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MEMORANDUM

TO: All Members of the World Commission on Environment
and Development

FROM: Jim MacNeill
Secretary General

DATE: 13 February, 1987

RE: Chapter 10

The attached draft of Chapter 10 has been revised as a result of previous discussion by the Commissioners and an extensive peer review process.

ACTION REQUIRED: For Discussion and Approval

CHAPTER 10

MANAGING THE COMMONS

	paras
(opening paragraphs untitled)	1-5
I. Antarctica : Building on Achievements	6-21
1. Guard Present Achievement	22-25
2. Anticipate Pressures for Mineral Development	26-31
3. Promote Evolution of Antarctic Treaty System	32-35
4. Establish a Means for More Effective Communication	36-40
II. Oceans: The Balance of Life	41-45
1. The Balance Under Threat	46-51
2. Improve Regimes for Oceans Management	52-58
2.1 Strengthen Capacity for National Action	59-61
2.2 Strengthen Fisheries Management	62-74
2.3 Reinforce Cooperation on Regional Seas	75-80
2.4 Strengthen Measures to Control Ocean Disposal of Waste	81-90
2.5 Advance the Law of the Sea	91-99
2.6 Establish an International Ocean Forum	100-105
III. Space: A Key to Sustainable Development	106-107
1. Monitoring the Biosphere from Space	108-117
2. Conflicts over the Geosynchronous Orbit	118-131
3. The Pollution of Orbital Space	132-142
4. Nuclear Power in Orbit	143-148
5. Towards a Space Regime	149-157

	Box	page
10-1 Antarctica's Unique Legal Status		5

	Table
10-1 World Fish Catch in Major Fisheries, 1979-84	25

CHAPTER 10

MANAGING THE COMMONS

1. The traditional forms of national sovereignty are increasingly contradicted by the realities of ecological and economic interdependence.^{1/} Nowhere is this more true than in shared ecosystems and in 'the global commons' – those parts of the planet that fall outside national jurisdictions. Here, sustainable development can be secured only through international cooperation and agreed regimes for surveillance, development, and management in the common interest. But at stake is not just the sustainable development of shared ecosystems and the commons, but of all nations whose development depends to a greater or lesser extent on their rational management.

2. The classical description of 'the tragedy of the commons' tells of herders keeping cattle on a limited pasture open to the use of all.^{2/} Each herder, acting rationally, would add to the pasture an animal beyond the total number that the land can sustain. The proceeds from its eventual sale, which go to the herder, outweigh the loss brought on by overgrazing, which is shared among all who use the pasture. This rational individual choice brings eventual ruin to all.

3. By the same token, without agreed, equitable, and enforceable rules governing the rights and duties of states in respect of the global commons, the pressure of

demands on finite resources will destroy their ecological integrity over time. Future generations will be impoverished, and the people who suffer most will be those who live in poor states that can least assert their own claims in a free-for-all.

4. Management of the various commons - Antarctica, the oceans, and outer space - is at different stages of evolution, as is the very 'commonality' of these areas. Antarctica has been protected for over a quarter of a century by a binding Treaty; however, its restricted membership excludes some states that feel they should participate in its management.

5. In the Law of the Sea, the international community has developed one of the most ambitious and advanced of international conventions ever for the seas and the sea-bed. But the refusal of a small number of countries to submit to a multilateral regime they helped negotiate is blocking implementation of certain key aspects. Boundaries have been drawn on the oceans that separate the common seas from national Exclusive Economic Zones (EEZ), but as the common and claimed waters form inter-locked ecological and economic systems, and as the health of one depends on the health of the other, both are discussed in this chapter. As for outer space, the least tapped global commons, discussion of joint management has only just begun.

I. ANTARCTICA: BUILDING ON ACHIEVEMENTS

6. The Antarctic continent - larger than the United States and Mexico combined - for over a generation has been managed under a regime that is an example of enlightened international cooperation and environmental

protection. Signed on 1 December 1959, the Antarctic Treaty has been the vehicle for a number of important initiatives in pursuit of its two primary objectives: to maintain Antarctica for peaceful uses only, prohibiting all military activities, weapons testing, nuclear explosions, and disposal of radioactive wastes; and to promote freedom of scientific investigation in Antarctica and international cooperation to that end.^{3/}

7. The fact that the 'question of Antarctica' is today on the UN agenda indicates how quickly and completely perspectives can change under the combined pressures of economic, technological, environmental, and other trends. New initiatives to establish a regime for minerals exploitation, new interest among countries not previously involved in the future of the continent, and new questions about equitable management are presenting challenges that may reshape the political context of the continent within the next decade.^{4/}

8. During the forthcoming period of inevitable change, the challenge is to ensure that Antarctica is managed in the interests of all humankind, in a manner that conserves its unique environment, preserves its value for scientific research, and retains its character as a demilitarized, non-nuclear zone of peace.

9. Responsibility for guiding change at present rests primarily with the countries party to the Antarctic Treaty.^{5/} Originally 12, now 18 nations enjoy full decision-making status under the Treaty, with these consultative parties exercising their rights and carrying out their obligations in peaceful cooperation despite their divergent views on the territorial claims to parts of the continent. Since 1983, an additional 14 nations have had observer status at the biennial Antarctic Treaty System meetings.

10. The Antarctic Treaty is open to accession by any state that is a member of the United Nations, and by others invited to accede. However, to become a Consultative Party, a state must demonstrate concrete interest in Antarctica by conducting substantial scientific research there.^{6/} Treaty Parties argue that this research criterion has been important in permitting Antarctic issues to be treated in a manner remarkably free of ideological or political considerations.

11. It is not generally agreed that Antarctica is part of the international commons. Seven states maintain territorial claims, and many developing countries reject the idea that what they regard as the 'common heritage of mankind' should be managed by some countries to the exclusion of others that lack the technological capacity to participate. Many of them see the Antarctic Treaty System (ATS) as the exclusive preserve of the rich and technologically advanced countries. Some object to what they consider the exclusivity of the Treaty System, with countries self-appointed to determine the future of the continent. Although the Consultative Parties assert that they have managed Antarctica in the interests of all peoples, several nations maintain that these interests cannot be defined exclusively by the Consultative Parties; this view has gained many new sources of expression since 1959.^{7/}

12. The Commission does not propose to adjudicate the status of Antarctica, but sees it as essential that the continent be managed and protected in a responsible manner that takes into account the common interests at stake. It notes also that the legal and management regimes are in the midst of a process of change.

13. The Antarctic Treaty Consultative Parties have demonstrated a strong concern for the protection of the continent's environment and the conservation of its natural resources. (See Box 10-1.) In 1964, they adopted the 'Agreed Measures for the Conservation of Antarctic Fauna and Flora',^{8/} which amount to a conservation protocol to the Treaty. At subsequent biennial meetings, they have continued to develop environmental principles and measures to guide the planning and execution of their activities. Additional measures would improve the scope and effectiveness of environmental protection, and it would be useful to consider means to ensure that the record of compliance with these measures is widely known.

BOX 10-1

Antarctica's Unique Legal Status

Under the Antarctic Treaty, the seven states claiming territory there have agreed with non-claimant parties to the Treaty to set aside the disputed territorial status of Antarctica in order to carry out agreed-upon activities in the area.

While the Treaty is in force, no acts or activities taking place will 'constitute a basis for asserting, supporting or denying a claim to territorial sovereignty in Antarctica', nor may any new claim, or enlargement of an existing claim, be asserted.

Decisions are taken by consensus, which guarantees to both claimant and non-claimant states that no activity or management practice prejudicial to their position on the territorial status of Antarctica will be approved. The Treaty provides for on-site inspection at any time in any or all areas of Antarctica by designated nationals of the consultative parties.

Source: Based on Lee Kimball, 'Testing the Great Experiment', Environment, September 1985.

14. The Consultative Parties have also played a leading role in the promulgation of two important international conventions relating to conservation of living resources: the 1972 Convention on the Conservation of Antarctic Seals and the 1980 Convention for the Conservation of Antarctic Marine Living Resources.^{9/} The second arose out of concern that the depletion of Antarctic fish stocks, particularly shrimp-like krill, could have severe and unpredictable effects on related and dependent species. It is remarkable in that it adopts an 'ecosystem approach' to resource management.^{10/}

15. Taken together, these legal instruments and accompanying protocols and recommendations, along with the non-governmental body the Scientific Committee on Antarctic Research (SCAR), constitute what is referred to as the Antarctic Treaty System. This system demonstrates the significant evolution that has taken place under the Antarctic Treaty since it entered into force.

16. Given these achievements, why has the Antarctic Regime come under attack? Some argue that its achievements stem from the fact that the Treaty System has confined itself to relatively narrow and uncontentious aspects of the continent's potential, mainly science, environment, and conservation. According to this view, more controversial issues, such as who will benefit from the mineral resources of the continent, are beginning to test the Treaty System, both internally and externally insofar as all states have an interest in them.^{11/} Also, the successful conclusion of the Law of the Sea Convention, which applies the principle of the 'common heritage of mankind' to sea-bed resources beyond national jurisdiction, raised hopes among some countries that the same principles would be extended to Antarctica.

17. Several international NGOs have begun to monitor the adequacy of and compliance with environmental protection and conservation measures in Antarctica. They have also sought observer status at ATS meetings and greater involvement in the formulation and review of Antarctic policies. Some UN agencies are concerned with southern hemisphere meteorology, oceanography, or fishing and have become involved in Antarctic science and politics. A concrete result of this interest has been invitations extended to WMO, FAO, IOC, IUCN, IWC, SCAR, and the Scientific Committee on Oceanic Research (SCOR) to attend as observers meetings of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). The European Economic Community (EEC) is also a CCAMLR member as a result of its member states ceding competence to it with respect to fisheries management policies.

