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CARING FOR THE SEA—ACCOMPLISHMENTS, ACTIVITIES AND FUTURE OF THE UNITED NATIONS GESAMP
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This document presents a summary of accomplishments and activities of GESAMP until 2002. It also discusses a way forward for GESAMP.

The document has been written by the past Chairman (1998-2000) and the current Chair and Vice-Chair of GESAMP.

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Recent development

Caring for the sea—accomplishments, activities and future of the United Nations GESAMP (the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection)

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Abstract

The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), established in 1969, is a scientific advisory body on marine pollution and marine environmental protection, sponsored by eight United Nations (UN) bodies (International Maritime Organization (IMO), Food and Agriculture Organization of the UN (FAO), United Nations Environment Programme (UNEP), World Health Organization (WHO), World Meteorological Organization (WMO), International Atomic Energy Agency (IAEA); United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Oceanographic Commission (IOC) and United Nations (NY) (UN)). The group provides scientific advice in five areas—assessment of the potential effects of marine contaminants; scientific basis for research and monitoring programs; international exchange of scientific information relevant to assessment and control of marine pollution; scientific principles for control and management of anthropogenic effects on the marine environment; and the scientific basis and criteria relating to legal instruments and other measures for prevention, control and abatement of marine pollution. In recent years, it has expanded its responsibility to include key topics related to marine environmental protection and integrated coastal management. Members are natural and social scientists, coastal managers and resource economists nominated by the sponsoring agencies but working in their individual capacity as

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marine specialists. Problems are technically reviewed and assessed through working groups composed of members and other specialists, drawing upon the world-wide oceanographic, marine science and coastal management communities. Members and working group specialists have come from over 50 countries. Since 1976, GESAMP has produced 47 reports on technical topics related to marine pollution, protection and conservation. The group has produced four global State of the Marine Environment reports. Its longest running working group evaluates the hazards of substances carried by ships for the MARPOL 73/78 Convention (Annexes II and III). Over its history, GESAMP has contributed to the landmark Stockholm Conference (1972), MARPOL 73/78, the UN Convention on Law of the Sea, the Bruntland Commission's report on sustainable development (1987), the Rio Conference (UNCED) and Agenda 21 (1992), and the Washington Declaration on LBA—land-based activities (1995). Its current program includes advice on the state of the marine environment (two reports published in 2001), oil inputs into the sea from sea-based activities, aquaculture in the context of IC(Z)M, hazards of harmful substances carried by ships, and endocrine disrupting compounds in marine ecosystems, and contributions to key ocean conferences.

1. Introduction

Many marine environmental indicators show that the sea in many parts of the world, especially in coastal areas, is in dire trouble. This situation is well known as it has been described many times, particularly recently [1–10]. As well, it is the topic of two recent GESAMP reports [11,12]. Many advances and improvements in marine environmental protection and conservation have occurred; however, the pace of change, human population movements and demands on the environment in many countries outstrip many of these advancements. Hence, the problems confronting the oceans continue. The solutions in many cases are elusive; they must be comprehensive, long-term and supported by both publics—"the land constituency and the oceans constituency" (Kullenberg, pers. comm.). Understanding the problems and issues, which are often complex and long-term, and developing new approaches to their resolution, is essential to progress. Such understanding and innovation to solving ocean problems has both natural science and social science components, captured now under the banner of integrated ocean and coastal management.

At the international level, the United Nations (UN) has many agencies and advisory groups involved in ocean issues. There are also independent international advisory groups and organizations. As noted by Holland [13], such groups have important roles of independent analysis and advice, representation of different viewpoints and stakeholders' interests, and assurance of opportunities for balanced and full review of problems and possible solutions.

One of the scientific advisory groups is the UN GESAMP. This paper describes GESAMP—its context, function, current and future projects, and products. The objective is to inform the reader and to solicit opinions and assistance for

strengthening GESAMP's operations and its capacity to provide timely advice and authoritative reviews of environmental protection issues confronting the oceans.

2. GESAMP in context

2.1. What is GESAMP?

GESAMP is a group of natural and social scientists sponsored by eight UN bodies (International Maritime Organization (IMO), Food and Agriculture Organization of the United Nations (FAO), United Nations Environment Programme (UNEP), World Health Organization (WHO), World Meteorological Organization (WMO), International Atomic Energy Agency (IAEA); United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Oceanographic Commission (IOC) and United Nations (NY) (UN)) to provide advice on marine environmental issues of concern to those bodies [14,15]. The sponsors appoint members according to the current GESAMP agenda and the need to maintain an appropriate disciplinary and geographical balance. Members act strictly in their personal capacities as marine specialists and not as representatives of their institutions, governments or sponsoring agencies. The Group first met in March 1969 at IMCO (now IMO) Headquarters in London.

