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RECEIVED DEC 28 1988

Prof. Elisabeth Mann-Borgese  
International Centre for Ocean  
Development ICOD  
5670 Spring Garden Road  
Halifax, Nova Scotia  
Canada B3J 1H6

15 December 1988  
44/MB/mp

Dear Dr. Mann-Borgese,

May I reiterate my best thanks for the cordial hospitality I enjoyed in Halifax; it was a pleasure for me to contribute to this project particularly aiming at the Third World and Nature.

As you can see from the enclosed copy of my letter to Mr. John, we are sending to ICOD some documents used for the preparation of our Final Report and the commented table I presented at the Seminar; copies of these documents are being sent to you under separate cover.

Following your kind inquiries, I am also enclosing some information about my activities.

With best regards,

Yours sincerely,



Dr. Max Börlin

Encl.:

- Copies of letters to Mr. Vernon and Mr. John
- List of documents sent under separate cover
- Information about my activities

Copies to Mr. Vernon and Prof. Giarini

DOCUMENTS SUBMITTED TO ICOD FURTHER TO THE PRESENTATION OF  
THE REPORT BY GIARINI AND BÖRLIN

1. Originals of the Final Report

1a - Text pages 1-73  
- Annex 4 to 14

1b - Annex 1, 2, 3: Papers by Prof. Giarini

2. One set of complements to the Annex of the Final Report (Working documents)

Annex 4 A: Minerals

Annex 5 to 9: Tables mentioned

Annex 10: This is Appendix 2

Annex 12 and 13: Tables mentioned

3. One set of Appendix of the Final Report (Working documents)

Appendix 1: Two UNEP brochures given in Halifax

Appendix 2: Systematic description and documents to most of the 24 marine resources programmes mentioned in Annex 10 of the Final Report (some already given in Halifax)

Appendix 4: Table included

Appendix 5: Table included; see reference on page 43 of the Final Report and Publication 67 b of the Bibliography

Appendix 6: Florida case study included

4. Old Annex 8 Mediterranean

See UNEP Programme 17 (2.1.2) in Appendix 2)

5. Transparents presented by Börlin at the Conference, with explanatory references to the Final Report (very preliminary considerations)

COPY

**MAX BÖRLIN**

Consultant en Economie de l'environnement, des ressources et du développement

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Téléphone (022) 76 25 09

Mr. Gary C. Vernon  
President of the International  
Centre for Ocean Development ICOD  
5670 Spring Garden Road  
Halifax, Nova Scotia  
Canada B3J 1H6

15 December 1988  
44/MB/mp

Dear Mr. Vernon,

May I thank you once again for the cordial hospitality I enjoyed, before, at, and after our Seminar in Halifax; from the very first to our last hour we were in best hands; as you can imagine, I enjoyed also the Sunday promenade to Petty Cove which brought me once again back to the sea.

Please note from the enclosed letter to Mr. John that we are sending to ICOD the originals of our Final Report, some further documents we used for and mentioned in our Final Report, as well as the commented table I presented at the Seminar, copy of this last being enclosed to this letter.

You also asked about my activities in the Geneva area. In this context, I now have pleasure in sending you some information.

With best regards,

Yours sincerely,



Dr. Max Börlin

Encl.:

- List of documents sent to ICOD
- Table presented at Seminar (item 5 of the list)
- Copy of letter to Mr. John
- Information about my activities

Copies to Prof. Mann-Borgese and Prof. Giarini

COPY

**MAX BÖRLIN**

Consultant en Economie de l'environnement, des ressources et du développement

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Téléphone (022) 76 25 09

Mr. Joshua John  
International Centre for  
Ocean Development ICOD  
5670 Spring Garden Road  
Halifax, Nova Scotia  
Canada B3J 1H6

15 December 1988  
44/MB/mp

Dear Joshua,

Please accept my thanks for your assistance before, during, and after our Conference; it improved our state of information and led us to a very pleasant sojourn in your area.

