its interest in the substantive work for the session. Such experts appointed to the Group should act in their individual capacities.

The composition of the Group is reviewed annually and agreed in principle among the Sponsoring Organizations taking account of the nature of the work to be carried out and the need for adequate geographical distribution. Some experts are nominated to serve for a period of up to four years to provide a continuing nucleus, while others can be appointed as occasion demands, having in mind the particular subjects to be considered at each session of the Group.

Each Sponsoring Organization should inform the Administrative Secretary and Technical Secretaries of the other Sponsoring Organizations of the names, titles and addresses of the experts it nominates.

Sessions

The Group normally meets once a year at the Headquarters of one of the Sponsoring Organizations. Sessions may be held elsewhere, if so agreed by the Sponsoring Organizations. The date and place of the session will be decided by the Joint Secretariat after consultation with the Chairman. Prospective experts should be informed of this decision as soon as possible by the Technical Secretaries of the Organizations concerned.

Each Sponsoring Organization should invite its own nominees to that session and inform the Administrative Secretary of the names of experts who will attend.

The Administrative Secretary should invite:

(a) the IOC, as well as such other organizations of the UN system as may so wish to send an observer to any session of the Group; and

(b) at the request of any one of the Sponsoring Organizations and by agreement with the other Sponsoring Organizations, any other intergovernmental organizations with official relations or consultative status with the requesting organization to send an observer.

Agenda

The Agenda for each session of the Group should include:

(a) any item which has been requested for inclusion by any Sponsoring Organization or by IOC;

(b) items considered at the previous session and not yet concluded; and

(c) any items proposed by any Specialized Agency or other organization of the UN system which is not a Sponsoring Organization, subject to agreement of the Sponsoring Organizations and to such preliminary consultations as may be necessary.

The provisional agenda should be prepared by the Administrative Secretary in consultation with the Technical Secretaries of the Sponsoring Organizations after consultation with the Chairman and, if necessary, other organizations of the UN system that have proposed items for inclusion. The Administrative Secretary should circulate to the Sponsoring Organizations the agreed provisional agenda.

When adopting the Agenda, the Group should not delete or substantially alter any items except with the unanimous agreement of the Joint Secretariat.

Chairman and Vice-Chairman

At the end of each session the Group elects from among its experts a chairman and a vice-chairman who will hold office for the intersessional period and for the following session. The candidates of these posts should be agreed upon by the Joint Secretariat. The candidates are to be proposed to the Group by the Administrative Secretary. Incumbents are eligible for reelection normally once.

Documents

Documents, papers and notes related to any Agenda item of any session should be prepared by the Sponsoring Organization concerned with that item. That Organization should reproduce each document and circulate them as follows:

(a) one copy each to the experts of the Group as far as they are known (where the nomination of experts is in doubt, the documents should be transmitted through the Technical Secretary of the Organization concerned);

(b) sixteen copies to the Administrative Secretary for transmittance to the organizations invited to the session and two copies each to the Technical Secretaries; and

(c) thirty copies to the Organization hosting the session of the Group.

Each working paper should be assigned provisionally with the symbol indicating the session number followed by the Agenda item (e.g. GESAMP VI/2). If there is more than one working paper under the same Agenda item, an addition to the symbol will be assigned by the Joint Secretariat at its meeting prior to the session.

Every effort should be made for the documents to be circulated well in advance of the session, preferably by at least two months.

Languages

The official languages of the Group are English, French, Spanish and Russian.

The working language of the sessions is English, unless six months prior to the session at least one of the Sponsoring Organizations requests in writing to the Administrative Secretary for the use of additional official language(s) of the Group to be also used as working language(s) of the session.

Statements at the sessions of the Group should be made in the working language(s) agreed for that session and will be interpreted into the other working language(s), as appropriate.

Supporting documents to Agenda items of the sessions should be issued normally in English, and if possible in the other working language(s) used at that session. Drafts of reports of the session should normally be drawn up in English.

The working language of the Joint Secretariat is English.

Intersessional Work

The preparation of each substantive Agenda item should, as far as possible, be carried out intersessionally through Working Groups. Such intersessional work should be organized by the Sponsoring Organization concerned with the relevant Agenda item (Lead Agency), in co-operation, if necessary, with the other Sponsoring Organizations (Co-operating Agencies) which have indicated their readiness to collaborate in the organization of this work.

The Working Groups established by the Group should consist of:

(a) member(s) elected from the experts of GESAMP; and

(b) additional member(s) selected from experts outside GESAMP.

The terms of reference for the Working Groups will be proposed by the Lead Agency in consultation with the Co-operating Agencies and should be approved by the Group.

The Group will nominate the Chairman of the Working Group and the member(s) of the Working Group selected from the experts of GESAMP. The recommendation for these nominations will be made by the Lead Agency after prior consultation with the Co-operating Agencies, the Chairman of GESAMP and, in the case of the member(s) of the Working Group, with the proposed Chairman of the Working Group.

Additional member(s) of the Working Group selected from experts outside GESAMP will be nominated by the Lead Agency in consultation with the Chairman of the Working Group and the Co-operating Agencies.

The Lead Agency should co-operate closely with the Co-operating Agencies on the intersessional work. Any Sponsoring Organization is entitled to send its representative to any meeting of the Working Group, subject to notification of the Lead Agency. The Lead Agency should therefore inform all Sponsoring Organizations of the date, time, place and Agenda for any Working Group meeting it may convene, together with details of its composition.

Reports of Session

The draft report of each session should be prepared jointly by the Administrative Secretary and the Technical Secretaries. Each Technical Secretary is responsible for drafting the relevant sections of the draft report, with assistance, as necessary, from the experts of the Group.

The Technical Secretary of the Organization hosting the session of the Group is the Secretary for the session. He is responsible for the compilation of the drafts and the presentation of the draft report to the meeting, as early as possible so as to leave adequate time for its consideration and approval by the Group.

No changes, except editorial ones, should be made to the report of the session after it is approved by the Group. After the session, the Secretary for the session should circulate to the Chairman, the Administrative Secretary and the Technical Secretaries a copy of the report in its edited form for clearance before translation and reproduction. Subsequently, the report of the session is distributed in the original language to the Group.

The publication of the report in its original language is the responsibility of the Technical Secretary acting as the Secretary for the session. The translation and publication of the report in the other official languages is the responsibility of Technical Secretaries of Sponsoring Organizations according to the agreement reached by the Joint Secretariat.