2.2. What is GESAMP's mandate?

The GESAMP mechanism encourages collaboration and coordination of activities within the UN system on matters relating to marine environmental protection. Initially, the Group focused on scientific aspects of marine pollution as well as periodic assessments of the state of the marine environment. In 1993, its mandate was broadened to include almost any matter relating to the protection and management of marine living resources and ecosystems where there is a need for multi-disciplinary advice from the natural and social sciences. GESAMP meets annually to review its work program and to discuss emerging issues, while most substantive work is performed inter-sessionally by designated working groups. Working groups include invited marine specialists from around the world with the relevant expertise, and are chaired by a GESAMP member. During the 1999–2000 inter-sessional period, 39 experts from 22 countries participated in GESAMP working groups.

Most working groups have specific tasks that can be accomplished within one to three years, after which the group's report is reviewed and published and the group disbands. There are, however, two standing working groups, one charged with the preparation of Marine Environmental Assessments (MEAs) and the other addressing the Evaluation of Hazardous Substances (EHSs). The latter, established in 1974, develops hazard profiles for substances transported by ships; this work is conducted on behalf of IMO and in accordance with requirements of the MARPOL 73/78 Convention [16,17]. Two thousand and two hundred substances have been

evaluated to date and the list is expanded annually. In addition, GESAMP as a whole has had a pivotal role in many scientific decisions of the London Convention—1972 (Convention on the Prevention of Marine Pollution by the Dumping of Wastes or Other Matter 1972) (Engler, pers. comm.).

2.3. *What has GESAMP done?*

GESAMP has so far initiated 32 working groups and has published 71 volumes in its Reports and Studies series, including 21 meeting summaries. Its products range from in-depth reviews of important marine processes, perturbations and contaminant categories to advice on monitoring, assessment and modeling, and guidance on strategic aspects of marine environmental protection and management.

As shown in Table 2, GESAMP studies published from 1990 onwards have included extensive reviews on potentially harmful substances (e.g. organochlorines, carcinogens, oil and related chemicals), introduced species (e.g. the ctenophore *Mnemiopsis leidyi*) and impacts of coastal aquaculture. Forthcoming reports will examine oil inputs into the sea from sea-based activities, aquaculture in the context of ICM, updated methods for evaluation of harmful substances and endocrine disrupters in the marine environment. GESAMP studies have been published in scientific journals, summarized in conference presentations (see Further reading), and extensively cited (R.E. Cordes, unpubl. man., Dalh. Univ.). Reports on the health of the oceans and the role of the sea surface micro-layer in global change also have been produced in book form (see Further reading).

GESAMP's influence on policies and agreements for marine environmental protection have been just as important as its publications. The GESAMP definition of marine pollution,[2] developed for the Stockholm Conference on the Human Environment [18,19], has been the basis of definitions of pollution contained in various international agreements, including the UN Convention on the Law of the Sea (1982, 1994, see [20]) and all UN regional seas conventions.

GESAMP has made important contributions to international conferences, agreements and legal instruments. These include the MARPOL 73/78 Convention and Protocol [21], the 1982 Convention on the Law of the Sea [20], the report of the World Commission on Environment and Development or "Bruntland Report" [22], the 1992 UN Conference on Environment and Development (UNCED), especially Chapter 17 of Agenda 21 [23], and the Washington Declaration on Protection of the Marine Environment from Land-based Activities [24]. Of special relevance to the UNCED process were GESAMP's report on *The State of the Marine Environment* [1] and a specially commissioned research paper entitled *Some Reflections on Scientific Research on Marine Issues* [25].

[2] Marine pollution is "the introduction by man, directly or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as harm to living resources; hazards to human health; hindrance of marine activities including fishing; impairment of the quality for use of seawater; and reduction of amenities".

2.4. What is GESAMP currently doing?

GESAMP continues to provide advice by identifying issues, conducting working groups, and publishing reports, against a backdrop of a growing number of threats to the oceans and their deteriorating quality, and a chronic shortage of fiscal resources. It has embarked on a review of operations, and indeed its future as an effective scientific advisory group to the UN agencies (see below).