Following discussions with yourself and Mr. Vernon, I now am sending you some documents concerning our Final Report, as mentioned in five items of the enclosed list.

The originals listed under (1) concern the volume "text" as well as the annex of Dr. Giarini's papers.

The documents listed under (2) and (4) were used to prepare the annex mentioned in the Final Report on page iii. I take the liberty to pass them over in the form of working papers. They include also tables out of the regular publications of "World Resources Institute", Washington D.C. (Publication 20, 24).

The table of content of our Report mentions also that the appendix listed under (3) is available from the authors. In this context, you received already the two UNEP brochures mentioned as Appendix 1. Appendix 2 lists the relevant programmes of some 24 institutions and organizations; out of this Appendix 2, you received already some documents in Halifax and will now receive the remaining documents.

Finally, I am also sending the transparencies I used for my intervention at the Seminar (item 5).

All this material covers a large number of relevant programmes and regular publications. Still, the subject is so vast that the available resources allowed only to prepare a starting point for further investigations. Specifically, I would like to complete Dr. Giarini's mention of Prof. Daly at World Bank mentioning also Dr. Jeremy Warford, who represents World Bank in the advisory committee for preparing IUCN/UNEP/WWF's World Conservation Strategy II; also, I think that Dr. Goodland, author of Publication 52, is with World Bank.

May I finally recall that Mrs. Cortez, who mentioned the contribution of the ocean sector to the GNP of several countries in her paper to Pacem in Maribus XV, is with Ocean Economics and Technology Branch, UN Department of International Economics and Social Affairs, in New York as far as I know (see pages 39, 44 and bibliography 86 in the Final Report).

I am convinced that all this material would be useful to ICOD if you decide to pursue the project.

With best regards,

AR

Max Börnin

Encl.: 1 list of documents sent separately.

Also sent separately: UN-ECE Compendium.

Copies

to Prof. Elisabeth Mann-Borgese; appendix, annex and transparents (mentioned as items 2-5) sent separately;

to Mr. Gary C. Vernon, President; copy of transparents (mentioned as item 5) enclosed;

to Prof. Giarini.

Presented by Max Börlin

The considerations of the report are now presented in a synoptical way (see the table). This very first, tentative draft table should give an idea about one possibility of implementing the proposals of the report.

Ad I

- (a) Following the elements of chapters 3.1 and 5; as well as the functions of chapters 3.2 and 6.
- (b) Aggregation in row 10 following chapter 4.3.1.
- (c) GNP following chapter 4.3.3.

Ad II to IV

Stock at the beginning of the period, +/- flows during the period = stock at the end of the period, according to chapter 4.1.

Ad II and IV

- (a) Quantity and quality according to chapter 4.2.
- (b) Functions according to chapters 3.2 and 6.
- (c) Market value according to chapter 4.3.3.
- (d) Interior of the columns.
  - Theory: 4.3.1, 4.3.2, 4.3.3.
  - Practical situations: 1.3.
  - Available information: chapters 5 and 6; section (a) for quantity, (c) for quality, (f) and Table 4 concerning state of information.
  - (8) p. 71 ICOD-data.

Ad III

- (a) Value deducted or pollution can be represented as "impact to" and "impact from":

FROM TO	Non Marine e.g. General Development	Marine e.g. Tourism
Non Marine	Not relevant	Perhaps
Marine	1 . . . 9	(d) by polluted marine resource (g) by polluter marine sector

(a) III refers to the polluted marine resources in the lower part of this table.

(b) Moreover, each polluting activity should be subdivided as in II and IV, with Table 3 of the report giving examples of market value.

(c) Interior of the columns.

- Theory: 4.3.1, 4.3.2, 4.3.3.

- Practical situations: 1.3.

- Available information; quantity: (b); quality: (d, e, g); (f) and Table 4.

- (8) p. 71 ICOD-data.

(d) According to Table (a) above, one further column for impacts of marine resources on the non-marine environment should perhaps be added; it would represent the non-marine deductions because of the development of ocean resources.

Ad V

This column, when appropriately designed, should recall that all previous columns are time dependent.