18. In 1983, the Seventh Summit Conference of the Non-Aligned Countries included a paragraph on Antarctica in its communique. That same year, the question of Antarctica was put on the agenda of the UN General Assembly. The debate resulted in a consensus resolution asking for the elaboration of a special report by the Secretary General, which was debated by the United Nations General Assembly at its 39th Session in November 1984. The consensus has not been maintained. At subsequent General Assembly sessions, resolutions on Antarctica have been passed over the objections of the parties to the Treaty, most of whom chose not to participate in the vote.

19. Thus the political context of Antarctica is far more diverse today than it was in 1959 when the Treaty was concluded. A broader constituency of interests projects claims for participation in the management of

Some unique objects like Lake Baikal and Siberia, the Great Lakes in Africa and North America, are part of our global patrimony. They are some of the absolute values our planet possesses and their significance transcends any national boundaries. We should learn how to foresee their future and how to anticipate the after-effects of large-scale engineering projects.

Since people's interests vary, it cannot be taken for granted that people will accept scholars' recommendations and come to agreement on that score. And their agreement is of special importance in situations where global problems are involved and where the human race as a whole may be threatened with perils generated by the absence of such agreement.

What is needed today is the moulding of a new ethos and new arrangements for building an understanding among people, countries, and regions. And as a first step we should produce new knowledge, concentrate our research efforts on maintaining life on earth, and develop a system distributing and disseminating knowledge and new moral criteria in a way that makes it available to billions of people who inhabit our planet.

Academician N.N. Moiseev
WCED Public Hearing
Moscow, 8 Dec 1986

issues relating to Antarctica in order to ensure solutions responsive to global requirements. But the issue of Antarctica is not polarized between industrial and developing countries. Argentina, Brazil, Chile, China, India, and Uruguay have consultative status under the Treaty, and several additional developing countries have acceded to it. The present regime therefore provides a framework for equitable international management. How it will develop depends on many factors.

20. For the ATS to remain viable into the next century, it will need to continue to adapt itself to deal with new issues and new circumstances. Although the Treaty could run indefinitely, in 1991 any of the Consultative Parties may call for a general conference of the signatory nations to review its operation. To take effect, any amendments proposed at that Conference must be agreed to

by a majority of the contracting parties and ratified by all of the Consultative Parties. Any nation that does not ratify those amendments within two years of the Conference is free to withdraw from the Treaty and will no longer be obliged to abide by its terms.

21. How should the current management system and non-party states react to the growing economic and political interest in Antarctica and to the possible 1991 review? Clearly, a number of imperatives should be respected. These include the need to:

- * guard and augment present achievements;
- * anticipate pressures for minerals exploration and development, and either foreclose the potential for development at least for a time, or ensure that if and when it does proceed it does so under a regime that ensures strict protection for the environment and equitable sharing of possible revenues;
- * promote evolution of the Antarctic Treaty System to accommodate new interests and new participants;
- * establish a means for more effective communication, both at the governmental and non-governmental levels, with respect to the future of Antarctica.

1. Guard Present Achievements

22. Although further change in the management status of Antarctica is inevitable, it is essential that such change not jeopardize the four pillars of the present Treaty System: peace, science, conservation, and environment. Antarctica has been an agreed zone of peace for nearly 30 years, free of all military activities, nuclear tests, and radioactive wastes. A retreat on that

front for any reason would strike down a pillar on which humanity must build.

23. Cooperation in scientific investigation has steadily expanded; it must be further strengthened, especially concerning Antarctica's role in global atmospheric and oceanic circulation and world climate. At the same time, more efforts should be made to secure full participation in such research. The Treaty System's managers should explore means to expand consultation and participation and to extend the benefits of international cooperation in Antarctic science and technology to the international community as a whole.

24. Several suggestions along these lines have been made. They include the establishment of a fund to facilitate the participation of interested developing countries in Antarctic science, and inviting more scientists from developing nations to join projects and visit scientific stations. Given the costly technologies involved in Antarctic science, the Consultative Parties should also explore possibilities for sharing Antarctic base and logistics capabilities with interested non-consultative states. The right to consultative status could be extended to states participating in scientific activities on a joint basis.

25. As Antarctic activities multiply, sound conservation will also require increased data collection, monitoring, and environmental assessment. The interactive and cumulative effects of these projects must be carefully reviewed and areas of unique scientific and environmental value protected. Among other things, international panels to review, or even undertake prior assessments of the impacts of proposed projects on the Antarctic and global environment, should be instituted. If future problems are not anticipated, decision makers

will be caught off-guard without appropriate information, institutions, and procedures.

2. Anticipate Pressures for Mineral Development

26. The 18 Consultative Parties are conducting negotiations to complete, 'as a matter of urgency', an agreed legal framework for determining the acceptability of possible minerals exploration and development in Antarctica and to govern any such activities determined to be acceptable. Their decision to open negotiations on such a regime reflected a desire to maintain the tradition of cooperation in Antarctica and to protect the continent against the disruptive effects of intensified competition.^{12/} Treaty members felt that it would be more more difficult to agree on such a regime after actual finds have been made. The negotiations in many ways are an expression of the idea that prevention is better than cure, forethought preferable to afterthought.

27. Minerals of various kinds are known to exist in Antarctica, but the minerals talks have triggered false assumptions about the imminence of their development. Even given the most optimistic growth trends, it seems clear that more accessible sources will be developed elsewhere long before Antarctica attracts major investment. Only two minerals have been found that might exist in concentrations suitable for exploitation - coal in the Transantarctic Mountains and iron in the Prince Charles Mountains. Mining them would be a fool's venture.^{13/} The costs would be prohibitive, and sufficient coal and iron can be found closer to nations needing it.

28. Circumstantial evidence suggests the existence of offshore oil and gas, but no deposits have yet been

discovered. During the summer of 1980-81, the USSR, Japan, France, and the Federal Republic of Germany were all actively surveying Antarctica's continental shelves. The surveys were of a scientific nature, but were viewed by some observers as signalling commercial interests, coinciding as they did with the first serious discussions of a minerals regime.

29. Antarctica is an enormous continent where claims to sovereignty are in dispute and where there are no agreed legal bases for issuing licences, leasing or selling mineral rights, or receiving royalty payments. These delicate questions have now been raised and will not lie silent until they have been answered within an internationally agreed framework. Until these matters are resolved, and protection of the Antarctic environment is assured, it seems unlikely that any nation or group of nations will be able to invest securely in developing the continent's mineral resources.^{14/}

30. The Consultative Parties do not believe that a future minerals regime can be divorced from the Treaty approach that protects the positions of states with differing views on the territorial status of Antarctica. Nor do they believe that other fundamental elements of the Treaty System can be discarded or applied selectively for different purposes in Antarctica. There is time in which to negotiate. The parties are committed to finding ways to maintain the territorial freeze and sidestep the ownership question, while pursuing the monitoring, science, and technology that is a necessary precondition for determining whether mineral resource exploration and development could be worthwhile.

31. Given the absence of technologies tested in the ultimate extremities of Antarctic conditions, the lack of agreement on procedures to assess and take account of the

The most cruel environmental threat comes from the environmental movement itself as we see the animal rights laws systematically destroy our way of life and violate our right as aboriginal peoples to our traditions and values. Yet our people, including the Arctic people, need development. The challenge is to find strategies for development that meet the needs of the people and the environment.

Rhoda Inuksu
Inuit Indian
WCED Public Hearing
Ottawa, 26-27 May 1986

impacts of any development, and the sparse data base, it could take a generation or more of dedicated research and technological development to ensure that minerals exploitation would not destroy the Antarctic's fragile ecosystem, and its place in global environmental processes. Thus it is important that no minerals activity takes place until these conditions have changed, and then only in consonance with a regime that guarantees implementation of the most stringent standards needed to protect the continent's environment.

3. Promote Evolution of Antarctic Treaty System

32. In the years ahead, activities in Antarctica will expand in kind and scale, as will the numbers of participants in such activities. Further efforts must be made to ensure effective management of those activities and an orderly expansion of participation in such management. These goals might be achieved through the negotiation of an entirely new treaty system, but success in that direction seems unlikely.

33. More effective management, including expanded participation, could evolve piecemeal in a reactive manner through the existing Treaty System. But given the

extent of probable change and the lure of mineral wealth, however remote, such an approach could be too slow to retain political support. Moreover, the result could be no more representative than the present system, reinforcing demands for negotiation of an entirely new system, with all its dangers.

34. A more effective alternative would be to intensify efforts to make the Treaty System more open and responsive to expressions of concrete concern and interest in Antarctica. There are many fairly easy ways in which this could be done; several have already been mentioned. The non-consultative parties already take part as observers in Antarctic Treaty meetings, in the minerals negotiations, and in meetings under CCAMLR. They participate in most discussions and may submit information documents. They may not take part in decision making as such, but the consensual nature of the process means that this distinction need not be great in practice.

35. Representatives of international organizations have been accorded observer status under CCAMLR, and the biennial consultative meetings may invite such observers in the near future. By providing a channel for communication between their more extensive membership networks and the Consultative Parties, these meetings can be particularly valuable in broadening participation. Moreover, countries challenging the existing system have made it clear that they will pay special heed to the development of the observer role as it applies both to non-consultative states and to international organizations.

4. Establish a Means for
More Effective Communication

36. As activities under the different treaties increase, so does the importance of coordination among the advisory and decision-making authorities responsible for various areas. Antarctica may require the establishment of somewhat more formal institutions than have governed the first generation of activities, in order to foster better communication and coordination both within and outside the Treaty System.

37. Antarctica is on the agenda of the UN General Assembly and will probably remain so. Nothing will happen, however, unless the participants in the debate find terms of reference that can command broad-based support and an agreed-upon means to explore and give effect to improved management.

38. To focus on longer-term strategies to preserve and build on the objectives of the existing Treaty System, nations must create the means to foster dialogue among politicians, scientists, environmentalists, and industries from countries within and outside it. A good place to start would be the development of closer working relationships between the parties to Antarctic regimes and the international organizations within and outside the UN system that have responsibilities for science and technology, conservation, and environmental management.