Substantive Reports and Studies

Reports of the intersessional Working Groups are submitted for approval of the Group. No changes, except editorial ones, should be made in these reports after the Group has agreed to publish them as GESAMP studies or reports.

The publications of studies and reports should be undertaken by the Lead Agency which should produce a sufficient number of copies to meet the needs of all the Sponsoring Organizations as agreed by the Joint Secretariat.

GESAMP Publications

The reports of the sessions as well as the studies and reports resulting from the Working Groups which were approved by the Group will be published in the GESAMP Reports and Studies series, with serial number assigned by the Joint Secretariat.

All such publications shall contain a standard outline, including the definition of marine pollution by GESAMP and other explanatory notes together with standard disclaimer as follows: "This (Report/Study) contains views expressed by experts acting in their individual capacities, and may not necessarily correspond with the views of the Sponsoring Organizations."

Studies and reports resulting from the Working Groups which were approved by the Group may also be published as separate publications by the relevant Lead or Co-operating Agencies under the same title and identifying GESAMP as author. Such publications should bear clear reference to the fact that they were also issued in the GESAMP Reports and Studies series.

Unless otherwise specially decided by the Sponsoring Organizations, permission may be granted for the publication appearing in the GESAMP Reports and Studies series to be wholly or partly reproduced in publications, by any individual who is not a staff member of a Sponsoring Organization of GESAMP, or by any organization that is not a sponsor of GESAMP, provided that the source (GESAMP Reports and Studies) is clearly indicated together with the disclaimer mentioned above.

Studies or reports resulting from the Working Groups which were not approved by the Group cannot be published in the GESAMP Reports and Studies series and cannot be referred to as GESAMP publications.

Copies of publications appearing in GESAMP Reports and Studies series may be made available to Governments, institutions and individuals concerned with marine pollution problems, each Sponsoring Organization arranging distribution according to its own needs.

Financial Arrangements

Each Sponsoring Organization should bear the expenses incurred by the members it nominates for their attendance at any session of the Group.

The costs for the session, including interpretation and secretariat work, will be borne by the Sponsoring Organization hosting the session.

The costs for translation and reproduction of reports, studies and documents should be borne by the Sponsoring Organizations undertaking the work.

The costs for intersessional activities of the Working Group should be borne by the Lead Agency and the relevant Co-operating Agencies according to an agreement reached between them before proposing the establishment or continuation of the Working Group.

ANNEX II

GESAMP Sessions

GESAMP I

IMCO Headquarters, London, 17-21 March 1969
Chairman: J. Wardley-Smith
Vice-Chairman: not elected
Administrative Secretary: L. Leplat, IMCO
Technical Secretary: S.L.D. Young, IMCO
Report: GESAMP I/11, IMCO 1969

GESAMP II

UNESCO Headquarters, Paris, 2-6 March 1970
Chairman: J. Wardley Smith
Vice-Chairman: not elected
Administrative Secretary: L. Leplat, IMCO
Technical Secretary: M. Steyaert, UNESCO
Report: GESAMP II/11, UNESCO 1970

GESAMP III

FAO Headquarters, Rome, 22-27 February 1971
Chairman: M. Waldichuk
Vice-Chairman: H.A. Cole
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: L. Andren, FAO
Report: GESAMP III/19, FAO 1971 and
FAO Fish. Rep. (102) 1971

GESAMP IV

WMO Headquarters, Geneva,
18-23 September 1972
Chairman: M. Waldichuk
Vice-Chairman: H.A. Cole
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: G.N. Kostjanoj, WMO
Report: GESAMP IV/19, WMO 1972

GESAMP V

IAEA Headquarters, Vienna, 18-23 June 1973
Chairman: M. Waldichuk
Vice-Chairman: H.A. Cole
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: Y. Nishiwaki, IAEA
Report: GESAMP V/10, IAEA 1973

GESAMP VI

WHO Headquarters, Geneva, 22-28 March 1974
Chairman: G. Berge
Vice-Chairman: A.I. Simonov
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: R. Pavanello, WHO
Report: GESAMP VI/10, WHO 1974

GESAMP VII

IMCO Headquarters, London, 24-30 April 1975
Chairman: G. Berge
Vice-Chairman: A.I. Simonov
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: S.L.D. Young, IMCO
Report: Rep. Stud. GESAMP (1), IMCO 1975

GESAMP VIII

FAO Headquarters, Rome, 21-27 April 1976
Chairman: G. Kullenberg
Vice-Chairman: C.H. Thompson
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: G. Tomczak, FAO
Report: Rep. Stud. GESAMP (4), FAO 1976

GESAMP IX

United Nations Headquarters, New York,
7-11 March 1977
Chairman: G. Kullenberg
Vice-Chairman: C.H. Thompson
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: L. Neuman, UN
Report: Rep. Stud. GESAMP (8), UN 1977

GESAMP X

UNESCO Headquarters, Paris,
29 May - 2 June 1978
Chairman: G. Kullenberg
Vice-Chairman: C.H. Thompson
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: W. Slaczka, UNESCO
Report: Rep. Stud. GESAMP (9), UNESCO 1978

GESAMP XI

Interuniversity Centre for Postgraduate Studies, Dubrovnik, 25-29 February 1980
Chairman: V. Pravdic
Vice-Chairman: A.D. McIntyre
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: S. Keckes, UNEP
Report: Rep. Stud. GESAMP (10), UNEP 1980

GESAMP XII

WMO Headquarters, Geneva, 22-28 October 1981
Chairman: V. Pravdic
Vice-Chairman: A.D. McIntyre
Administrative Secretary: Y. Sasamura, IMCO
Technical Secretary: V. Smagin, WMO
Report: Rep. Stud. GESAMP (14), WHO 1981

GESAMP XIII

WHO Headquarters, Geneva, 28 February - 4 March, 1983
Chairman: A.D. McIntyre
Vice-Chairman: E.D. Gomez
Administrative Secretary: J. Wonham, IMO (Acting)
Technical Secretary: R. Helmer, WHO
Report: Rep. Stud. GESAMP (18), WHO 1983

GESAMP XIV

IAEA Headquarters, Vienna, 26-30 March 1984
Chairman: A.D. McIntyre
Vice-Chairman: E.D. Gomez
Administrative Secretary: Y. Sasamura, IMO
Technical Secretary: A. Hagen, IAEA
Report: Rep. Stud. GESAMP (21), IAEA 1984

GESAMP XV

United Nations Headquarters, New York, 25-29 March 1985
Chairman: E.D. Gomez
Vice-Chairman: G.D. Howells
Administrative Secretary: A. Morozov, IMO
Technical Secretary: L. Neuman, UN
Report: Rep. Stud. GESAMP (25), UN 1985