Ad VI

Means should be found to represent the degree of uncertainty attached to the information in columns II to IV.

44/MB/OG/mp  
Geneva, December 1988

PATRIMONY (ASSETS)

II STATE 1 JAN. 1995

III DEVELOPMENT POLICY IN 1995 \*\*

	QUANTITY	QUALITY	FUNCTION UTILIZATION	MARKET VALUE *	GENERAL DEVELOPMENT	MARINE FUNCTION TOURISM : RESSORT CONSTRUCTION	OPERAT.
1 POPULATION		TRAINING LEVEL					
2 NAVIGATION							
. PORT INFRASTRUCTURE					++ TELECOM.		
. ACCESSIBILITY (DREDGED)							- LIMITATIONS
3 MANGANESE				ESTIMATE	+ TECHNOL.		
4 TOURISM						++	++
. HOTEL INFRASTRUCTURE						++	
. WATER	SHORES, m	"FLAGS"			- POLLUTION		
5 CORAL REEFS	LENGTH	BLEACHING			- DESTRUCTION	PURPOSELY CONSERVED	PURPOSELY CONSERVED
6 MANGROVES	AREA				- DESTRUCTION		
7 FISHERY	TOTAL BIOMASS	TOXICITY		ESTIMATE	- DUMPING OF WASTE	- INADVERTED KILLING	- POLLUTION
8 SELF-CONSUMPTION PRODUCTS							
9 ETC. ETC.							
10 TOTAL (IN % OF REL. IMPORTANCE)							
11 GROSS NATIONAL PRODUCT GNP							

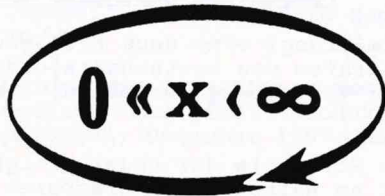
\* Where appropriate    \*\* + positive impacts  
 - negative impacts



PATRIMONY (ASSETS)	IV STATE 1 JAN. 1996				V TIME HORIZON		VI DEGREE OF UNCERTAINTY
	QUANTITY	QUALITY	FUNCTION UTILIZATION	MARKET VALUE *	10 YEARS	50 YEARS	
1 POPULATION		TRAINING LEVEL					
2 NAVIGATION							
. PORT INFRASTRUCTURE							
. ACCESSIBILITY (DREDGED)							
3 MANGANESE				ESTIMATE	X	X	
4 TOURISM							
. HOTEL INFRASTRUCTURE							
. WATER	SHORES, m	"FLAGS"					XX
5 CORAL REEFS	LENGTH	BLEACHING					XX
6 MANGROVES	AREA						XX
7 FISHERY	TOTAL BIOMASS	TOXICITY		ESTIMATE			X
8 SELF-CONSUMPTION PRODUCTS							
9 ETC. ETC.							
10 TOTAL (IN % OF REL. IMPORTANCE)							
11 GROSS NATIONAL PRODUCT GNP							