39. National policy processes could also be structured to provide for dialogue with concerned industries, public interest organizations, and expert advisors, perhaps through an Antarctic advisory committee. The U.S. Government has been in the forefront of those countries appointing industry and public interest advisors to its

delegations to Consultative Parties meetings. Australia, New Zealand, and Denmark have more recently followed suit.

40. Hammering out an internationally supported consensus on Antarctica while keeping the territorial bear in hibernation is a huge task requiring time and patience. And the lure of minerals increases with every new rumour of a find. Yet such a consensus is the only way to prevent a tragic plundering of the silent continent, and to maintain Antarctica as a symbol of peaceful international cooperation and environmental protection.

II. OCEANS: THE BALANCE OF LIFE

41. In the Earth's wheel of life, the oceans provide the balance. Covering over 70 per cent of the planet's surface, they play a critical role in maintaining its life-support systems, in moderating its climate, and in sustaining animals and plants, including minute, oxygen-producing phytoplankton. They provide protein, transportation, energy, employment, recreation, and other economic, social, and cultural activities.

42. The oceans also provide the ultimate sink for the by-products of human activities. Huge, closed septic tanks, they receive wastes from cities, farms, and industries via sewage outfalls, dumping from barges and ships, coastal run-off, river discharge, and even atmospheric transport. In the last few decades, the growth of the world economy, the burgeoning demand for food and fuel, and accumulating discharges of wastes have begun to press against the bountiful limits of the oceans.

43. The oceans are marked by a fundamental unity from which there is no escape. The interconnected cycles of energy, climate, marine living resources, and human activities move through coastal waters, regional seas, and the closed oceans. The effects of urban, industrial, and agricultural growth are contained within no nation's exclusive economic zone; they pass through currents of water and air from nation to nation, and through complex food chains from species to species, distributing the burdens of development, if not the benefits, to both rich and poor.

44. Only the high seas outside of national jurisdiction are truly 'commons'; but fish species, pollution, and other effects of economic development do not respect these legal boundaries. Sound management of the ocean commons will require management of land-based activities as well. Five zones bear on this management: inland areas, which affect the oceans mostly via rivers; coastal lands - swamps, marshes, and so on - close to the sea, where human activities can directly affect the adjacent waters; coastal waters - estuaries, lagoons, and shallow waters generally - where the effects of land-based activities are dominant; offshore waters, out roughly to the edge of the continental shelf; and the high seas, largely beyond the 200-mile Exclusive Economic Zones of coastal states' control.

45. Major fisheries are found mostly in offshore waters, while pollution affecting them comes mostly from inland sources and is concentrated in coastal waters. Formal international management is essential in the areas beyond the EEZs, although greater international cooperation, including improved frameworks to coordinate national action, is needed for all areas.

1. The Balance Under Threat

46. Today, the living resources of the sea are under threat from overexploitation, pollution, and land-based development. Most major familiar fish stocks throughout the waters over the continental shelves, which provide 95 per cent of the world's fish catch, are now threatened by overfishing.

47. Other threats are more concentrated. The effects of pollution and land development are most severe in coastal waters and semi-enclosed seas along the world's shore-lines. The use of coastal areas for settlement, industry, energy facilities, and recreation will accelerate, as will the upstream manipulation of estuarine river systems through dams or diversion for agriculture and municipal water supplies. These pressures have destroyed estuarine habitats as irrevocably as direct dredging, filling, or paving. Shore-lines and their resources will suffer ever increasing damage if current, business-as-usual approaches to policy, management, and institutions continue.

48. Certain coastal and offshore waters are especially vulnerable to ecologically insensitive onshore development, to competitive overfishing (one of the more obvious tragedies of the commons), and to pollution. The trends are of special concern in developing countries, where coastal pollution by domestic sewage, industrial wastes, and pesticide and fertilizer run-off may threaten not only human health but also the development of fisheries. Adding to these pressures is the new threat of flooding by rising sea levels due to climate change. The rise projected over the next 40 to 60 years could

wipe out a large proportion of the world's most productive habitats.^{15/}

49. Even the high seas are beginning to show some signs of stress from the billions of tons of contaminants added each year. Pollution brought to the oceans by great rivers such as the Amazon can be traced for as much as 2,000 kilometres out to sea.^{16/} Heavy metals from coal-burning plants and some industrial processes also reach the oceans via the atmosphere. The amount of oil spilled annually from tankers now approaches 1.5 million tons.^{17/} The marine environment, exposed to nuclear radiation from past nuclear weapons tests, is receiving more exposure from the continuing disposal of low-level radioactive wastes.

50. New evidence of a possible rapid depletion of the ozone layer and a consequent increase in ultraviolet radiation poses a threat not only to human health but to ocean life. Some scientists believe that this radiation could kill sensitive phytoplankton and fish larvae floating near the ocean's surface, damaging ocean food chains and possibly disrupting planetary support systems.^{18/}

51. High concentrations of substances such as heavy metals, organochlorines, and petroleum have been found on the oceans' surface. With continued accumulation, these could have complex and long-lasting effects, but the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) has as yet found no serious damage to this critical interface.^{19/} The sea-floor is a region of complex physical, chemical, and biological activity where microbial processes play a major role, but as yet serious damage is known to have occurred only in very localized regions. Although both findings are encouraging, given accelerating pressures and the

inadequacy of present data, they provide no grounds for complacency.

2. Improve Regimes for Oceans Management

52. Looking to the next century, the Commission is convinced that sustainable development, if not survival itself, depends on significant advances in the management of the oceans. The mounting pressures on coastal and offshore waters and the high seas could seriously threaten the oceans' planetary balancing role. If this is to be avoided, significant changes will be required in our institutions and policies and more resources will have to be committed to oceans management.

53. Three imperatives lie at the heart of the oceans management question:

- * the major land-based threats to the oceans require effective national actions based on international cooperation;
- * the shared resource characteristics of many regional seas make forms of regional management mandatory;
- * the underlying unity of the oceans require effective global management regimes.

54. National action is key to all efforts to manage the oceans. But given the interdependent nature of the resources, international cooperation is essential to stimulate, assist, and provide a framework for national actions. The two are mutually reinforcing, both positively and negatively.

55. This mutual dependence has increased in recent years. The Law of the Sea Convention, with the establishment of the 200-mile EEZs, has put an additional 35 per cent of the planet's surface under national jurisdictions. It has also provided an institutional setting that could lead to better management of these areas, given that single governments may be expected to manage more rationally resources over which they have sole control. However, this expectation ignores the realities of short-sighted political and economic goals.

56. An international ecosystem approach is required for the management of these resources for sustained use. Significant gains have been made in past decades, nationally and internationally, and many essential components have been put in place. But nowhere do they add up to a system that reflects the imperatives mentioned above. Few coastal nations have the information base, let alone the legal and institutional capacity, to construct a regime for the integrated management of their Exclusive Economic Zone and the related inland areas. Where the EEZs of several states come together in semi-enclosed or regional seas, integrated management requires varying degrees of international cooperation, such as joint monitoring and research on migratory species and measures to combat pollution and regulate actions whose effects reach across boundaries.

57. When it comes to the high seas beyond national jurisdiction, international action is essential to integrated management for sustainable development. But there is as yet no body of agreed concepts and principles on which to construct an integrated management regime for the oceans. The sum of the multiple conventions and programmes now in place do not and cannot represent such

The opinion of the public is what you see here in this room. You see important leaders from all over Brazil, from all over the country that have come here, from the rubbermen that was under a palmtree yesterday and was here speaking to the U.N. Commission and leaders that are independent. The Brazilian population yearned to have someone to speak to. Someone who will listen, who will not sort of mystify things, and someone who will not trick them. So there is an enormous expectation with regards to the seriousness of your Commission.

Randau Marques
Journalist
WCED Public Hearing
Sao Paulo, 28/29 Oct 1985

a regime. Even the separate UN programmes are not coordinated and, given the structure of the United Nations, cannot be coordinated.^{20/}

58. The Commission believes that a number of actions are urgently needed to improve regimes for oceans management. Thus the Commission proposes measures to:

- * strengthen capacity for national action, especially in developing countries;
- * improve fisheries management;
- * reinforce cooperation in semi-enclosed and regional seas;
- * strengthen control of ocean disposal of hazardous and nuclear wastes;
- * advance the Law of the Sea; and
- * establish an international ocean forum.

2.1 Strengthen Capacity for National Action

59. Coastal governments should launch an urgent review of the legal and institutional requirements for integrated management of their EEZs, and of their roles in arrangements for international cooperation. This review should be undertaken within the framework of a clear statement of national goals and priorities. Reducing overexploitation of fisheries in coastal and offshore waters might be one such goal. The rapid clean-up of municipal and industrial pollution discharging into critical marine habitats could be another. Others might include strengthening national research and management capacity, and producing an inventory of coastal and marine resources.

60. Given the increased pressures on coastal and marine resources projected through the year 2000, all coastal states should have a complete inventory of these assets. Drawing on senior experts from national and international agencies, nations could deploy the latest satellite mapping and other techniques to put together an inventory of these resources and then monitor changes in them. Contingency plans for areas that may be flooded over the next generation as a result of rising sea levels could then be prepared.

61. Many developing countries will require assistance to strengthen their legal and institutional frameworks needed for integrated management of coastal resources. Many small island and maritime developing countries lack the economic or military means to prevent the theft of their coastal resources or the pollution of their waters by powerful countries or companies. This has become a major concern in the Pacific in particular, and threatens the political stability of the region. International

development banks and development assistance agencies should establish programmes to support the development of this institutional capacity.

