UNEP

CBD

CONVENTION ON
BIOLOGICAL DIVERSITY

Distr.
GENERAL

UNEP/CBD/SBSTTA/3/Inf.25
25 August 1997

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL
AND TECHNOLOGICAL ADVICE
Third Meeting
Montreal, Canada
1 to 5 September 1997

Marine Biological Diversity
Context, Status and Approaches to Protection

This paper was prepared by the Intergovernmental Oceanographic Commission as contribution to the implementation of the Jakarta Mandate

/...

Third Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice
to the Convention on Biological Diversity
Montreal, Canada, 1 - 5 September, 1997

Marine Biological Diversity
Context, Status and Approaches to Protection

Paper prepared by the IOC Secretariat
July, 1997

Pursuant to the Memorandum of Cooperation between the Convention on Biological Diversity (CBD) and the Intergovernmental Oceanographic Commission (IOC) in July, 1997, this paper provides scientific information and advice regarding the topic of marine biodiversity. The Memorandum of Cooperation specifies exchange of information and co-ordination of activities (Articles II and III respectively) as cornerstones of the cooperation between the two agencies in the furtherance of the aims and objectives of the CBD. The purpose of this paper is to bring to the attention of the CBD the content and conclusions of a scientific paper authored by Dr. J.S. Gray, Oslo University, entitled "*Marine Biodiversity: patterns, threats and conservation needs*". (Gray, 1997).

The issue of biological diversity and its promotion in a marine context was discussed by the United Nations Joint Group of Experts on the Scientific Aspects of Protection of the Marine Environment (GESAMP) at its 25th Session in 1995. As a consequence of this discussion, Dr. Gray agreed to prepare a discussion paper in consultation with other members of GESAMP. The paper was initially completed in November 1995, following review by members of GESAMP and other scientific experts. It will be published in the GESAMP Reports and Studies Series by the International Maritime Organisation (GESAMP, 1997) but was also accepted for open literature publication in February, 1996, following further review (Gray, 1997).

The following paragraphs present a synopsis of the content and conclusions of this paper which should be of interest to those involved in the CBD. Several reprints of the entire paper are attached for distribution or reproduction for those interested. Additional reprints can be obtained from Professor John S. Gray, Biologisk Institut, Universitetet i Oslo, PB 1064 Blindern, 0316 Oslo, Norway (e-mail: j.s.gray@bio.uio.no).

The concept of "biodiversity" is first evaluated from the perspectives of genetic diversity, species diversity, phyletic diversity, community and ecosystem diversity and habitat diversity. This is followed by an analysis of meridional and zonal patterns of marine biodiversity. The threats to marine biodiversity are then characterized for both pelagic (open ocean) and coastal marine environments. The threats to pelagic biodiversity are less numerous than those to coastal diversity with the threats to the open ocean being limited to the consequences of global climate change, enhanced ultra-violet irradiation of the surface ocean, the effects on planktonic and benthic systems of the accumulation of organochlorine compounds and the more limited damage caused by deep ocean dumping. In the polar regions the threats posed by the long-distance poleward transport of relatively volatile organic compounds and metal species through the so-called "global distillation" process is giving rise to concerns about the accumulation of organochlorines and mercury in top predators and their effects on individuals and populations.

The threats to coastal biodiversity are of a much more diverse nature simply because of the proximity to, and scale of, human activities in most of the coastal areas. Such threats include: over-exploitation of living marine resources; pollution (direct and indirect effects of chemicals introduced into the environment); eutrophication; species introductions/invasion, watershed alterations; coastal development; tourism and litter. Many of the consequences of human activities on the coastal zone are most directly evident in habitat changes which presage alterations in community structure and diversity. Habitat destruction is particularly pervasive in tropical areas where mangroves, coral reefs and wetland areas are being destroyed at alarming rates. In temperate areas there are severe threats to wetlands and estuaries caused by industrial development and hydrologic modifications intensified by the increasing concentration of population in coastal cities. Indeed, destruction of habitats in temperate areas has proceed to such an extent that there are relatively few wetland areas remaining in many countries. In developed areas, conflicts between

socio-economic development and conservation are essentially ubiquitous. Finally, it is noted that the threats posed by commercial fishing on the biodiversity of coastal areas has been largely neglected.

The paper concludes with an examination of "*how can marine biodiversity best be conserved*". Some previous analyses of this topic are criticized by the author as not having provided concrete specifications of strategies or actions for the preservation of marine biodiversity. Some have argued that the creation of marine protected areas is an appropriate strategy for biodiversity preservation. However, to date, marine protected areas constitute less than 1% of the worlds coasts and are often relatively isolated and remote from human activities. Primary reliance on marine protected areas as a basis for protecting biodiversity would seem untenable as it would leave over 99% of the global coastal zone lacking a suitable strategy.