GESAMP XVI

IMO Headquarters, London, 17-21 March 1986
Chairman: E.D. Gomez
Vice-Chairman: G.D. Howells
Administrative Secretary: A. Morozov, IMO
Technical Secretary: M. Nauke, IMO
Report: Rep. Stud. GESAMP (27), IMO 1986

GESAMP XVII

FAO Headquarters, Rome, 30 March - 3 April 1987
Chairman: G.D. Howells
Vice-Chairman: H.L. Windom
Administrative Secretary: A. Morozov, IMO
Technical Secretary: H. Naeve, FAO
Report: Rep. Stud. GESAMP (31), FAO 1987

GESAMP XVIII

UNESCO Headquarters, Paris, 11-15 April, 1988
Chairman: G.D. Howells
Vice-Chairman: H.L. Windom
Administrative Secretary: K. Voskresensky, IMO
Technical Secretary: G. Kullenberg, UNESCO
Report: Rep. Stud. GESAMP (33), UNESCO 1988

GESAMP XIX

UNEP's Co-ordinating Unit for the Mediterranean Action Plan, Athens, 8-12 May 1989
Chairman: H.L. Windom
Vice-Chairman: D. Calamari
Administrative Secretary: K. Voskresenky, IMO
Technical Secretary: S. Keckes, UNEP
Report: Rep. Stud. GESAMP (37), UNEP 1989

GESAMP XX

WMO Headquarters, Geneva, 7-11 May 1990
Chairman: H.L. Windom
Vice-Chairman: D. Calamari
Administrative Secretary: K. Voskresensky, IMO
Technical Secretary: A. Soudine, WMO
Report: Rep. Stud. GESAMP (41), WMO 1990

ANNEX III

GESAMP Reports and Studies

The following reports and studies thus far published are available from any of the organizations sponsoring GESAMP.

Report of the seventh session. London, 24-30 April 1975. (1975) **Rep. Stud. GESAMP (1)**: pag. var. Available also in French, Spanish and Russian.

Review of harmful substances. (1976) **Rep. Stud. GESAMP (2)**: 80 p.

Scientific criteria for the selection of sites for dumping of wastes into the sea. (1975) **Rep. Stud. GESAMP (3)**: 21 p. Available also in French, Spanish and Russian.

Report of the eighth session, Rome, 21-27 April 1976. (1976) **Rep. Stud. GESAMP (4)**: pag. var. Available also in French and Russian.

Principles for developing coastal water quality criteria. (1976) **Rep. Stud. GESAMP (5)**: 23 p. Published also as **UNEP Regional Seas Reports and Studies No. 42.**

Impact of oil on the marine environment. (1977) **Rep. Stud. GESAMP (6)**: 250 p.

Scientific aspects of pollution arising from the exploration and exploitation of the sea-bed. (1977) **Rep. Stud. GESAMP (7)**: 37 p.

Report of the ninth session, New York, 7-11 March 1977. (1977) **Rep. Stud. GESAMP (8)**: 33 p. Available also in French, Spanish and Russian.

Report of the tenth session, Paris, 29 May - 2 June 1978. (1978) **Rep. Stud. GESAMP (9)**: pag. var. Available also in French, Spanish and Russian.

Report of the eleventh session, Dubrovnik, 25-29 February 1980. (1980) **Rep. Stud. GESAMP (10)**: pag. var. Available also in French and Spanish.

Marine pollution implications of coastal area development. (1980) **Rep. Stud. GESAMP (11)**: 114 p.

Monitoring biological variables related to marine pollution. (1980) **Rep. Stud. GESAMP (12)**: 22p. Available also in Russian.

Interchange of pollutants between the atmosphere and the oceans. (1980) **Rep. Stud. GESAMP (13)**: 55 p.

Report of the twelfth session, Geneva, 22-29 October 1981. (1981) **Rep. Stud. GESAMP (14)**: pag. var. Available also in French and Russian.

The review of the health of the oceans. (1982) **Rep. Stud. GESAMP (15)**: 108 p. Published also as **UNEP Regional Seas Reports and Studies No. 16.**

Scientific criteria for the selection of waste disposal sites at sea. (1982) **Rep. Stud. GESAMP (16)**: 60 p.

The evaluation of the hazards of harmful substances carried by ships. (1982) **Rep. Stud. GESAMP (17)**: pag. var.

Report of the thirteenth session, Geneva, 28 February - 4 March 1983. (1983) **Rep. Stud. GESAMP (18)**: 50 p. Available also in French and Spanish.

An oceanographic model for the dispersion of wastes disposed of in the deep sea. (1983) **Rep. Stud. GESAMP (19)**: 182 p.

Marine pollution implications of ocean energy development. (1984) **Rep. Stud. GESAMP (20)**: 44 p.

Report of the fourteenth session, Vienna, 26-30 March 1984. (1984) **Rep. Stud. GESAMP (21)**: 42 p. Available also in French, Spanish and Russian.

Review of potentially harmful substances. Cadmium, lead and tin. (1985) **Rep. Stud. GESAMP (22)**: 114 p. Published also as **UNEP Regional Seas Reports and Studies No. 56.**

Interchange of pollutants between the atmosphere and the oceans (Part II). (1985) **Rep. Stud. GESAMP (23)**: 55 p.

Thermal discharges in the marine environment. (1984) **Rep. Stud. GESAMP (24)**: 44 p. Published also as **UNEP Regional Seas Reports and Studies No. 45.**

Report of the fifteenth session, New York, 25-29 March 1985. (1985) **Rep. Stud. GESAMP (25)**: 49 p. Available also in French, Spanish and Russian.

Atmospheric transport of contaminants into the Mediterranean region. (1985) **Rep. Stud. GESAMP (26)**: 53 p. Published also as **UNEP Regional Reports and Studies No. 68.**

Report of the sixteenth session, London, 17-21 March 1986. (1986) **Rep. Stud. GESAMP (27)**: 72 p. Available also in French, Spanish and Russian.

Review of potentially harmful substances. Arsenic, mercury and selenium. (1986) **Rep. Stud. GESAMP (28)**: 172 p. Published also as **UNEP Regional Seas Reports and Studies No. 92.**

Review of potentially harmful substances, Organosilicon compounds (Silanes and Siloxanes). (1986) **Rep. Stud. GESAMP (29)**: 26 p. Printed in limited number only by IMO. Published also as **UNEP Regional Seas Reports and Studies No. 78.**

Environmental capacity. An approach to marine pollution prevention. (1986) **Rep. Stud. GESAMP (30)**: 49 p. Published also as **UNEP Regional Seas Reports and Studies No. 80.**

Report of the seventeenth session, Rome, 30 March-3 April 1987. (1987) **Rep. Stud. GESAMP (31)**: 36 p. Available also in French, Spanish and Russian.