2.4.1. Identifying critical issues in marine environmental protection

At its 30th Session, in May 2000, GESAMP approved the final drafts of two new reports, published in Jan. 2001, on critical issues in marine environmental protection:

A Sea of Troubles. This report [11] was initiated by GESAMP on the state of the oceans, targeting decision makers and the public at large. It has seven chapters:

- The Changing Relationship between humanity and the oceans, focusing on the pressures and effects and changing perspectives.
- The State of the Waters, the Life in the Seas, and the Oceans and the Atmosphere, reviewing threats to the world's oceans under several categories (pollution, eutrophication, alteration in the flow of sediments, fisheries, alien species, habitat issues, global warming, ultraviolet light and nitrogen).
- The Land and Sea, describing the nature and consequences of particular categories of land-based activities, looking at urbanization, industry, agriculture, forestry and aquaculture, hydrological changes, commerce and transport, tourism, military activities and social conflict.
- The chapter on Action analyses the causes of failure for many global political initiatives. These include the failure of governments to provide enough political and financial commitment, and the lack of capability (capacity) that many governments have to take effective action even if desired, which are embedded in powerful social, political and economic driving forces. This chapter also addresses the role of science and policy, the risk and benefits of acting or not acting, and the need for an integrated approach to ocean management.
- The final chapter with a number of specific conclusions and recommendations.

This report presents "a stark picture of the deterioration of the seas and oceans. But all is not yet lost. There are still grounds for hope. The problems are becoming increasingly well understood; the solutions to them are increasingly being worked out. The gap between such knowledge and effective action is largely a matter of political will. What is needed is demonstrated public and political commitment, not merely in signing agreements and conventions, but in providing the resources to implement the remedies that are now so abundantly clear" [11].

Land-Based Sources and Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environment. This report [12] was initiated by UNEP as a contribution to the inter-governmental review meeting on implementation of the Washington Declaration (the Global Programme of Action for the

Protection of the Marine Environment from Land-Based Activities (GPA)), scheduled for November 2001. It has five substantive chapters on the impact of land-based activities on human and ecosystem health:

- Identification and assessment of problems—describes the causes, nature and severity of problems in the marine environment derived from land-based activities, primarily from scientific perspectives. The chapter deals with issues of long-standing nature.
- Emerging problems and new perspectives—covers emerging issues and those for which scientific assessments warrant re-evaluation in the report. Issues include the impact of marine environmental pollution on human health, climate and global change, changes of fixed nitrogen fluxes to the ocean, coral diseases and bleaching, endocrine-disrupting chemicals in the ocean, and submarine groundwater discharge to coastal waters.
- Regional perspectives—consider 15 regional programmes of action and regional strategies on land-based activities (their objectives, priorities and actions), ten of which were developed within the context of the GPA.
- Strategies and measures—focuses on the policies required for effective environmental management within a framework of common policy elements, including cross-sectoral, holistic management; rational, equitable and sustainable allocation of resources; clear commitment of both government and the public; poverty alleviation; and regional and global cooperation.
- Conclusions and priority actions—concludes that the economic costs of not taking action to control land-based activities are enormous and are escalating. At the global level, the most serious problems associated with land-based activities are physical alteration and destruction of habitats, sewage, nutrients and sediment mobilization. Litter, heavy metals, hydrocarbons and radionuclides, although often a high priority at local levels, are not considered to rank as priorities at the global level. Persistent organic pollutants are considered not to merit as high priority at the global level as the four top priorities.

Both reports [11,12] were prepared by the MEA Working Group, comprised of 15 experts from developing and developed countries, and supported by all GESAMP sponsoring agencies and the Advisory Committee on Protection of the Sea (ACOPS). The reports were exhaustively peer-reviewed by more than 70 specialists with different scientific backgrounds and by environmental managers and policy makers, from around the world.

As well, ten regional reports on the problems of the marine environment associated with land-based activities were analyzed. They were prepared and endorsed by Government-designated experts within the framework of the GPA and under the aegis of the UNEP Regional Seas Programme, together with numerous reports and other documentation from regional bodies not linked with UNEP and available scientific literature. The ten regional reports were the basic new information used for the two GESAMP reports.