The author then discusses the concept of habitat and the sustainability of habitat resource use as a proxy for biodiversity preservation. It is argued that in developing areas there exists a need to explore the economic and other practical benefits of biodiversity conservation so that policy decisions are made in full knowledge of the benefits to be gained from biodiversity conservation. In developed areas, it is argued that the preservation of biodiversity is best achieved through a framework of Integrated Coastal Management with emphasis on the sustainability of marine habitat.

It is worth noting that the more recent paper by Constanza *et al.* (1997) provides some scale to the economic immensity of global habitat loss. The value of "ecosystem services" of US$ 33 trillion per year far exceeds the global gross national product of US$ 18 trillion. The waste treatment "value" of tidal marshes and mangroves and of swamps and floodplains was estimated to be *ca.* US $ 7000 and US$ 1700 ha $^{-1}$ y^{-1} respectively. More pertinent to biodiversity are the estimated values of nutrient recycling in estuaries and seagrass/algal beds of *ca.* US$ 21000 and US$ 19000 ha^{-1} y^{-1} respectively. These figures provide some scale to the economic consequences of habitat loss and the economic threats associated with concomitant effects on biodiversity in the marine sphere. These figures dwarf the value of food production from the global coastal zone and demonstrate the ecosystemic service values associated with the Earth's coastal zone (US$ 12.6 trillion) and wetlands (US$ 4.9 trillion) compared with that of the pelagic ocean (US$ 8.4 trillion). On a unit area basis, these comparisons ($ 4052, $ 14785 and $ 252 ha^{-1} y^{-1} respectively) are even more striking (Roush, 1997).

References

Constanza, R.R. D'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neil, J.Paruelo, R.G. Raskin, P. Sutton and M. van den Belt, 1997. "The value of the world's ecosystem services and natural capital". *Nature* 387, 253-260.

GESAMP, 1997. "Marine biodiversity: patterns, threats and conservation needs". GESAMP Reports and Studies Series No. 62. International Maritime Organisation, London.

Gray, J.S. 1997. "Marine biodiversity: patterns, threats and conservation needs". *Biodiversity and Conservation* 6. 153 -175

Roush, W. 1997. "Putting a price tag on nature's bounty". *Science* 276, 1029.

Attach.

Attachment

Gray, J.S., 1997. "Marine biodiversity: patterns, threats and conservation needs." *Biodiversity and Conservation* 6, 153-175.

First Page

Biodiversity and Conservation 6, 153–175 (1997)

Marine biodiversity: patterns, threats and conservation needs

JOHN S. GRAY

Biological Institute, University of Oslo, Pb 1064 Blindern, 0316 Oslo, Norway

Received 7 November 1995; revised and accepted 3 February 1996

Marine biodiversity is higher in benthic rather than pelagic systems, and in coasts rather than the open ocean since there is a greater range of habitats near the coast. The highest species diversity occurs in the Indonesian archipelago and decreases radially from there. The terrestrial pattern of increasing diversity from poles to tropics occurs from the Arctic to the tropics but does not seem to occur in the southern hemisphere where diversity is high at high latitudes. Losses of marine diversity are highest in coastal areas largely as a result of conflicting uses of coastal habitats. The best way to conserve marine diversity is to conserve habitat and landscape diversity in the coastal area. Marine protected areas are only a part of the conservation strategy needed. It is suggested that a framework for coastal conservation is integrated coastal area management where one of the primary goals is sustainable use of coastal biodiversity.

Keywords: patterns of diversity; threats; habitat and landscape conservation; integrated coastal area management.

Introduction

Although there are a number of general reviews of biodiversity, such as the Global Biodiversity Assessment (Heywood and Watson, 1995) and Huston's (1994) more theoretical approach, there is no concise synthesis of marine biodiversity in relation to conservation needs. Short general reviews cover coastal-zone biodiversity patterns (Ray, 1991), deep sea benthic diversity (Grassle, 1991), marine benthic biodiversity research (Lambshead, 1993), marine functional diversity (Steele, 1991), coral reefs (Jackson, 1991), foraminifera (Buzas and Culver, 1991), fish diversity in the Caribbean (Robbins, 1991) and whale and dolphin diversity (Perrin, 1991).

Angel (1993) reviews possible causes for the patterns of the pelagic biodiversity in the ocean and Suchanek (1994) temperate coastal marine biodiversity showing that temperate systems are among the most productive and diverse. Coral reefs, with their associated flora and fauna, although highly diverse, are still relatively poorly described and their functioning is not well understood (Sebens, 1994). However, not all coral reefs are highly diverse, inshore shallow habitats on the Pacific rim have physically tolerant species to elevated temperatures and surface irradiance (B.E. Brown, pers. comm.) and are threatened by exploitation, dredging and removal. Such low diversity areas are also in need of conservation. Rao (1991) has reviewed the threats to mangroves and states the objectives for their conservation as: maintainenance of genetic resources, sustainable utilization and conservation or re-creation of suitable habitats.

The research agenda for biodiversity has been fully expounded by Solbrig (1991) and Grassle *et al.* (1991), and more recently for marine biodiversity by the US National