Land-sea boundary flux of contaminants: contributions from rivers. (1987) **Rep. Stud. GESAMP (32)**: 172 p.

Report of the eighteenth session, Paris, 11-15 April 1988. (1988) **Rep. Stud. GESAMP (33)**: 56 p. Available also in French, Spanish and Russian.

Review of potentially harmful substances. Nutrients. (1990) **Rep. Stud. GESAMP (34)**: 40 p.

The evaluation of the hazards of harmful substances carried by ships: revision of GESAMP Reports and Studies No. 17. (1989) **Rep. Stud. GESAMP (35)**: 211 p.

Pollutant modification of atmospheric and oceanic processes and climate: some aspects of the problem. (1989) **Rep. Stud. GESAMP (36)**: 35 p.

Report of the nineteenth session, Athens, 8-12 May 1989. (1989) **Rep. Stud. GESAMP (37)**: 47 p. Available also in French, Spanish and Russian.

The atmospheric input of trace species to the World Ocean. (1989) **Rep. Stud. GESAMP (38)**: 111 p.

The state of the marine environment. (1990) **Rep. Stud. GESAMP (39)**: 111 p. Published also as **UNEP Regional Reports and Studies No. 115.**

Long-term ecological consequences of low-level contamination of the marine environment. (1989) **Rep. Stud. GESAMP (40)**: 14 p.

Report of the twentieth session, Geneva, 7-11 May 1990. (1990) **Rep. Stud. GESAMP (41)**: 32 p. Available also in French, Spanish and Russian.

Review of potentially harmful substances: Chlorinated hydrocarbons. (1990) **Rep. Stud. GESAMP (42)**: 10 p.

Coastal modelling. (in press) **Rep. Stud. GESAMP (43).**

ANNEX IV

GESAMP Working Groups

WORKING GROUP 1

Evaluation of the hazards of harmful substances carried by ships*
GESAMP II - continuing
Chairmen: H.A. Cole, P.G. Jeffrey, J.E. Portmann, W. Ernst
Sponsoring Organization: IMO in cooperation with UNEP

WORKING GROUP 2

Bio-essays and other techniques for evaluation of lethal and sub-lethal effects of pollutants on marine organisms
GESAMP III-IV
Chairman: G. Berge
Sponsoring Organization: FAO

WORKING GROUP 3

Transport and dilution of pollutants and marine pollution monitoring
GESAMP IV-V
Chairman: K.O. Münnich
Sponsoring Organization: WMO

WORKING GROUP 4

Review of harmful substances in the marine environment
GESAMP IV-VIII
Chairmen: H.A. Cole, P.G. Jeffrey
Sponsoring Organization: IMO

WORKING GROUP 5

Sewage and industrial waste management technologies and their performance
GESAMP IV-V
Chairman: H.C. Thompson
Sponsoring Organization: UN

WORKING GROUP 6

Principles for developing coastal water quality criteria
GESAMP IV-VII
Chairmen: G. Berge, M. Waldichuk
Sponsoring Organization: FAO with assistance of UNEP

WORKING GROUP 7

The consequences of the human perturbation of the deep-sea floor
GESAMP IV-V
Chairman: K.K. Turekian
Sponsoring Organization: IAEA in cooperation with UN

WORKING GROUP 8

Impact of oil on the marine environment
GESAMP V-VIII
Chairmen: H.C. Thompson, H.A. Cole
Sponsoring Organization: FAO with assistance of UNEP

WORKING GROUP 9

Scientific basis for disposal of waste into the sea
GESAMP V-VIII
Chairman G. Kullenberg
Sponsoring Organization: FAO with assistance of UNEP

WORKING GROUP 10

Scientific bases for the determination of concentrations and effects of marine pollutants
GESAMP VI-VII
Chairman: E.D. Goldberg
Sponsoring Organization: UNESCO with assistance of UNEP

* Until GESAMP VIII the name of the Working Group was "Evaluation of the hazards of harmful substances in the marine environment."

WORKING GROUP 11

Scientific aspects of pollution arising from the exploration and exploitation of the sea bed
GESAMP VI-VIII
Chairman: H.A. Cole
Sponsoring Organization: UN in cooperation with IMCO and with assistance of UNEP

WORKING GROUP 12

Marine pollution implications of coastal area development
GESAMP VII-X
Chairman: H.A. Cole
Sponsoring Organization: UN in cooperation with FAO, WHO and UNEP

WORKING GROUP 13

Review of potentially harmful substances
GESAMP IX - continuing
Chairmen: B.H. Ketchum, A. Jernelov, L. Friberg, J. Portmann, L. Landner
Sponsoring Organization: UNESCO in cooperation with FAO, IMO, UNEP and WHO

WORKING GROUP 14

Interchange of pollutants between the atmosphere and the oceans
GESAMP VIII-XIX
Chairmen: W.D. Garrett, R. Duce
Sponsoring Organization: WMO in cooperation with UNESCO, IAEA and UNEP

WORKING GROUP 15

Biological effects of thermal effluents in the marine environment
GESAMP VIII-XIV
Chairmen: V. Pravdic, G.D. Howells
Sponsoring Organization: FAO in cooperation with UNESCO and UNEP

WORKING GROUP 16

Monitoring of biological variables related to marine pollution
GESAMP IX-XI
Chairman: A.D. McIntyre
Sponsoring Organization: UNESCO in cooperation with FAO

WORKING GROUP 17

Scientific aspects of removal of harmful substances from waste water
GESAMP IX-XI
Chairman: H.C. Thompson
Sponsoring Organization: WHO in cooperation with FAO

WORKING GROUP 18

Review of the health of the oceans
GESAMP X-XIII
Chairman: G. Kullenberg
Sponsoring Organization: UNESCO in cooperation with IMO, FAO, WMO, WHO, IAEA, UN and UNEP

WORKING GROUP 19

Oceanographic model for the dispersion of water disposed of in the deep sea
GESAMP XI-XIII
Chairman: G.T. Needler
Sponsoring Organization: IAEA in cooperation with IMO, UNESCO and UNEP

WORKING GROUP 20

Sea disposal studies
GESAMP XI-XII
Chairman: A.D. McIntyre
Sponsoring Organization: IMO in cooperation with UNEP