\* Where appropriate

file → Berlin, Max



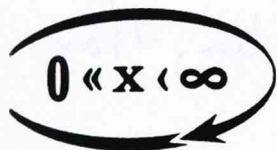
INSTITUT DE LA DUREE, GENEVE

THE PRODUCT-LIFE INSTITUTE, GENEVA

**MANDATS  
CONSULTING CONTRACTS  
AUFTRÄGE**

**LISTE DE PUBLICATIONS  
LIST OF PUBLICATIONS  
LISTE DER VERÖFFENTLICHUNGEN**

**1983 - 1988**



INSTITUT DE LA DUREE, GENEVE

THE PRODUCT-LIFE INSTITUTE, GENEVA

INSTITUT FUER PRODUKTDAUERFORSCHUNG, GENF

#### CONSULTING CONTRACTS 1988

- "Produktdaueroptimierung: eine neue Erfolgsstrategie?" Seminar für Führungskräfte des Wirtschaftsförderungsinstitutes der Handelskammer Vorarlberg, Dornbirn; 7. Dezember 1988; Walter R. Stahel.
- "Die Vorteile der Strategie der Dauerhaftigkeit auf dem Gebiet der Computer am Beispiel des tragbaren Betriebssystems BS2000"; (advantages of long-life products in the computer field: the portable operating system BS2000); case study for Siemens-Albis AG, Zürich; May 1988, Walter R. Stahel.
- "From Design to Disposal", a conference on risk prevention and engineering; consultant to the organisers, ETH Zürich and Gottlieb Duttweiler Institute, Rüschlikon; to be held on Jan 16/17 at ETH, the Swiss Federal Institute of Technology, in Zürich, Switzerland.

#### CONSULTING CONTRACTS 1987

- "The feasibility of entering the environmental protection business", report to a multinational company by Michael Royston and Max Börlin, Geneva, October 1987.
- "Towards a Western European Conservation Strategy", project for IUCN, Gland, sponsored inter-alia by the European Cultural Foundation and UNEP, with inputs into the Council of Europe's and UN-ECE's Regional Strategies 1987/88 and with an IUCN Position Paper stressing the role of non-government actors of society; Max Börlin.
- "Towards conservation strategies in Eastern Europe", IUCN East European Programme, Cambridge, UK, 1987/88; Max Börlin.
- "La poubelle ne ment pas", radio-télévision suisse romande, Genève, émission temps présent, conseils techniques; Walter R. Stahel.
- "The Fourth Pillar (flexible retirement and part-time work) : transcription of the product-life concept to elderly people as a resource", report commissioned by the International Association for the Study of Insurance Economics, Geneva; Walter R. Stahel, December 1987.

"Personenwagen Toyota 1969", Fallstudie zum Projekt "Erhaltung industrieller Kulturgüter" der Schweizerischen Vereinigung für Technikgeschichte, im Rahmen des Nationalen Forschungsprogramms NFP 16 des Schweizer Nationalfonds, 1987; Walter R. Stahel.

Secretary of EGLEI, European Group of Local Employment Initiatives, Brussels; Walter R. Stahel.

Member of steering committee of GDI / ETH-Z conference "From design to disposal", to be held in September 88 in Zürich; Walter R. Stahel.

Ingenieurschule beider Basel, Muttentz, Seminar im Rahmen des Nachdiplomstudiums "Energie" : Produktdaueroptimierung und Energieeinsparungen; Dezember 1987; Walter R. Stahel.

#### CONSULTING CONTRACTS 1986

"Stratégie économique de la durabilité", rapport mandaté par l'Institut de la Vie / Société Suisse pour la protection de l'environnement, Genève; financé par la Fondation du Centenaire de la Société de Banque Suisse, Bâle; Max Börlin, avec Walter R. Stahel, décembre 1986.

Seminar on aspects of environmental protection, MBA Graduate Course at City University, Seattle / Zürich, 1986; Max Börlin.

Consultation Européenne lors de la Semaine pour l'Emploi, sous le patronat de la fondation Roi Baudouin; "le recyclage des déchets", exposé de Walter R. Stahel, rapporteur Prof G. Neuray; Gembloux (Belgique), 21 au 24 avril 1986.

Expert on the Local Labour Market Management Action Research Programme for Employment Development, Commission of the EC, Brussels, Programme coordinator CH&M Martinos, London; Walter R. Stahel.

Expert on the organization and implementation of the GTZ-workshop on "Youth underoccupation and reforestation", organized by Technology for the people, Geneva, for Gesellschaft für Technische Zusammenarbeit; Kathmandu, Nepal; January and June 1986; Walter R. Stahel.