2.2 Strengthen Fisheries Management

62. World fisheries have been expanding since World War II, with the global catch rising at a steady 6-7 per cent annually from 20 million to 65 million tons between 1950 and 1969. But after 1970, as more and more stocks were depleted, the growth in annual catches fell to only about 1 per cent (see Table 10-1). With conventional management practices, the growth era in fisheries is over. Even assuming restored productivity in now depleted stocks, and an increased harvest from underutilized fisheries, FAO sees only a gradual increase in catches, perhaps rising from current levels of over 80 million tons to about 100 million. This does not augur well for future food security, especially in low-income countries where fish are a principal source of animal protein and where millions secure their livelihoods from fisheries activities.^{21/}

63. Overexploitation threatens many stocks as economic resources. Several of the world's largest fisheries - the Peruvian anchoveta, several North Atlantic herring stocks, and Californian sardine - have collapsed following periods of heavy fishing. In some of the areas affected by these collapses, and in other rich fisheries such as the Gulf of Thailand and off West Africa, heavy fishing has been followed by marked changes in species composition.^{22/} The reasons for these changes are not well understood, and more research is needed into the responses of marine resources to exploitation so that managers can receive better scientific advice. Greater support for such work is urgently needed, and this support must include additional assistance to developing countries in

TABLE 10-1						
World Fish Catch in Major Fisheries, 1979-84						
	1979	1980	1981	1982	1983	1984
(thousand tons)						
N. Atlantic	14,667	14,676	14,489	13,597	13,891	13,940
N. Pacific	20,303	20,733	21,908	22,603	23,666	26,416
Cent. Atlantic	6,064	6,867	6,833	7,239	7,210	7,164
Cent. Pacific	7,536	7,910	8,478	8,175	7,848	8,531
Indian Ocean	3,541	3,693	3,728	3,852	4,061	4,362
South Atlantic	4,420	3,895	4,037	4,340	4,314	3,957
South Pacific	7,242	6,619	7,240	8,328	6,724	8,684
Inland	7,240	7,603	8,138	8,455	9,131	9,716
Total*	71,014	71,996	74,850	76,590	76,846	82,770
Developed	37,143	38,234	38,890	39,265	39,991	42,412
Developing	33,871	33,758	35,961	37,326	36,855	40,358
Developing countries catch as per cent of world total	47.7	46.9	48.0	48.7	48.0	48.8
*Columns do not add to totals due to rounding. Source: Based on data in FAO, <u>Yearbooks of Fishery Statistics</u> (Rome: 1979-84).						

increasing their research capacity and their knowledge of their own resources.

64. One factor leading to the establishment of extended EEZs was the concern of coastal states, both industrialized and developing, over the depletion of fisheries off their coasts. A large number of

conventions had been established covering most major fisheries, but they proved inadequate in most cases. Participating countries were in general unable to overcome the difficulties of allocating shares to limited common resources. Improved management was seen as an urgent need, and open access was perceived as the main obstacle to it.

65. The advent of extended EEZs under the Law of the Sea Convention was expected to solve or at least alleviate the problem. Coastal states were required to introduce effective conservation and management of the living resources in their EEZs. They could also control the activities of foreign fishers and develop their own fisheries.

66. Industrial countries have been much more successful in doing this than developing countries. In the north-west Atlantic, the annual catch by long-range fleets has declined from over 2 million tons before 1974 to around a quarter of a million tons in 1983, and the share of the catch taken by the United States and Canada has risen from under 50 per cent to over 90 per cent.

67. Yet long-range industrial fishing fleets still catch about 5 million tons annually in developing regions.^{23/} Off West Africa, for example, over half the total catch is still taken by such fleets. This is due partly to the fact that many of the biggest resources lie off thinly populated areas - the western edge of the Sahara and off Namibia. But it is also due to the common lack of locally available capital, and to a shortage of local expertise in many technical aspects of fisheries, especially processing and marketing.

68. Coastal developing countries can usually obtain some modest revenue in the form of licence fees, but this

represents only a fraction of what they could earn from a full national use of the resource. Another 10-15 million tons of so far underutilized or unexploited resources could be added to the existing fisheries off their coasts. There is a pressing need for these resources to be managed sustainably, for the benefit of developing countries and in ways that help to meet global nutritional needs.

69. The damage that can be done by unsustainable exploitation has been dramatized in the history of commercial whaling. The story of successive overexploitation of different whale stocks as the factory fleets roamed the world's oceans is well known. Recent improvements in the state of stocks offer lessons for future marine management.

70. In its early days, the International Whaling Commission, the main international body regulating whaling, was dominated by whaling nations. After 1979, non-whaling nations became an increasingly significant majority of the membership. This change was reflected in the Commission's decisions, which increasingly opted in cases of scientific doubt for a cautious approach and the reduction of catch levels or the cessation of whaling altogether on certain stocks.

71. This trend culminated in the moratorium decision of 1985. Members had the right to object and continue commercial whaling or to catch whales for scientific purposes. The allowance for scientific whaling can be used as a loophole by whaling nations; and permissions for such hunting should be stringently applied by IWC members, or the commission's credibility will be undermined.

72. An important political factor in recent developments has been the ability of the U.S. Government to invoke legislation that enables contracts for fishing in U.S. waters to be withheld from nations that undermine marine conservation agreements. The value of such fishery concessions is large and the legislation has significant political and economic leverage. Another important factor has been the strength of the NGOs in organizing support for anti-whaling actions, lobbying governments and organizing boycotts of fish and other products from whaling nations.

73. By early 1987, whaling was restricted to scientific catches by Iceland and Korea; a small catch by Norway, which continued to object to the moratorium, but which planned to halt its commercial whaling following the 1987 season; and catches by Japan and the Soviet Union. The Soviet Union had indicated it would observe the 1985 moratorium after the 1987 Antarctic season, and Japan had withdrawn its objection to the moratorium with effect from 1988. Japan had indicated, however, that it may continue scientific whaling.^{24/} In addition, some whaling was being performed by native peoples in Alaska and the Soviet Union.

74. Commercial whaling is no longer a major threat to the conservation of whale stocks. The annual rate of increase of these stocks, however, is unlikely to exceed a few per cent. Thus substantial whale populations will probably not be observed much before the second half of the next century.

2.3 Reinforce Cooperation on Regional Seas

75. A large number of agreements have been entered into on regional seas, and many have been effective. The

Commission has not attempted to evaluate them all, but given the Commission's origin in the UNEP Governing Council and the General Assembly resolution, it has given special attention to UNEP's Regional Seas Programme. This programme now brings together over 130 states bordering 11 different shared seas around the world, states that have an interest in cooperating for their own and mutual benefit.

76. UNEP provides the initial impetus by bringing governments together to develop a flexible legal framework within which further agreements can be negotiated as needs require and politics allow. UNEP also provides some initial seed money for programme development, but the governments of the region themselves are meant to take over funding and management, drawing on the technical advice of UN and other agencies. The result is a gradually evolving action-oriented programme rooted in the needs of the regions as perceived by the governments concerned. Fourteen UN agencies and over 40 international and regional organizations participate in the worldwide programme.

77. Prevention of pollution through the promotion of sound onshore development is a major goal of the programme. Over four-fifths of the pollution burden of the Mediterranean, where the first UNEP Action Plan got under way in 1976, is from land-based sources. When governments adopted the Caribbean Action Plan in 1981, they emphasized coastal-zone management^{25/} and development planning in the Caribbean islands so as to permit the tourist industry to expand in a manner less destructive to the natural resources that attract vacationers. Future damages avoided as a result of ecologically sound planning of coastal development and the adoption of less polluting technologies could turn

out to be the greatest long-term benefits of the Regional Seas Programme.

78. The Regional Seas Programme has helped bridge the gap between governments and scientific communities. Expanding networks of cooperation have been created in different regions (such as 84 laboratories in the Mediterranean, 39 in the South-east Pacific, and so on). The coordination of work by these national institutions is often a breakthrough in itself; but, more importantly, it can provide an agreed scientific basis for necessary pollution control actions.

79. The political strategy behind the programme and the requirement that management and financing be undertaken by the participating countries have clearly been crucial to its success. The inspired leadership and staff expertise for the programme was also important. Unfortunately, this was abruptly undermined in 1985 when 20 of the 22 staff members resigned following a decision to transfer the Geneva-based operation to Nairobi.

80. This set-back has to be overcome to confront the regional seas challenge through the year 2000: how to move beyond general agreement on goals and research to a solid schedule of investment on a scale that will make a difference. It is one thing to contribute a few million dollars for research, quite another to incorporate the resulting findings into land-based development plans and to enforce strong pollution control programmes. The massive U.S.-Canadian clean-up of the Great Lakes over the past 15 years cost \$8.85 billion for partial treatment of municipal and industrial wastes.^{26/} Huge investments will also be required to roll back land-based pollution along UNEP's regional seas. Yet nowhere have the sums been committed under agreed schedules to construct the necessary urban and industrial pollution

control systems and to underwrite policies to control agricultural run-off.

2.4 Strengthen Measures to Control Ocean Disposal of Waste

81. The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention, or LDC) was concluded in November 1972 and entered into force on August 30, 1975.^{27/} Its political evolution parallels that of the International Whaling Commission. Initially, it consisted largely of dumping states; but non-dumping states are now in the majority. At present it has 61 contracting parties, and secretariat facilities are provided by the International Maritime Organization.

82. The dumping of wastes is regulated by the three annexes to the Convention:^{28/} on extremely dangerous substances including high-level radioactive wastes, the dumping of which is prohibited, (Annex I); on somewhat less noxious substances, the dumping of which can be permitted only by 'prior special permit' (Annex II); and all other substances that can be dumped only after a general permit has been obtained from national authorities (Annex III). Although the Convention applies to all wastes dumped deliberately at sea, the ocean disposal of radioactive wastes has attracted the most attention. It is this question that the Commission considers here.