WORKING GROUP 21

Marine pollution implications of ocean energy development
GESAMP XI-XIII
Chairmen: R.D. Gerard, J. Roney
Sponsoring Organization: UN in cooperation with UNESCO and UNEP

WORKING GROUP 22

Land-sea boundary flux of pollutants
GESAMP XIII-XVII
Chairman: H.L. Windom
Sponsoring Organization: UNESCO in cooperation with UNEP and IAEA

WORKING GROUP 23

Methodology and guidelines for the assessment of the impact of pollutants on the marine environment
GESAMP XIII-XVI
Chairman: V. Pravdic
Sponsoring Organization: FAO and WHO in cooperation with IMO, UNESCO, IAEA and UNEP

WORKING GROUP 24

Integrated global ocean monitoring
GESAMP XIV-XVII
Chairman: A. Tsyban
Sponsoring Organization: UNEP in cooperation with WMO

WORKING GROUP 25

Coastal modelling
GESAMP XV-XX
Chairman: J. Blanton
Sponsoring Organization: IAEA in cooperation with UNEP, UNESCO and IMO

WORKING GROUP 26

State of the marine environment
GESAMP XV-XIX
Chairman: A.D. McIntyre
Sponsoring Organization: UNEP in cooperation with UN, IAEA, WHO, WMO, FAO, IMO and UNESCO

WORKING GROUP 27

Long-term ecological consequences of low-level contamination of the marine environment
GESAMP XVI-XIX
Chairman: G.D. Howells
Sponsoring Organization: FAO in cooperation with UNEP and IMO

WORKING GROUP 28

Scientifically based strategies for marine environmental protection and management
GESAMP XIX-XX
Chairman: D. Calamari
Sponsoring Organization: FAO in cooperation with UN, UNEP, UNESCO, WHO, WMO and IMO

WORKING GROUP 29

Comprehensive framework for the assessment and regulation of waste disposal in the marine environment
GESAMP XIX - continuing
Chairman: R.G.V. Boelens
Sponsoring Organization: IMO in cooperation with UN, UNEP, FAO, UNESCO and IAEA

WORKING GROUP 30

Impacts of anthropogenically mobilized sediments in the coastal environment
GESAMP XIX - continuing
Chairman: J. Gray
Sponsoring Organization: UNESCO in cooperation with UN, UNEP, FAO and IMO

WORKING GROUP 31

Environmental impacts of coastal aquaculture
GESAMP XX - continuing
Chairman: Chua Thia-Eng
Sponsoring Organization: FAO in cooperation with UNEP, UNESCO and WHO

WORKING GROUP 32

Global change and the air/sea exchange of chemicals
GESAMP XX-XXI
Chairman: R. Duce
Sponsoring Organization: WMO in cooperation with UNEP and UNESCO