Table 1
Matters of particular concern regarding the marine environment as identified by GESAMP

GESAMP XXVII 1997 (Nairobi)
Science
Deeper ocean drilling for petroleum and its impacts
Effects of fishing on the marine environment
The large marine ecosystem (LME) concept—need for a critical appraisal
Management
Management of wastes—impact on coastal seas of recent changes to the London Convention
Remediation of contaminated marine sediments—management options

GESAMP XXVIII 1998 (Geneva)[a]
Science
Placing pollution in context as an ocean stressor
Management
The need for better long-term marine surveillance and monitoring

GESAMP XXIX 1999 (London)
Science
Potential blindness in deep-dwelling bentho-pelagic species
Coral bleaching
Fertilization of the oceans
Environmental impact assessment in relation to offshore oil and gas exploration and exploitation
Investigations into the global disease burden and economic impacts of various human diseases associated with marine pollution
Human health risks posed by contaminated food
Synergism: what is meant by it
Management
Diverging global approaches to management of anthropogenic inputs of contaminants

GESAMP XXX 2000 (Monaco)
Science
Intentional fertilization of the coastal and pelagic ocean
Genetic interaction between farmed and wild fish stocks
The connection between ocean health and human health
Contamination from offshore oil and gas exploration
Coral reef degradation: new perspectives
Methane hydrates
Photo-oxidation products of PAHs and their toxicity
Carbon dioxide sequestration
Management
Assessment strategies for integrated coastal management
Methodologies for prioritizing marine environmental problems
Chemical classification and related terminology
Improved information on human activities affecting the marine environment
GESAMP definition of the terms "pollution" and "contamination"

[a]The "Oceans at Risk" paper [27,28] was completed at this session. It describes a number of threats to the oceans and what can be done about them.

2.4.2. Identifying emerging issues

During the past four meetings (1997–2000), a number of issues[3] have been tabled by GESAMP members as crucial ones for the world scientific and oceans management communities to address. These are called "matters of particular concern regarding degradation of the marine environment (Table 1). The issues raised cover a wide range of topics, including technical methods (e.g. for biomonitoring), specific problems facing the sea, and management and legal concerns. Their consideration by members and the GESAMP Technical Secretaries, often leads to either scoping papers or full working group analyses and reviews (see Section 2.4.3).

2.4.3. Conducting working groups (2000–2001)

GESAMP continues to have a very full agenda of working group activities, advice to prepare, and technical reports to complete.

Three working groups are continuing during the period 2000–2001:

Working Group 1—Evaluation of the hazards of harmful substances carried by ships (IMO, UNEP, FAO and WHO).

Working Group 31—Environmental impacts of coastal aquaculture (FAO, UNEP, UNESCO/IOC, WHO and International Union for the Conservation of Nature (or The World Conservation Union) (IUCN)).

Working Group 32—Estimates of oil entering the marine environment from sea-based activities (IMO and UNESCO/IOC).

Two working groups are waiting for fiscal resourcing before working:

Working Group 26—MEAs (all agencies).

Working Group 27—Endocrine disrupting substances in the aquatic environment: impacts on aquatic life and human health (IMO, WHO, FAO, UNEP and European Inland Fisheries Advisory Commission (EIFAC)).

As well, there will be three "scoping activities" in the inter-sessional period, to determine the feasability of future GESAMP studies. These are:

- identification of methodologies for ballast water management to minimize risks of alien species transfer;
- a review of aquatic environmental hazard assessment methods for application in seafood safety risk assessment and management;
- a review of intentional fertilization of the coastal and pelagic ocean (in cooperation with the International Council for Science (formerly Scientific Unions) (ICSU)—Scientific Committee on Oceanic Research (SCOR)).

2.4.4. Publishing reports

A number of recent GESAMP reports show the range of topics that have been the attention of GESAMP, all priorities to the agencies (Table 2). These reports often lead to other publications (see Further reading) and presentations and advice in

[3] Many of these also are described in the two states of the marine environment reports, now published, January 2001 [11,12].

Table 2
A selection of GESAMP Reports and Studies in the 1990s

1993	Impact of oil and related chemicals and wastes on the marine environment. GESAMP Reports and Studies No. 50
1994	Guidelines for MEA. GESAMP Reports and Studies No. 54
1995	Biological indicators and their use in the measurement of the condition of the marine environment. GESAMP Reports and Studies No. 55
1995	The sea surface micro-layer and its role in global change. GESAMP Reports and Studies No. 59
1996	Monitoring of ecological effects of aquaculture wastes. GESAMP Reports and Studies No. 57
1996	The contributions of science to integrated coastal management. GESAMP Reports and Studies No. 61
1997	The invasion of the ctenophore *M. leidyi* in the Black Sea. GESAMP Reports and Studies No. 58
1997	Marine biodiversity: patterns, threats and conservation methods. GESAMP Reports and Studies No. 62
1997	Towards safe and effective use of chemicals in coastal aquaculture. GESAMP Reports and Studies No. 65
2000	Planning and management for sustainable coastal aquaculture development. GESAMP Reports and Studies No. 68 (in press)

various fora. For example, the "impact of oil" report [26] was in high demand as a background document for environmental impact assessment and effects monitoring associated with the offshore oil and gas industry in Atlantic Canada. Demand in the same region has been equally high for the aquaculture impacts reports, given the current high activity in salmonid aquaculture in inshore embayments. Reports have been widely used by NGOs such as the Worldwatch Institute, World Wildlife Fund, Greenpeace and numerous others.