83. Prior to 1983, the United Kingdom, Switzerland, Belgium, and the Netherlands had been dumping low-level wastes regularly at the North-east Atlantic dumpsite in international waters off the coast of Spain. Despite protestations from representatives of these nations at the LDC meeting that they would ignore a moratorium resolution on low-level wastes and carry out dumping

Why must we gamble with the lives of innocent children in order to generate plutonium for bombs? Even to contemplate dumping radioactive waste in waters that belong to all of us as part of our global heritage is an outrage. For us to make such important decisions on behalf of future generations without taking into account the morality of using international waters as an exclusive rubbish bin is an arrogant act.

Peter Wilkinson
Greenpeace
WCED Public Hearing
Oslo, 24-25 June 1985

during 1983, a 'de facto' moratorium - which all countries honour but to which some have not formally agreed - went into and remains in effect. Some states expressed uncertainty as to whether the Convention covers the placing of high-level radioactive wastes and other matter in the sea-bed itself by drilling or other techniques. A consensus was reached, however, that the LDC is the appropriate international forum to address this question, and that no disposal should take place until it can be demonstrated that it is environmentally safe.

84. In 1985, the LDC voted to extend indefinitely the moratorium on the ocean dumping of low-level radioactive wastes.^{29/} The resolution called for consideration of political, legal, economic, and social aspects, in addition to the results of scientific research, before ocean dumping can be resumed. As a result, the burden of proof that such activities are safe was effectively reversed, being put on those nations who want to dump. This revolutionary reversal, though not binding, reflects the changed composition of the LDC.

85. In 1986, the LDC established an intergovernmental panel of experts to examine the issue of comparative risks of land- and sea-based options for disposal of radioactive waste. Without prejudging this assessment, the Commission would urge all states to continue to refrain from disposing of either low- or high-level wastes at sea or in the sea-bed. Moreover, it would seem prudent to anticipate continuing opposition by the LDC to sea dumping and to actively pursue the siting and development of environmentally safe land-based methods of disposal.

86. Several other conventions regulate the dumping of wastes in the North-east Atlantic and North Sea, the Mediterranean Sea, and the Baltic Sea. Most of the Regional Seas Conventions also include a general provision calling on contracting parties to take all appropriate measures to prevent and reduce pollution caused by dumping.

87. Land-based sources of nuclear waste have become significant in the Irish Sea, where high levels of radioactivity have been found in salmon, and could threaten other seas.^{30/} The Convention for the Prevention of Marine Pollution from Land-Based Sources (Paris Convention) was ratified in 1978 by eight states and the European Economic Community. While it has achieved some international cooperation, its silence on nuclear plants as such and its acceptance of the 'best available technology' principle in determining permitted levels of radioactive discharges clearly needs to be reviewed.

88. The Law of the Sea Convention requires states to establish national laws and regulations to 'prevent, reduce and control pollution of the marine environment

from dumping'. It also requires express prior approval by the coastal state for dumping in the territorial sea, the EEZs and onto the continental shelf. The legislative history of this Article indicates that coastal states have not only the right to act but a duty to do so. States also have an obligation under the Law of the Sea to ensure that their activities do not injure the health and environment of neighbouring states and the commons.

89. The Commission encourages the LDC to reaffirm the rights and responsibilities of states to control and regulate dumping within the 200-mile EEZ. It is urgent that they do so, as oceans and food chains respect no boundaries.

90. Moreover, all states should undertake to report all releases of toxic and radioactive substances from land-based sources into any body of water to the appropriate Convention Secretariat so that they may begin to report on the aggregate releases into various seas. Competent authorities must be designated to keep records of the nature and quantities of wastes dumped. Beyond that, regional institutions should forward this information to the LDC.

2.5 Advance the Law of the Sea

91. The United Nations Conference on the Law of the Sea was the most ambitious attempt ever to provide an internationally agreed regime for the management of the oceans. The resulting Convention represents a giant step towards an integrated management regime for the oceans. It has already encouraged national and international action to manage the oceans.^{31/}

92. The Convention reconciled widely divergent interests of states, and established the basis for a new

equity in the use of the oceans and their resources. It confirmed that coastal states are empowered to exercise sovereignty over their territorial sea, sea-bed, and subsoil, and the superjacent air space, up to a distance of 12 nautical miles. It redefined the rights of coastal states concerning the continental shelf. It established Exclusive Economic Zones of up to 200 nautical miles beyond the territorial sea within which the coastal state may exercise sovereign rights with regard to the management of national resources, living and non-living, in the waters, sea-bed, and subsoil.

93. The Convention removed 35 per cent of the oceans as a source of growing conflict between states. It stipulates that coastal states must ensure that the living resources of the EEZs are not endangered by overexploitation. Thus, governments now have not only the legal power and the self-interest to apply sound principles of resource management within this area, but they have an obligation to do so. The Convention calls for regional cooperation in formulating and implementing conservation and management strategies for living marine resources, including cooperation in the exchange of scientific information, the conservation and development of stocks, and the optimum use of highly migratory species.

94. Similarly, coastal states now have a clear interest in the sound management of the continental shelf and in the prevention of pollution from land- and sea-based activities. Under the Convention, coastal states may adopt laws and regulations for their EEZs compatible with international rules and standards to combat pollution from vessels.

95. The Convention also defines the waters, sea-bed, and subsoil beyond the limits of national jurisdiction,

and recognizes this as international. Over 45 per cent of the planet's surface, this sea-bed area and its resources are declared to be the 'common heritage of mankind', a concept that represents a milestone in the realm of international cooperation.

96. By early 1987, the Convention had been signed by 159 nations, and 32 countries had ratified it. However, in its present form a number of significant states are unlikely to ratify it.^{32/} The reasons for this rest largely with the regime proposed to manage the common sea-bed. The Convention would bring all mining activities in the sea-bed under the control of an International Seabed Authority. This proposal does not command the support of a number of countries.^{33/}

97. Despite this, many of the convention's other provisions have been broadly accepted and have already entered into international law and practice in various ways. This process should be encouraged, especially as regards those provisions that relate to the environment.

98. Yet given the vital need for an integrated regime for oceans management, it is urgent that further serious and constructive efforts be made to design a broad management regime, including a sea-bed regime, that will command complete adherence. As technologies for deep-sea mining advance, the absence of law and rules governing such activity will pose an increasingly acute threat to human security. If the vacuum remains, it will be filled; each advanced technological power will occupy parts of this international heritage and manage it to its own benefit. Unregulated competition, here as elsewhere, would lead inevitably to least-cost approaches, using the oceans as a free dump. Within an agreed regime, on the other hand, development could be managed on behalf of the international community.

The world's environmental problems are greater than the sum of those in each country. Certainly, they can no longer be dealt with purely on a nation-state basis. The World Commission on Environment and Development must strike at this fundamental problem by recommending specific ways for countries to cooperate to surmount sovereignty, to embrace international instruments in order to deal with global threats. The growing trend towards isolationism demonstrates that the current rhythm of history is out of harmony with human aspirations, even with its chances for survival.

The challenge ahead is for us to transcend the self-interests of our respective nation-states so as to embrace a broader self-interest -- the survival of the human species in a threatened world.

Tom MacMillan
Canadian Minister of
Environment
WCED Public Hearing
Ottawa, 26-27 May 1986

99. In this regard, some thought should be given to re-examining the form of the sea-bed authority described in the Convention in order to see whether some improvements could not be made on the model that would enable it to command full support. At the same time, it would be useful to examine the scope of the regime to be managed by the authority. Should it be limited to minerals or should it have a broader responsibility for resource management? Should it also be given responsibility for environmental protection, or should these functions be handled by other, perhaps existing, institutions?

2.6 Establish an International Ocean Forum

100. Essential components of an ocean monitoring system are to be found in various regional and national networks. Scientists have made significant progress in understanding the ecological (physical, biological, and chemical) functioning of the marine environment, and have

measured some pollutants in some regions. But they have been unable to undertake any global assessments. Networks and coverage are uneven, and data remain sparse in many areas, especially in developing countries, where information is practically non-existent.

101. Knowledge of trends in the levels of various pollutants and of their cumulative impact on species, food chains, and critical balance points in the planet's support system is therefore woefully inadequate, nationally and globally. National agencies do not as a practice release, and international agencies have not been granted the authority and resources to receive, aggregate, and publish data on the daily releases of wastes and pollutants into oceans. It is not known, for example, how much radioactive waste is being released into the coastal and offshore waters around Europe, either directly or indirectly via rivers. The same is true of persistent chemicals and pesticides. The trends in these areas are unknown, as are the short and long-term effects on critical ecosystems.

102. If the planet's critical support systems are to be secured for the future, and utilized in ways that are sustainable over the long term, the information base for ocean management must be greatly strengthened. So must coordination between existing and new regional and national agencies, institutes, industries and others involved in the development and protection of the oceans.

103. Just as the consumption of fossil fuels and the destruction of forests is affecting the planet's climatic balance, so could the rising volumes of waste accumulating in the oceans threaten other critical thresholds of stability. We do not know. Given the enormous growth in population and economic activity

projected over the next few years, we need to know. Hence the Commission underlines the compelling urgency to bring the oceans beyond national jurisdiction into the framework of deliberate management.

104. Several governments have told the Commission that they would be prepared to convene special meetings to advance global goals on critical issues. This technique has worked well on acid pollution, for example, where Sweden, Canada, the Federal Republic of Germany, and other governments have convened meetings to secure ratification of the ECE Convention on Transboundary Air Pollution, and to secure commitment to specific targets for the reduction of sulphur oxide emissions. The Commission would propose that like-minded governments mount a similar effort to advance the Law of the Sea and to provide data to enable more efficient management of the oceans. .

105. Governments seldom move swiftly, even when their self-interest is clearly at stake, unless pushed or, better, led. There is a great need for an organized constituency for the oceans, a kind of International Ocean Forum, in which those most concerned with the sustained use of the oceans resources could participate in the design and development of a management regime. This should include not only governments and international organizations but also industry, academic and research institutes, and non-governmental environment and development organizations. All share a common goal in the sustainable use of the oceans and all have a critical role to play in achieving it.