ANNEX V

GESAMP Members

R. ALI
United Arab Emirates
GESAMP XI-XIV

T. BALKAS
Turkey
GESAMP XV-XVII

D.J. BAUMGARTNER
USA
GESAMP III

T. BEASELY
USA
GESAMP III

B.E. BENGTSSON
Sweden
GESAMP IX-X

G. BERGE
Norway
GESAMP IV-IX

M. BERNHARD
Italy
GESAMP XV-XVIII

J.M. BEWERS
Canada
GESAMP XV-XX

J. BLANTON
USA
GESAMP XVI-XX

R.G.V. BOELENS
Ireland
GESAMP XVIII-XX

J. BRISOU
France
GESAMP III-IV

J. BROADUS
USA
GESAMP XVI-XVII and XIX

J. BROADIE
Fiji
GESAMP XVII

D. CALAMARI
Italy
GESAMP XVIII-XX

P. de CASTRO MOREIRA da SILVA
Brazil
GESAMP XI-XIII

HANSA CHANSANG
Thailand
GESAMP XVIII-XIX

R.P. CHESSELET
France
GESAMP IX-XIII

CHUA THIA-ENG
Philippines
GESAMP XX

H.A. COLE
United Kingdom
GESAMP III-V and VII-XI

J. CORREDOR
Puerto Rico
GESAMP XVII

M.J. CRUICKSHANK
USA
GESAMP VII

A.L. DOWNING
United Kingdom
GESAMP VI-VIII

R. DUCE
USA
GESAMP XVII-XX

E.K. DUURSMA
Netherlands
GESAMP XV-XVII

D. DYRSSEN
Sweden
GESAMP I-II

F. EL-SHARKAWI
Egypt
GESAMP X-XI

W. ERNST
Germany
GESAMP XIV-XX

H.L. FALK
USA
GESAMP VII

M.A. FONTAINE
France
GESAMP III-IV

S.W. FOWLER
USA
GESAMP XI-XIII

E. FOYN
Norway
GESAMP I-III

L. FRIBERG
Sweden
GESAMP XII-XVII

R. FUKAI
Japan
GESAMP IV-V, VII and XI-XIII

W.D. GARRETT
USA
GESAMP VIII-XVI

E.E. GELDREICH
USA
GESAMP V-VI

R.D. GERARD
USA
GESAMP VII, IX and XI

E.D. GOLDBERG
USA
GESAMP III and V-VII

E.D. GOMEZ
Philippines
GESAMP XII-XVI

V.L. GONZALEZ-ANGELES
Mexico
GESAMP XII-XIV

J. GRAY
Norway
GESAMP XVIII-XX

P.A. GURBUTT
United Kingdom
GESAMP XX

B.W. HALSTEAD
USA
GESAMP I-IV

O. HAUG
Norway
GESAMP I-II

C.S. HEGRE
USA
GESAMP VI

G.D. HOWELLS
United Kingdom
GESAMP XIII-XIX

C. IBE
Nigeria
GESAMP XVIII-XIX

P.G. JEFFERY
United Kingdom
GESAMP IV-XI and XIII-XVII

A.B. JERNELOV
Sweden
GESAMP VIII-IX and XI-XIV

R. JOHANNES
USA
GESAMP VI

J. JOSEPH
Germany
GESAMP III

P.R. KAMATH
India
GESAMP VIII-IX

A. KAPAUAN
Philippines
GESAMP XVII-XIX

S. KECKES
Yugoslavia
GESAMP V-VII

B.H. KETCHUM
USA
GESAMP VIII-XI

V. KIORTSIS
Greece
GESAMP VIII

V. KOROPALOV
USSR
GESAMP XIII-XVII

P. KORRINGA
The Netherlands
GESAMP I-II

G.E.B. KULLENBERG
Denmark
GESAMP V-XIII

A. LA FONTAINE
Belgium
GESAMP VII-IX

P.S. LISS
United Kingdom
GESAMP XVIII

R. LLOYD
United Kingdom
GESAMP XX

J.M. LOPEZ
Puerto Rico
GESAMP XVIII-XIX

J. LOPUSKI
Poland
GESAMP I-III

L.P.A. MAGOS
United Kingdom
GESAMP X-XVI

A.D. McINTYRE
United Kingdom
GESAMP X-XIX

L. MENDIA
Italy
GESAMP III-IV and VII-IX

E.A. MOZHAEV
USSR
GESAMP VII-VIII

E.P. MYERS
USA
GESAMP XIII-XV

K.O. MÜNNICH
Germany
GESAMP III-IV

G.T. NEEDLER
Canada
GESAMP XII-XIV

M. NESTEROVA
USSR
GESAMP III-IV

L. OTTO
The Netherlands
GESAMP IV-VIII

J. PERNETTA
Papua New Guinea
GESAMP XVIII-XX

J.E. PORTMANN
United Kingdom
GESAMP I-VIII, X-XIII, XVII-XIX

V. PRAVDIC
Yugoslavia
GESAMP VIII-XVI

C.P. RAMACHANDRAN
Malaysia
GESAMP X

D. RAMSAROOP
Trinidad and Tobago
GESAMP XII-XV

J.W. van RIJN van ALKEMADE
Netherlands
GESAMP XI

J. RONEY
USA
GESAMP XII

G.T. ROWE
USA
GESAMP XII-XIII

A. SALO
Finland
GESAMP XVIII-XIX

H. SHUVAL
Israel
GESAMP XVIII-XIX

A.I. SIMONOV
USSR
GESAMP I-VII and XI

V. SMAGIN
USSR
GESAMP X

J.B. SPRAGUE
Canada
GESAMP V-VII

Y.K. STRIZHAK
USSR
GESAMP IV-V

G. TENDRON
France
GESAMP I-III

C.H. THOMPSON
USA
GESAMP IV-V and VII-XI

P. TORTELL
New Zealand
GESAMP XVI-XX

H. TSURUGA
Japan
GESAMP I-II

A. TSYBAN
USSR
GESAMP XII and XIV-XX

K. TUREKIAN
USA
GESAMP IV-V

E.J.B. TUTUWAN
Cameroon
GESAMP XI-XIII

J. UI
Japan
GESAMP III-IV

F. VALDEZ-ZAMUDIO
Peru
GESAMP IV-VII

G.J. van ESCH
Netherlands
GESAMP III

M.E. VINOGRADOV
USSR
GESAMP XIV

M. WALDICHUK
Canada
GESAMP I-IX and XIV-XVII

J. WARDLEY-SMITH
United Kingdom
GESAMP I-III

R.M. WARWICK
United Kingdom
GESAMP XV

G.F. WEICHART
Germany
GESAMP III-VII

L.W. WEINBERGER
USA
GESAMP I-II

P.G. WELLS
Canada
GESAMP XVIII-XX

K.W. WILSON
United Kingdom
GESAMP IX-X

H.L. WINDOM
USA
GESAMP XIV-XX

F. WUERGLER
Switzerland
GESAMP XX

T. YOSHIDA
Japan
GESAMP VI-VIII

ANNEX VI

Scientists Who Have Participated in GESAMP Working Groups

ADAM, Y.
Belgium

ADEMA, D.M.M.
Netherlands

AITSAM, A.
USSR

ALI, R.
United Arab Emirates

ALABASTER, J.S.
United Kingdom

ALTUNIN, I.
USSR

ARIMOTO, R.
USA

ARNAUDO, R.
USA

ATLAS, E.
USA

ATWOOD, D.K.
USA

BALKAS, T.I.
Turkey

BALLANTYNE, B.
USA

BAUMGARTNER, D.J.
USA

BARROS, M. de
Portugal

BATHIE, F.
United Kingdom

BAYNE, B.
United Kingdom

BEAK, T.W.
Canada

BEASLEY, T.
USA

BENGTSSON, B.E.
Sweden

BENNETT, B.G.
United Kingdom