2.4.5. Review of the GESAMP mechanism

An independent evaluation of every aspect of the GESAMP group, from operational procedures to a review of achievements and the impact, use and benefits of its reports and advice, was conducted during the inter-sessional period 2000–2001, and was presented at GESAMP XXXI in August 2001. This review was much needed, considering the 32 years of GESAMP conduct, and the rapidly changing marine science, information technology and marine policy worlds. It had the support of all GESAMP members and sponsoring agencies. Following the review's recommendations, GESAMP will continue to flourish with new organization, members and operating procedures, and a revitalized way of doing its work.

3. The way ahead for GESAMP

There is abundant evidence that marine ecosystems throughout the world are suffering from chemical change, habitat destruction and resource depletion

stemming from human activities [10–12]. However, scientific knowledge and advice will not, by themselves, solve such problems. The causes are far deeper than this; it is well recognized that any effective long-term solution will be multi-faceted—political, social, economic, legal and technical. But science has a vital role to play in understanding the nature, extent and consequences of environmental and ecological change, in isolating the critical factors involved, and in determining its significance for marine ecosystems and human welfare. Reliable scientific advice is the key to effective environmental management, especially for establishing priorities and evaluating options, and is essential in formulating environmental policy.

GESAMP's unique structure and working procedures assist the Group in examining properties and conditions of the marine environment from a global perspective. Thus, GESAMP is ideally suited to investigating fundamental, often ubiquitous, features of marine ecosystems that are high in the scale of ecological importance and sensitive to human intervention. As shown by the reports in Table 2 and Further reading, GESAMP and its working groups also can identify the most common and serious problems facing the marine environment as well as priorities for remedial measures. The discussions and reports of GESAMP are particularly important in focusing global and regional programs for marine environmental protection.

The change in GESAMP's mandate in the early 1990s was significant in two ways. First, it was a declaration by GESAMP and its sponsors that pollution is no longer the only, or even most important, problem facing the marine environment. The impacts of fishing and over-fishing and continuing losses of aquatic habitat and biodiversity are stark reminders of this. Second, it recognized that effective action to protect and conserve the marine environment is inseparable from carefully planned economic and social development, the concept underlying the widely adopted policy of sustainable development [22]. Accordingly, GESAMP continues to build its expertise in fields such as economics, social science, public health, environmental policy, and integrated coastal management. This facilitates a multi-disciplinary approach to problem analysis and the formulation of advice on marine environmental issues.

GESAMP is open to collaboration with other international groups and programs addressing marine environmental issues. One of its members is active in the ACOPS. It is contributing to the UNEP/GEF Global International Waters Assessment (GIWA) which will identify priority issues affecting the quality of trans-boundary waters (river basins and associated coastal areas) internationally, and interventions required at national, regional and global levels. GESAMP also is investigating the feasability of joint studies of the nitrogen inputs issue with the ICSU Scientific Committee on Oceanic Research (SCOR) and on the significance of endocrine disrupting compounds (EDCs) in aquatic ecosystems with the EIFAC. It has also assisted the National Research Council (USA) in its review of the inputs and fate of oil in North American waters. Most recently, it has contributed to the Global Conference on Oceans and Coasts at Rio + 10 (Paris, December 2001), and ongoing discussions of the land-based activities issue.

GESAMP has broadened its deliberations to encompass the social sciences and more management-oriented issues. The question now arises as to how best to

package and disseminate its reports. Many readers will be familiar with the Reports and Studies series in which the majority of GESAMP reports have been published to date, many of them aimed at the more specialized reader. Although freely available from GESAMP's sponsoring agencies, and now being mounted on the Web (http://gesamp.imo.org), reports in this series or their abstracts may not reach the managers, policy makers and applied scientists around the world to whom many of them are addressed. Articles such as this may, indeed, be one important way of describing activities and announcing new reports, but other active means (such as the Web) are under consideration.

Caring for the sea (oceans and coasts) and ensuring its sustainability requires our collective efforts and commitment, now and in the future. The authors and the GESAMP Secretariat (London, UK) would greatly welcome suggestions on any matters raised above on the activities and way ahead for GESAMP.

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