III. SPACE: A KEY TO SUSTAINABLE DEVELOPMENT

106. The 'resource' of outer space can play a vital role in ensuring the continued habitability of the Earth, largely through space technology to monitor the vital signs of the planet and aid humans in protecting its health. According to the 1967 Treaty on the Peaceful Uses of Outer Space, orbital space around the planet is not the property of any power or group of powers but is a global commons that is a 'common heritage of mankind.' What happens there is the concern of all humanity.

107. The future of the space as a resource will depend not so much on technology but on the slow and difficult struggle to create sound international institutions to manage this resource. For space to contribute to sustainable development, a regime similar in some respects to those that regulate the use of airspace and the radio bands should be instituted.

1. Monitoring the Biosphere from Space

108. Satellites capable of monitoring vast reaches of the Earth from space can play a key role in the routine management of resource systems and in increasing human understanding of Earth systems. Only satellites can provide data about the upper atmosphere and about the sun's complex and fluctuating interaction with it. And satellites are the only affordable way to acquire data on the movements of the ocean, atmosphere, and biomass in remote regions of the planet.

109. If humanity is going to respond effectively to the consequences of changes human activity has induced - the

build-up of atmospheric carbon dioxide, depletion of stratospheric ozone, acid precipitation, and tropical forest destruction - better data on the Earth's natural systems will be essential. Indeed, such data will be needed to convince governments to make the major investments needed to respond to these problems.

110. Today several dozen satellites contribute to the accumulation of new knowledge about the Earth's systems, with perhaps the most important data coming from weather satellites.^{34/} As well as doing their daily work of providing data for forecasts, these satellites have yielded information on the spread of volcanic gases and dust from the eruption of a volcano in a remote region of Central America, enabling scientists for the first time to describe the specific links between a major natural disturbance of the upper atmosphere and changes in the weather thousands of miles away.^{35/}

111. Satellites also played a key scientific role after the 1986 discovery of a 'hole' in the ozone layer over Antarctica. After ground-based observers noted this phenomenon, archived satellite data were examined and provided a record of seasonal ozone fluctuation extending back nearly a decade.^{36/} And scientists have been able to follow closely the unfolding of the drought in the Sahel region of Africa in the 1980s. Satellite-generated maps correlating rainfall patterns and biomass have served as a tool in understanding droughts and helped in the targeting of relief aid.

112. The primary frustration about this wealth of data is that the information is dispersed among governments and institutions, rather than being pooled. UNEP's Global Environment Monitoring System (GEMS) is a modest effort to pool space data relevant to the Earth's habitability. But most such efforts are underfunded,

We need a kind of new earth/space monitoring system. I think that it goes farther than simply an earth environmental system. It's a combined earth/space monitoring system, a new agency that would have the resources to be able to monitor, report, and recommend in a very systematic way on the earth/space interaction that is so fundamental to a total ecological view of the biosphere.

Maxwell Cohen
International Joint Commission
WCED Public Hearing
Ottawa, 26-27 May 1986

undercoordinated, and inadequate to the tasks. Wide areas and important systems go largely unmonitored. The available technological capabilities are far in advance of what is actually being done in most cases.

113. As the biosphere and the non-living physical processes with which it interacts are indivisible and planetary in scale, no one nation or even bloc of nations operating alone can adequately study their properties. Recently, an international and interdisciplinary group of scientists has proposed a major new initiative - the International Geosphere Biosphere Project (IGBP) - to be coordinated through ICSU, whose membership includes the scientific academies of 71 countries.

114. This effort had its genesis at the 1982 UNISPACE Conference in Vienna, when NASA proposed a 'Global Habitability' study that caught the imagination of scientists attending from many countries. The IGBP initiative seems to be gaining momentum; it is already shaping the budget decisions of several nations on allocations for future satellite launches and is increasing coordination between existing efforts.

115. In early 1986, the 21st Assembly of ICSU approved a proposal, drafted by a committee representing the scientific academies of China, the USSR, the United States, and several other nations, to develop a comprehensive plan for global monitoring. Four years of planning and preparation are to precede the beginning of the actual effort in the 1990s.^{37/}

116. In any substantial international effort to monitor the Earth from space for scientific purposes, the following institutional questions must be answered: Who will formulate plans? How will projects be funded? How will hardware (satellites, launch vehicles, computers) be acquired? How will available resources be allocated between data collection (hardware-intensive) and data study (staff-intensive)? Should existing international organizations (such as ICSU or IIASA) be used or should new ones be created? To what degree will scientists run the programme or simply be its beneficiaries? These questions give rise to difficult policy choices.

117. The primary responsibility for choice rests initially with national governments, and while national programmes should be extended as rapidly as possible their effectiveness depends on more effective means for international cooperation. The IGBP could provide a framework within which such cooperation can be increasingly effective. With one set of agreed goals and priorities, nations can decide how and where they can contribute. An international institutional presence, perhaps an existing agency or body, could be designated initially to pool, store, and exchange data. Gradually, other institutions, national and international, would receive financial support to collect and study the data. In time, international efforts might be funded through some direct global revenue source or through contributions from individual nations. (See Chapter 12.)

2. Conflicts Over the Geosynchronous Orbit

118. From an economic point of view, the most valuable part of the Earth's orbital space is the geosynchronous orbit, a band of space 22,500 miles above the equator. When the speed of a satellite matches the speed of the planet's rotation, the satellite is stationary relative to particular places on the Earth. There is only one band or arc, directly above the equator, where it is possible to achieve geosynchronous orbit.

119. Most communication and many weather satellites - as well as many military ones - are in geosynchronous orbit, where their field of view can cover large areas. Just three communications satellites can provide coverage for all the Earth's surface except the polar circles. To prevent signals to and from the satellites interfering with one another, satellites must be placed some distance apart, effectively limiting the number that can use this valuable band to 180. Thus, the geosynchronous orbit is not only a valuable but also a scarce global resource.

120. The growth in satellite communication traffic during the 1970s led to many predictions that slots, particularly for satellites located over the Brazilian equator serving the North Atlantic region, would soon be saturated. Thus conflict emerged over the the use and ownership of the geosynchronous orbit, largely between industrial nations that have the capacity to put satellites in this orbit and the equatorial developing nations that do not but that lie beneath this band of space.

121. The first effort to devise a property regime for geosynchronous orbit was the 1976 Bogota Declaration signed by seven equatorial countries.^{38/} These

countries declared that the orbits above them were extensions of their territorial airspace. The Bogota Declaration has been generally rejected by nations active in space, who see it as contradicting the 'non-appropriation' principle of the Treaty on the Peaceful Uses of Outer Space.

122. During the 1970s, a loose coalition of developing countries, led by India, proposed a licensing system for the use of geosynchronous orbits.^{39/} Countries would be awarded slots that could then be sold, rented, or reserved for future use. The awarding of slots in such a plan is a difficult and contentious problem. However, a system guaranteeing countries not now active in space access to slots but permitting sale or rental to current users could perhaps be made both efficient and equitable. (Satellites last only about seven years, so turnover of slots could be fairly rapid.)

123. Some free-market economists have suggested schemes to establish defined rights and a market for these rights, arguing that such an approach would discourage less valuable uses, conserve the resource from waste, and encourage the development and utilization of technologies that could squeeze more benefit out of the resource. The slots' economic value depends upon complex factors that change over time, but one study estimated that users of communication satellites would be willing to pay \$500 million for the right to use the slots in geosynchronous orbit.^{40/}

124. Another way of managing this resource and capturing its rental value for the common interest would be for an international body to own and license the slots to bidders at an auction, with the proceeds used to fund international agencies or development projects. Such an alternative would be analogous to the Seabed Authority in the Law of the Sea Treaty.

125. Industrial countries have strenuously opposed the creation of a property rights regime for geosynchronous orbit, especially a regime that granted rights to slots to countries that cannot now use them. They argue that a regime of prior allocation would drive up costs and reduce the incentives of the private sector to develop and use this orbit.

126. A de facto regime for the parcelling out of slots in geosynchronous orbit has emerged through the activities of the International Telecommunications Union (ITU) in the past several years. The ITU allocates the use of the radio waves (those parts of the electromagnetic spectrum, that is, used for communication).^{41/} The highly technical character of the task of parcelling out radio waves, combined with the fact that strict compliance is necessary to allow any user to enjoy access to this resource, has produced a highly successful international resource regime.

127. The ITU decision-making process has been 'de-globalized' by handing the issue over to the ITU's three regional conferences to deal with problems arising in their regions (covering Europe, Africa, the USSR, Turkey, and Mongolia; North, Central, and South America; and Asia, Oceania, Australia, and New Zealand). These meetings have provided more a forum for hard bargaining among parties than a 'regime' in any real sense, but they have provided for effective management of the resource.^{42/}

128. This approach reduces negotiating complexity by involving fewer parties, and it permits regional differences to be reflected in regional settlements. But it reduces the coherence of resource allocation, and it lowers the chances of establishing a mechanism to capture

at least part of the value of the resource for the international community at large. Whether this approach will endure depends in large part upon the perceived justice of the decisions reached by the RARCs.

129. The geosynchronous orbit resource can be expanded through technological innovation: different frequencies can be used; more information can be crammed into the existing wavelengths; and new ways to differentiate the wavelengths can be devised - all at added cost and complexity.

130. There is also a growing body of evidence to suggest that the growth rate in the use of communication satellites may be slowing due to the increasing economic attractiveness of fibre optic cables, which will compete with satellites for high-volume traffic in business data, a growth sector that had been expected to employ satellites. Satellites will continue to be cost-effective for very long distance communications, for communications to sparsely populated areas, and for new applications such as direct broadcasting of television signals and broadcasting to mobile receivers.

131. It is impossible to predict future needs for satellites and specific orbits. Some industrial country experts argue that technological advances and changes can postpone into the indefinite future the need to establish a regulatory regime for geosynchronous orbit. Others who see a rapidly growing role for satellite communications argue that regulatory regimes should be established before competition makes such a step more difficult.