BERGE, G.
Norway

BERLIN, M.
United Kingdom

BERNHARD, M.
Italy

BEWERS, J.M.
Canada

BIENATI, N.L.
Argentina

BLACKMAN, R.A.A.
United Kingdom

BLANCHARD, D.C.
USA

BLANTON, J.
USA

BOSCH, F.X.
France

BORDET, F.
France

BOTELLO, A.V.
Mexico

BOWEN, V.T.
USA

BRISOU, J.
France

BROADUS, J.
USA

BRUGMAN, L.
Germany

BRIAN, G.W.
United Kingdom

BUAT-MENARD, P.
France

BURTON, J.D.
United Kingdom

BYRD, J.T.
USA

CABELLI, V.J.
USA

CAIRNS, Jr., J.
USA

CALAMARI, D.
Italy

CARTER, H.H.
USA

CAUWET, G.
France

CHARDY, P.
France

CHESSELET, R.P.
France

CHUA, T.-E.
Philippines

CHUECAS, L.
Chile

CHURCH, T.
USA

CLARKSON, T.
USA

CLERICI, G.C.
Italy

COCHRAN, J.K.
USA

COLE, H.A.
United Kingdom

COLEBROOK, J.M.
United Kingdom

COLES, S.L.
USA

COLWELL, R.R.
USA

CONNOR, P.M.
United Kingdom

CRUICKSHANK, M.J.
USA

CRUZADO, A.
Spain

CSANADY, G.T.
USA

da SILVA, P. Castro de Moreira
Brazil

DAHL-MADSEN, K.I.
Denmark

DAVIES, A.M.
United Kingdom

DAVIS, L.J.C.
Canada

DAWSON, R.
USA

DAYTON, P.K.
USA

DE BOER, E.J.
Belgium

DE MAEYER, S.
Belgium

DESHPANDE, R.D.
Thailand

DETHLEFSEN, V.
Germany

DITMARS, J.D.
USA

DOOLEY, H.D.
United Kingdom

DOWNING, A.L.
United Kingdom

DUCE, R.A.
USA

DUINKER, J.C.
Netherlands

DUKE, T.
USA

DUURSMA, E.K.
Netherlands

DYBERN, B.I.
Sweden

DYRSSEN, D.
Sweden

EDMOND, J.
USA

EDMONDS, J.S.
Australia

EHRETH, D.
USA

EHRHARDT, M.G.
Germany

EL-SHARKAWI, F.
Egypt

ELDER, D.
USA

ELDREDGE, L.
USA

ELIASSEN, A.
Norway

ELMGREN, R.
Sweden

ERNST, W.
Germany

EVANS, D.J.
USA

FARRINGTON, J.
USA

FERNICOLA, N.
Mexico

FIEDLER, H.
Germany

FISHER, N.
Monaco

FLECKSEDER, H.
Austria

FLOODGATE, G.D.
United Kingdom

FONTAINE, M.A.
France

FOWLER, S.
USA

FOYN, E.
Norway

FOYN, L.
Norway

FRIBERG, L.
Sweden

FUKAI, R.
Japan

FURTADO RAHDE, A.
Brazil

GALLOWAY, J.
USA

GARRETT, W.D.
USA

GARRETT, C.J.R.
Canada

GARZOLI, S.
USA

GELDREICH, E.E.
USA

GENOVESE, S.
Italy

GENTRY, C.R.
USA

GERARD, R.D.
USA

GILMOUR, A.
Australia

GOLDBERG, E.D.
USA

GOMEZ, E.D.
Philippines

GONZALES-ANGELES, V.L.
Mexico

GOODMAN, J.M.
USA

GORDEEV, V.V.
USSR

GRAY, J.
Norway

GURBUTT, P.
United Kingdom

HALIM, Y.
Egypt

HALSTEAD, B.W.
USA

HAMON, B.V.
Australia

HANN, Jr., R.W.
USA

HANN, R.H.
USA

HANSEN, D.J.
USA

HARGRAVE, R.
Canada

HARVEY, G.
USA

HARVEY, G.R.
Canada

HASSAN, E.M.
Canada

HASSE, L.
Germany

HAUG, D.
USA

HEGRE, C.S.
USA

HEIMANN, M.
Germany

HESPE, E.D.
USA

HICKS, B.
USA

HOFMANN, E.
USA

HOLDEN, A.V.
United Kingdom

HONGSKUL, V.
Thailand

HOWGATE, P.
United Kingdom

HOWELLS, G.
United Kingdom

HUNGSPREUGS, M.
Thailand

HUNTER, K.
New Zealand

JAMART, B.M.
Belgium

JEFFERY, P.G.
United Kingdom

JENSEN, S.
Sweden

JERNELOV, A.
Sweden

JICKELLS, T.
United Kingdom

JOHANNES, R.E.
USA

JOHNSTON, R.
United Kingdom

JOSEPH, J.
Germany

KAMATH, P.R.
India

KAPAUAN, A.
Philippines

KECKES, S.
Yugoslavia

KELLY, J.R.
USA

KETCHUM, B.H.
USA

KHALAF, F.I.
Kuwait

KITANO, M.
Japan

KLUG, W.
Germany

KNAP, A.H.
Bermuda

KOIKE, I.
Japan

KOROLEV, S.
USSR

KOROPALOV, V.
USSR

KORRINGA, P.
Netherlands

KOWALIK, Z.
Poland

KOYANAGI, T.
Japan

KUDRYAVTSEV, B.
USSR

KULLENBERG, G.
Denmark

KURELEC, B.
Yugoslavia

KUZMIC, M.
Yugoslavia

LA FONTAINE, A.
Belgium

LAKEY, R.
USA

LAL, D.
India

LAM, D.
Canada

LEFCOURT, P.
USA

LEVANDER, O.A.
USA

LEVINGS, C.D.
Canada

LEVY, E.M.
Canada

LEWIS, L.
USA

LISS, P.S.
United Kingdom

LLOYD, R.
United Kingdom

LOHANI, B.
Thailand

LONGHURST, A.R.
Canada

LOPUSKI, J.
Poland

MACLEAN, D.M.
Canada

MACLEOD, J.C.
Canada

MAGOS, L.P.A.
United Kingdom

MALMBERG, S.A.
Iceland

MARCHAND, P.
France

MARIETTA, M.G.
USA

MARINOV, U.
Israel

MARTIN, D.
France

MARTIN, J-.M.
France

MATSON, E.A.
USA

McINTYRE, A.D.
United Kingdom

MEE, L.D.
Mexico

MELLERGAARD, S.
Denmark

MENAD SIAHMED, S.
Algeria

MENDIA, L.
Italy

MERRETT, N.R.
United Kingdom

MERRILL, J.
USA

MEYERS, S.P.
USA

MIKHAILOV, V.
USSR

MILLER, J.
USA

MIRONOV, O.G.
USSR

MOLCARD, R.
France

MOORE, B.
United Kingdom

MORRIS, A.
United Kingdom

MORRISSETTE, M.
USA

MÜNNICH, K.O.
Germany

MURPHY, S.D.
USA

MYERS, E.P.
USA

NEEDLER, G.T.
Canada

NESTEROVA, M.
USSR

NICHOLS, J.A.
United Kingdom

NOVIKOV, YU. V.
USSR

NOZAKI, Y.
Japan

OAKLEY, H.R.
United Kingdom

OKUBO, K.
Japan

OLSSON, M.
Sweden

OSTERBERG, C.L.
USA

OSKARSSON, A.
Sweden

OTTO, L.
Netherlands

PALMORK, K.H.
Norway

PAYNE, J.F.
Canada

PEARCE, J.B.
USA

PEARSON, T.H.
United Kingdom

PIOTROWICZ, S.R.
USA