## CONSULTING CONTRACTS 1985

- "Vers une stratégie nationale de la conservation en Suisse, SNC-CH", Union Internationale pour la conservation de la nature et des ressources naturelles (UICN), Gland VD, août 1985; Agences gouvernementales et ONGs, Berne 1986; Max Börlin.
- "Policy implications of product-life extension activities", seminar to Irish government officials, financed by IDA, Irish Development Agency and YEA, Youth Employment Agency, Dublin; February 12, 1985, Dublin; Walter R.Stahel.
- "An action plan for defining business opportunities that could be linked to CEP's and / or CTW's in Ireland (NEW PRODUCTS FROM WASTE)"; project commissioned by Youth Employment Agency, Dublin, May/June 1985; Walter R.Stahel.
- EG - Anhörung über Arbeitsmarktprobleme, Tagung "Selbsthilfe und Arbeitsmarkt in Bremen", 13.-15.Februar 1985, Bremen, Walter R. Stahel als Experte der EG-Kommission.
- EG - Anhörung über Entwicklungschancen örtlicher Beschäftigungsinitiativen in Zeiten hoher Arbeitslosigkeit, Dortmund; Dortmund, 10./11.Juni 1985; Walter R.Stahel als Experte der EG-Kommission (workshop über "die Wiederverwendung von Gütern und Rohstoffen: eine Chance für örtliche Beschäftigungsinitiativen?") "

LISTE DE PUBLICATIONSLIST OF PUBLICATIONSLISTE DER VERÖFFENTLICHUNGEN1. PUBLICATIONS1.1. A paraître / to be published / im Druck :

"Consequences of advanced industrialization and the management of common property resources"; H.C.Binswanger and Max Börlin. A contribution to the UNESCO / Vienna Centre's ECOTRAIN Conference, Budapest, Sep 1987.

"La protection de l'environnement: Promoteur des technologies propres rentables et de l'éco-industrie prometteuse"; texte révisé et condensé d'une conférence donnée au Club de l'Environnement du Grand Conseil, Fribourg, le 11 nov 1987; Max Börlin.

1.2. Publiées / published / erschienen :

"Stratégie économique de la durabilité - Eléments d'une valorisation de la durée de vie des produits en tant que contribution à la prévention des déchets"; Société de Banque Suisse, cahier SBS no.32 (janvier 1988). Etude réalisée sur mandat de la Société Suisse pour la Protection de l'Environnement (SPE), par Max Börlin en collaboration avec Walter R.Stahel;

Erscheint gleichzeitig als Bankverein-Heft Nr.32, Jan 88: "Wirtschaftliche Strategie der Dauerhaftigkeit - Betrachtungen über die Verlängerung der Lebensdauer von Produkten als Beitrag zur Vermeidung von Abfällen";

"Fallbeispiel Personenwagen", in: Erhaltung industrieller Kulturgüter der Schweiz; Oskar Baldinger, Ed., Industriearchäologie-Verlag; Brugg, Dezember 1987; Walter R.Stahel;

"Das versteckte Innovationspotential"; Titelbeitrag der Technischen Rundschau Nr.19/87 vom 8.Mai 1987, Bern; Walter R.Stahel;

"<<Nutzen statt verbrauchen!>> heisst das Motto", Alternativen zur Wegwerfgesellschaft; Interview mit Walter R.Stahel; Der Schweiz.Beobachter, Nr.10/87, 22.Mai 1987.

"Eviter les déchets grâce à des produits plus durables"; Affaires Publiques no 1, 15 avril 1987; Max Börlin;

"Profile of Dr. Max Börlin"; Interview with the Chairman of IUCN / EC-NCS, IUCN's European Committee for National Conservation Strategies; The Environmentalist, vol 7 no 1, 1987;

Science and Public Policy, Journal of the International Science Policy Foundation, London; Volume 13, Number, 4 August 1986 : SPECIAL ISSUE : THE HIDDEN WEALTH, edited by Orio Giarini and Walter R.Stahel:

- Product-life as a variable: the notion of utilization, Walter R.Stahel,
- Health as wealth, Paul Ekins, London,
- R & D in a sustainable society, Walter R.Stahel,
- Role of local employment initiatives, Chris W.Brooks, Paris,
- Local capital generation - rethinking employment initiatives, Simone Swan and Michaela Walsh, New York,
- Coming of age of the service economy, Orio Giarini,
- Indicators of economic progress, Paul Ekins, London,
- Basic incomes and hidden economic potential, Bill Jordan, London,
- Developing productive activities for the wealth of nations in the service economy, Orio Giarini,
- Hidden costs : Use of natural resources and pollution of the environment, Max Börlin,
- Challenge of uncertainty: a dialogue, Orio Giarini,
- Europe's technology perspective, Umberto Colombo, Rome.