3. The Pollution of Orbital Space

132. Debris in orbit is a growing threat to human activities in space. In 1981, a panel of experts convened

by the American Institute of Aeronautics and Astronautics concluded that the growth of space debris could pose 'an unacceptable threat' to life in space within a decade.^{43/} Others have noted that if satellite numbers continue to grow at present rates, the probability of collision will become a virtual certainty.^{44/}

133. There are between 10,000 and 15,000 artificial objects in space large enough to be tracked from the Earth's surface, and several hundred million smaller but still hazardous pieces.^{45/} This debris consists of spent fuel tanks, rocket shells, satellites that no longer function, and shrapnel from explosions in space; it is concentrated in the region between 100 and 1,100 miles above the Earth.

134. Most debris is the result of more than 60 explosions in space. In 1970, for example, a U.S. Nimbus weather satellite blew up, yielding 318 trackable pieces of debris, and a myriad of smaller pieces. The debris in orbit is estimated to be increasing at a rate of slightly more than 10 per cent a year.^{46/}

135. Travelling at high velocities, typically around 10 kilometres a second, a very small object can cause major damage to a space vehicle. Several operating satellites are believed to have been destroyed by collisions with debris from manufactured objects. Although most debris poses little threat to the biosphere because it burns up in the atmosphere before striking the ground, it does pose a threat to human life in space. In 1983, a U.S. space shuttle suffered a large pit in its windshield when struck by a paint fleck that was subsequently traced to a rocket booster explosion 20 years earlier. Design of the U.S. space station is proceeding under the assumption that a collision with space debris is likely.^{47/}

Utilization of spacecraft for solving the problems of forestry provides a good example of the peaceful use of space. Taking into account the interests of the present and future generations, there is no other more favourable area of space technology application than environmental protection, to study the natural resources of Earth and control their rational utilization and reproduction. We think that in the forthcoming years international cooperation in this field will be further expanded.

L. E. Mikhailov
USSR State Committee on
Forestry
WCED Public Hearing
Moscow, 11 Dec 1986

136. Most space debris has been created by accident or by carelessness. With greater care in the design and disposal of satellites, much of it could be avoided. However, the creation of debris is an integral and unavoidable consequence of the testing and use of space weapons, and both the United States and the Soviet Union are involved in developing and testing anti-satellite (ASAT) weapons. The Soviet ASAT destroys targets by exploding in the vicinity of the target and the American ASAT by high-speed collision: both inevitably add substantial quantities of debris.

137. The contribution of military activities to the Earth's 'debris belt' could grow greatly if plans to place large numbers of satellite-based weapons and weapons-related sensors are realized. One important stratagem of large-scale space warfare is the destruction of satellites by placing clouds of small metal pellets or stones into their orbits. Any nation that felt threatened by the deployment of space-based weapons might decide the best defence would be to deny the regions of space of military importance to any user for the indefinite future. Creating such a belt of destruction

would be relatively cheap; it would also deny important regions of space to all other uses.^{48/} Furthermore, the chance destruction by space debris of a highly sensitive, military-related satellite during a superpower crisis could be mistakenly interpreted as the beginning of an attack and trigger the outbreak of war.^{49/}

138. Stopping the formation of debris is infinitely easier than cleaning it up once it has been created. When the 'debris belt' begins to thicken, collisions between larger pieces and smaller pieces will greatly increase the number of small pieces.

139. As with other forms of pollution, greater awareness coupled with simple housekeeping steps can also help ameliorate the problem. For example, when NASA discovered that a large number of spent booster tanks from Delta rockets were exploding in orbit, apparently because of small quantities of fuel left in the tanks, they took simple steps to assure that all the fuel was burned up.^{50/} This has greatly cut the proliferation of Delta debris.

140. Satellites can also be designed to move into less frequented orbits at the end of their useful lifetime - particularly important for the geosynchronous orbit, where crowding might become a problem. The European Space Agency has begun to equip its geosynchronous satellites with this capability.

141. The most important measure to minimize space debris, however, is to prevent the further testing and deployment of space-based weapons or weapons designed for use against objects in space. Thus far the international community has been little involved in these questions. But since the debris belt constitutes a threat to every nation's use of space, the question of space weapons can

and should be approached through a variety of international forums and treaties.

142. Clean-up would be expensive. It has been proposed that the superpowers lead an international effort to retrieve the larger pieces of space debris from orbit. Such work would involve the design, construction, and launch of vehicles that could manoeuvre in space and grapple with large, jagged, tumbling space objects. The proposal has elicited little enthusiasm.

4. Nuclear Power in Orbit

143. The United States has launched 23 spacecraft that relied at least in part upon nuclear power sources: one source was a reactor; the rest were radioactive materials the decay heat of which is converted into electricity (thermoelectric generators). By the end of 1986 the Soviet Union had launched 31 nuclear-powered spacecraft, almost all of which contained fission reactors, and it currently operates all of the reactor-powered satellites, which because of the larger volume of radioactive materials, constitutes the greatest threat of environmental contamination.^{51/}

144. Nearly 20 per cent of these satellites have failed in one way or another. Eight containing enriched uranium, plutonium, and fission by-products fell into the Earth's atmosphere from orbit or failed to achieve orbit. To date approximately 1,300 kilogrammes (2,860 pounds) of nuclear reactor fuel have been placed in orbit. The mass of contaminated reactor and other spacecraft materials associated with this fuel is many times as large.^{52/} Little of this material has yet re-entered the Earth's atmosphere.

145. Eight nuclear-powered space vehicles have re-entered the Earth's biosphere, the most widely publicized being the USSR's Cosmos 954, which crashed in Canada's Northwest Territories in 1978. The five-ton satellite left several thousands of pieces of debris, weighing a total of about 200 pounds, scattered over a wide arc of Canadian territory.

146. Efforts to set international standards for radioactive materials on satellites have been unsuccessful. Both the United States and the Soviet Union have increased the shielding around radioactive materials aboard satellites, and designed missions to send spent, but still very radioactive, satellites into higher, longer-lived orbits. Once there, the radioactive material will decay in the hundreds or thousands of years that it takes for the satellite to fall to the Earth. Such systems are far from fool-proof; both Cosmos 954 and another Soviet satellite, Cosmos 1402, malfunctioned and re-entered the Earth's atmosphere while being sent commands to move to a higher orbit. The unreliability of such methods seems inherent, since the satellite is being disposed of precisely because its systems have degraded to the point where they are no longer reliable.

147. There are two basic approaches to the problem: ban or regulate. The option of banning all radioactive materials from space is the simplest to enact. It would eliminate the problem and would also severely stunt the further development of space-based warfare systems. A total ban should exempt scientific uses in deep-space, as small amounts of fissionable materials have been essential for the powering of deep-space probes. A ban on reactors in space would be easy to monitor, because reactors produce waste heat detectable by infrared sensors at great distances. Verifying the absence of

small nuclear power systems would be more difficult, but still possible.

148. A wide variety of methods are available for regulating the use of radioactive materials in space. The most important include limiting the size of reactors permitted in orbit, requiring shielding around radioactive material sufficient to withstand re-entry into the Earth's atmosphere, and requiring deep-space disposal of spacecraft that contain radioactive material. All are technologically feasible, but would add cost and complexity to missions. Nevertheless, these measures should be implemented as a minimum step.

5. Towards a Space Regime

149. Soon after the aeroplane was invented, it became obvious that collisions would occur unless a general air traffic control regime was established. This model offers a useful way to think about the need for and contents of a space regime. The creation of 'Rules of the Road' for orbital space could ensure that the activities of some do not degrade the resource for all.

150. The creation of such a regime does not imply the general regulation of the actual uses of space, just as the existence of air traffic control regimes does not mean control over who flies where for what purpose. Far from reducing or controlling other uses, such a regime would permit the greatest feasible diversity and number of activities, which in the absence of such a regime would be constrained by a limited set of activities.

151. Orbital space cannot be effectively managed by any one country acting alone. The inherently international character of orbital space has been recognized by a majority of nations. Article 1 of the Outer Space Treaty

states: 'The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit of and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.' To help translate this unfulfilled vision into reality, the international community should seek to design and implement a space regime to ensure that space remains a peaceful environment for the benefit of all.

152. Despite the Treaty's promise that space would be used for peaceful purposes, its uses for military purposes has continued to grow. Space weaponry has an impact beyond the realms of military strategy and beyond the countries in conflict. The arming of orbital space is a direct threat to the continued utility of the space environment generally. Because space is so indivisible, and because irresponsible activities there so readily spill over to obstruct other uses, the ability of space to contribute to sustainable development depends on the extent to which certain activities are restrained.

153. Since the uses of orbital space are diverse and no general plan or overarching regulatory regime will be appropriate for the foreseeable future, the establishment of comprehensive regimes can result in inflexible solutions. Ad hoc and use-specific solutions should be pursued wherever possible.

154. An essential step towards efficient management of the space resource is to abandon the notion that because outer space in general is unlimited, orbital space can absorb all human activity. Because of the speeds involved, orbital space is for practical purposes much 'closer' than the atmosphere. A system of space traffic control in which some activities were forbidden and

others harmonized cuts a middle path between the extremes of a sole Space Authority and the present near anarchy.

155. Establishing a space traffic control regime would extend international governance into orbital space, but such an extension would not be unprecedented. Already the electromagnetic spectrum has been effectively regulated by international agreement, and through this regulation has begun to emerge the beginnings of a space regime for geosynchronous orbital space. An extension of this type of approach to control debris and the use of nuclear materials in orbit is the next logical step.

156. The creation of a space traffic control regime to govern orbital space need not require a treaty governing all activities there. And a new treaty need not deal with all the areas of potential conflict. Instead, a space regime can emerge gradually through prudential response to problems. In contrast, the Moon Treaty of 1976 sought to regulate activity far in advance of any clear idea of what that activity might be.