PIYAKARNCHANA, T.
Thailand

POLIKARPOV, G.G.
USSR

POOPETCH, T.
Thailand

PORTMANN, J.E.
United Kingdom

PRAVDIC, V.
Yugoslavia

PRESTON, A.
United Kingdom

PROSPERO, J.
USA

RAMACHANDRAN, C.P.
Malaysia

REINHARDT, K.H.
Germany

RIEKERT, L.
Germany

ROBINSON, A.R.
USA

RONEY, J.
USA

ROWE, G.
USA

REEDER, S.W.
Canada

RETAMAL, M.A.
Chile

RIBOLI, E.
France

RICHARDSON, K
Denmark

ROLFE, M.S.
United Kingdom

RONEY, J.
USA

ROWNTREE, P.R.
United Kingdom

RYABOSHAPKO, A.
USSR

SAAD, M.A.H.
Egypt

SALIBA, L.
Malta

SALO, A.
Finland

SATKUNANANTHAN, C.
Sri Lanka

SCHINK, D.
USA

SCHMIDTKE, N.W.
Canada

SCHNEIDER, B.
Germany

SCHNEIDER, E.
USA

SCHWARTZ, J.S.
USA

SEKI, H.
Japan

SEN GUPTA, R.
India

SHARRATT, M.
United Kingdom

SHELTON, R.G.J.
United Kingdom

SHEPHERD, J.
United Kingdom

SHUVAL, H.I.
Israel

SIEGENTHALER, U.
Switzerland

SIMONOV, A.I.
USSR

SIVALINGAM, P.M.
Malaysia

SMAGIN, V.
USSR

SMALE-ADAMS, B.
United Kingdom

SMITH, A.E.
USA

SNIDVONGS, K.
Thailand

SOEGIARTO, A.
Indonesia

SOUTHWARD, A.J.
United Kingdom

SPRAGUE, J.B.
Canada

STEELE, J.
USA

STEWART, R.W.
Canada

STIRN, J.
Yugoslavia

STRAUGHAN, D.
USA

STRIZHAK, Y.K.
USSR

STROHAL, P.
Yugoslavia

SUDYIN, A.
USSR

SWEERS, H.E.
Netherlands

SYLVESTER, R.O.
USA

SYVERSEN, T.
Norway

TAKAHASHI, M.
Japan

TEMPLETON, W.L.
USA

TENDRON, G.
France

THIEL, H.
Germany

TOMASSI, G.
Italy

THOMPSON, B.
France

THOMPSON, H.
USA

THORPE, S.A.
United Kingdom

TORTELL, P.
New Zealand

TRUHAUT, R.
France

TSUNOGAI, S.
Japan

TSURUGA, H.
Japan

TSYBAN, A.
USSR

TUREKIAN, K.K.
USA

TUTUWAN, E.J.B.
Cameroon

UI, J.
Japan

UTHE, J.F.
Canada

VAHTER, M.
Sweden

VAINIO, H
France

VALDEZ-ZAMUDIO, F.
Peru

van ESCH, G.J.
Netherlands

van der POT, B.
the Netherlands

van RIJN van ALKEMADE, J.W.
Netherlands

VELNER, H.
USSR

VERBOOM, G.K.
Netherlands

VIGLIANI, E.C.
Italy

VINOGRADOV, M.E.
USSR

WALDICHUK, M.
Canada

WALKER, J.D.
USA

WALTON, A.
Canada

WARDLEY-SMITH, J.
United Kingdom

WASTLER, T.A.
USA

WEBB, B.
United Kingdom

WEICHART, G.F.
Germany

WEINBERGER, L.W.
USA

WELLS, P.
Canada

WHELPDALE, D.M.
Canada

WHITFIELD, M.
United Kingdom

WIDDOWS, J.
United Kingdom

WILBOURN, J.D.
France

WILDE, P.
USA

WILSON, K.W.
United Kingdom

WINDOM, H.L.
USA

WOLLAST, R.
Belgium

WUERGLER, F.
Switzerland

YOSHIDA, T.
Japan

YU ZHOU, M.
China

YU GUO-HUI
China

ZAFIRIOU, O.C.
USA

ZITKO, V.
Canada

ZRAJEVSKIJ, I.
USSR

ANNEX VII

Secretaries of GESAMP

Administrative Secretaries:

LEPLAT, L. (IMO)
GESAMP I-II

SASAMURA, Y. (IMO)
GESAMP III-XIV

VOSKRESENSKY, K. (IMO)
GESAMP XVIII-XX

MOROZOV, A.(IMO)
GESAMP XV-XVII

Technical Secretaries:

ANDERSEN, N. (UNESCO)
GESAMP XIII

ANDREN, L. (FAO)
GESAMP II-IV

CALMET, D. (IAEA)
GESAMP XIX-XX

CAPURRO, L.R.A. (UNESCO)
GESAMP IV

CLEARY, G.J. (WHO)
GESAMP V

DALE, C.R. (WMO)
GESAMP I-II

DAWSON, R. (UNESCO)
GESAMP XIV, XV

FEDOROV, K.N. (UNESCO)
GESAMP I

FORSTER, W.O. (IAEA)
GESAMP X-XI

GRIFFITHS, R. (UNESCO)
GESAMP V-VIII and XI

HAGEN, A. (IAEA)
GESAMP XIII-XVII

HELMER, R. (WHO)
GESAMP X, XII-XIV, XVI-XX

HESPE, A. (IAEA)
GESAMP II

HOLT, S.G. (UNESCO)
GESAMP II-III

KECKES, S. (UNEP)
GESAMP X-XX

KLIMOV, A. (IAEA)
GESAMP III-IV

KOSTJANOJ, G. (WMO)
GESAMP IV-V

KULLENBERG, G. (UNESCO)
GESAMP XVI-XX

LINSLEY, G. (IAEA)
GESAMP XVIII

MATTHEWS, G. (UN)
GESAMP III-V, XIX-XX

MIZUNO, S. (WMO)
GESAMP III

MOLINARI, J.P.A. (IAEA)
GESAMP XII

NAEVE, H. (FAO)
GESAMP X-XX

NAUKE, M. (IMO)
GESAMP XI-XX

NEUMAN, L. (UN)
GESAMP VI-XVII

NISHIWAKI, Y. (IAEA)
GESAMP V-VIII

OSTENBERG, C. (IAEA)
GESAMP IX

PAVANELLO, R. (WHO)
GESAMP II-III AND VI-IX

RUIVO, M. (FAO)
GESAMP I

SLACZKA, W. (UNESCO)
GESAMP IX-X

SMAGIN, V. (WMO)
GESAMP XI-XIV

SMITH, J. (WHO)
GESAMP XV

SOUDINE, A. (WMO)
GESAMP XV-XX

STEINER, E. (UN)
GESAMP XVIII

STRIJAK, E. (WHO)
GESAMP XI

TOMCZAK, G. (FAO)
GESAMP V-IX

TOMCZAK, G. (UNESCO)
GESAMP XII-XIII

VOUK, V. (WHO)
GESAMP IV

YOUNG, S.L.D. (IMO)
GESAMP I-X

ZRAJEVSKIJ, I. (WMO)
GESAMP VI-X

ABOUT THE AUTHOR

Herbert L. Windom is Professor of Oceanography at the Skidaway Institute of Oceanography, Savannah, Georgia, U.S.A, where he has been a member of staff since 1968. He was educated at the Florida State University (B.S., 1963) and the Scripps Institution of Oceanography (M.S., Ph.D., 1968).

Dr. Windom's research interests concern the transport of material from the continent to the oceans and biogeochemical processes that influence material exchange in ocean margins.