157. A fine balance must be struck between regulating activities too late and regulating non-existent activities too soon. Regulating activities on the Moon beyond the general principles laid out in the Outer Space Treaty is clearly premature. But regulating space debris and nuclear materials in Earth orbit is clearly overdue.

CHAPTER 10 - FOOTNOTES

- 1/ WCED wishes to thank J. Beddington, F. Burhenne-Guilmin, B. Jasani, L. Kimball, J. Logsdon, E. Mann Borgese, B. Mitchell, J. Nye, and R. Sagdeev for their reviews of this chapter.
- 2/ G. Hardin, 'The Tragedy of the Commons', Science, 13 December 1968.
- 3/ 'Antarctic: A Continent in Transition', Fact Sheet Folio, International Institute for Environment and Development, London, 1986.
- 4/ Lee Kimball, 'Testing the Great Experiment', Environment, September 1985.
- 5/ The Antarctic Treaty (reference U.N. official source)
- 6/ They include the original seven claimants: Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom; an additional five who were original signatories: Belgium, Japan, South Africa, USSR and the United States; plus six who have since acceded to the Treaty and become full Consultative Parties: Poland (1977), the Federal Republic of Germany (1981), Brazil and India (1983), and China and Uruguay (1985). Any country can accede to the Treaty, becoming a full 'Consultative Party' providing, and during such time as, it demonstrates an interest in the continent through the presence of a substantial scientific activity. To date, six countries have acceded on this basis: Brazil, The Federal Republic of Germany, India, Poland, China, and Uruguay. Eighteen other countries have acceded to the Treaty, but do not hold consultative status. Since 1983, they have been invited to attend Antarctic Treaty meetings as observers.
- 7/ Both in their declaration of principles concerning the environment and in the text of the Convention for the Conservation of Antarctic Marine Living Resources, the Consultative Parties insist that the primary responsibility for these matters lies with them by virtue of their status as Consultative Parties, a proposition that Parties to the Convention who are not also Parties to the Treaty are obliged to affirm.
- 8/ Agreed Measures for the Conservation of Antarctic Fauna and Flora (reference U.N. official source)
- 9/ Convention for the Conservation of Antarctic Seals (reference U.N. official source); Convention for the Conservation of Antarctic Marine Living Resources (reference U.N. official source). See also James N.

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- 10/ John R. Beddington and Robert M. May, 'The Harvesting of Interacting Species in a Natural Ecosystem', Scientific American, November 1982.
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- 16/ M. W. Holdgate et al., 'The Marine Environment', in The World Environment 1972-1982 (Dublin: Tycooly International Publishing Ltd., 1982).
- 17/ see National Academy of Sciences, Oil in the Sea (Washington, DC: National Academy Press, 1985); and OECD, Maritime Transport, 1984 (Paris: 1985).
- 18/ 'Scientists Closer to Identifying Cause of Antarctic Ozone Depletion', National Science Foundation News, 20 October 1986; Ad Hoc Working Group of Legal and Technical Experts for the Elaboration of a Protocol on the Control of Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer (Vienna Group), 'Report of the Second Part of the Workshop on the Control of Chlorofluorocarbons, Leesburg, USA', UNEP/WG.151/Background 2, Na.86-2184, UNEP, Nairobi, 15 October 1986; A.S. Miller and I.M. Mintzer, The Sky Is the Limit: Strategies for Protecting the Ozone Layer, WRI Research Report No. 3 (Washington, DC: World Resources Institute, 1986).
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- 21/ E. P. Eckholm, Down to Earth (London: Pluto Press, Ltd., 1982).
- 22/ J. A. Gulland and S. Garcia, 'Observed Patterns in Multispecies Fisheries,' in R. M. May (ed.), Exploitation of Marine Communities (Berlin: Springer-Verlag, 1984); FAO, 'Review of the State of World Fishery Resources, Fisheries Circular 710 (rev. 4), Rome, 1985.
- 23/ FAO, op. cit.
- 24/ IWC, Report of the IWC 36th Session, 1986 (Cambridge: forthcoming).
- 25/ F. Szekely, Massachusetts Institute of Technology, 'The Marine and Coastal Environment', prepared for WCED, 1986.
- 26/ 1985 Report on Great Lakes Water Quality; Great Lakes Water Quality Board Report to the International Joint Commission (Windsor, Ont.: IJC, 1985).
- 27/ IMO, 'The Provisions of the London Dumping Convention, 1972', and Decisions made by the Consultative Meetings of Contracting Parties, 1975-1984.
- 28/ Dumping in the Convention means any deliberate disposal at sea of material and substances of any kind, form, or description from vessels, aircraft, platform, or other artificial structures, as well as the disposal of vessels, aircraft, platforms, or other artificial structures themselves.
- 29/ Twenty-five nations, led by Spain, Australia, and New Zealand, supported the resolution, while Canada, France, South Africa, Switzerland, the United Kingdom, and the United States voted against.
- 30/ Source to be provided
- 31/ United Nations. Final Act of the Third Conference on the Law of the Sea. Montego Bay, Jamaica, December 1982. In its final form, the Convention is composed of 17 main parts (320 articles), dealing with the territorial sea and contiguous zone; straits used for international navigation; archipelagic states; exclusive economic zone; continental shelf; high seas; regime of islands; enclosed or semi-enclosed seas; right of access of land-locked states to and from the sea and freedom of transit; the area, protection, and preservation of the marine environment; marine scientific research; development and transfer of

marine technology; settlement of disputes; general provisions; and final provisions. There are nine annexes to the Convention: highly migratory species; Commission on the Limits of the Continental Shelf; basic conditions of prospecting; exploration and exploitation; statute of the International Tribunal for the Law of the Sea; Statute of the Enterprise; conciliations; arbitration; and special arbitration and participation by international organizations. Under the Convention, coastal states may adopt laws and regulations in the EEZ compatible with international rules and standards to combat pollution from vessels.

- 32/ Declaration by the President of the United States, Ronald Reagan, made on 9 July, 1982 on the reasons of the United States for not signing the Law of the Sea Convention: "On January 29 of this year (1982) I reaffirmed the United States' commitment to the multilateral process for reaching agreement on such a treaty ..." and he announced "... that we will return to the negotiations and seek to correct unacceptable elements in the deep seabed mining part of the draft Convention. ... On the 30th(January), the Conference adopted a Convention that does not satisfy the objectives sought by the United States. ... We have now completed a review of that Convention ... Our review recognizes, however, that the deep seabed mining part of the Convention does not meet U.S. objectives. For this reason, I am announcing today that the US will not sign the Convention as adopted by the Conference." (as quoted in Wireless Bulletin 129, dated 12.7.82 issued by the U.S. Embassy in Bonn, FRG).

Following a Cabinet decision, the Federal Republic of Germany announced its decision not to sign the L.O.S. Convention on 27 November, 1984. The same decision was taken by the United Kingdom on 6 December, 1984.

Statement by the FRG: "My government will continue to work with other countries to bring about the seabed mining regime that will eventually make the L.O.S. Convention acceptable to all states. Statement by the United Kingdom: "I wish to emphasize, as my delegation did in 1982, that the search for a consensus must continue. It remains the sole wish of the United Kingdom to see the development of provisions relating to the seabed mining which can be accepted by consensus among the whole international community." (United Nations General Assembly debate on 13 December 1984 on Resolution L 35 on the Law of the Sea Convention).

Declarations made by States upon signature of the L.O.S. Convention: Belgium, France, Italy, Luxemburg, and EEC all expressed the view that part 11 of the Convention contains considerable deficiencies and flaws which require correction. They either implied or stated explicitly that

their countries would not ratify the Convention if these flaws were not rectified within the preparatory committee stage. (L.O.S. Bulletin No 5, July 1985, issued by the Office of the Special Representative of the Secretary General for the Law of the Sea Convention)

- 33/ reference to be completed
- 34/ A good overview is provided in: World Meteorological Organization, Satellites in Meteorology, Oceanography, and Hydrology (Geneva: 1982).
- 35/ W. Sullivan, 'Eruption in Mexico Tied to Climate Shift off Peru,' New York Times, 12 December 1982.
- 36/ R. Kerr, 'Taking Shots at Ozone Hole Theories,' Science, 14 November 1986.
- 37/ M. Waldrop, 'An Inquiry Into the State of the Earth,' Science, 5 October 1984, and 'Washington Embraces Global Earth Sciences', Science, 5 September 1986; J. Lowndes, 'International Team to Design Earth Observation System', Aviation Week and Space Technology, 4 August 1986.
- 38/ The general case for a regulatory regime and several alternative regimes is spelled out in K. G. Gibbons, 'Orbital Saturation: The Necessity for International Regulation of Geosynchronous Orbits', California Western International Law Journal, Winter 1979.
- 39/ A summary of Third World views is found in H. J. Levin, 'Orbit and Spectrum Resource Strategies: Third World Demands', Telecommunications Policy, June 1981.
- 40/ reference to be provided.
- 41/ The allocation is done every 10 years at World Administrative Radio Conferences (WARCs), the last of which was held in 1979. U.S. Congress, Office of Technology Assessment, Radiofrequency Use and Management: Impacts from the World Administrative Radio Conference of 1979 (Washington DC: U.S. Government Printing Office, 1980).
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- 43/ AIAA Technical Committee on Space Systems, Space Debris, July 1981.
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- 50/ reference to be provided.
- 51/ G.L. Bennett et al., 'Development and Use of Nuclear Power Sources for Space Applications', Journal of Astronautical Sciences, October/December 1981; R. T. Reese and C. Vick, 'Soviet Nuclear Powered Satellites', Journal of the British Interplanetary Society, Vol. 36, 1983, pp. 457-62.
- 52/ S. Aftergood, 'Nuclear Space Mishaps and Star Wars', Bulletin of the Atomic Scientists, October 1986.