"La commission économique pour l'Europe des Nations Unies et l'environnement", EUROPA, Revue suisse pour les questions européennes, 2/1986.

"Recycling - eine Chance für lokale Beschäftigungs-initiativen"; Titelbeitrag der Technischen Rundschau Nr.45/85; Bern; Walter R.Stahel;

"Cycles, Value and Employment", Responses to the Economic Crisis; Pergamon Press, Oxford, 1984; Orio Giarini;

"How to overcome obstacles and barriers to Product-Life Extension"; Creativity and Innovation Network, vol xii no 3, July/Sep 1984, Manchester Business School, Manchester; Walter R.Stahel;

"Longer life, less waste"; UN Development Forum volume XII no 2, March 1984, DESI/DPI United Nations, New York; Walter R.Stahel;

"Aspects économiques des mesures d'antipollution"; Revue politique no.3/1983; Max Börlin.

"Banken und Umweltschutz"; Broschüre 4/1981, J.Vontobel, Banquiers, Zürich; Max Börlin;

**2. DOSSIERS DE RECHERCHE DE L'INSTITUT**  
**RESEARCH FILES OF THE INSTITUTE**

- no. 301: THE PRODUCT-LIFE FACTOR, Walter R.Stahel, 1983;
- no. 302: CYCLES, VALEUR ET EMPLOIS, Orio Giarini / Henri Loubergé, 1984;
- no. 303: LA DUREE D'UTILISATION DES PRODUITS COMME FACTEUR ECONOMIQUE, Walter R.Stahel, 1984;
- no. 304: UMWELTGERECHTES HANDELN, OEKONOMIE UND OEKOLOGIE - EIN ZIELKONFLIKT ?, Max Börlin, 1984;
- no. 305: A STRATEGY OF DEVELOPMENT FOR REGIONS THAT NEVER HAD AN INDUSTRIAL TISSUE - A THINK PAPER; Walter R.Stahel, 1986;
- no. 306: LES COUTS SOCIAUX DE LA POLLUTION ET DE L'EXPLOITATION DES RESSOURCES NATURELLES, Max Börlin, 1986.
- no. 307: STRATEGIES DE PREVENTION DANS LE CADRE DE L'ECONOMIE, A L'EXEMPLE DE LA DURABILITE". Présentations par M.Börlin et/ou Walter R.Stahel du cahier SBS no 32 à Yverdon, Bruxelles, Kopenhagen, Vienne, Genève, Lugano, Dornbirn; 1987/88.

**3. RAPPORTS DE RECHERCHE DE L'INSTITUT (CONFIDENTIELS)**  
**RESEARCH REPORTS OF THE INSTITUTE (CONFIDENTIAL)**

- no. 501: NEW PRODUCTS FROM WASTE, AN ACTION PLAN FOR DEFINING BUSINESS OPPORTUNITIES THAT COULD BE LINKED TO CEPES AND /OR CTWs IN IRELAND; for Youth Employment Agency, Dublin, 1985; Walter R.Stahel.
- no. 502: DIE BEDEUTUNG DER DAUERHAFTIGKEIT VON BETRIEBSSYSTEMEN (VON COMPUTERN) FUER WIRTSCHAFT, ANWENDER UND UMWELT; für Siemens AG, München/Zürich, 1988; Walter R.Stahel (Embargo bis 1.1.1989).

**4. EMISSIONS TV / TV BROADCASTS**

"Will tomorrow work ?", BBC Television London, 1983; Walter R.Stahel.

"La Poubelle ne ment pas", émission temps présents, TV de la Suisse Romande, le 12 novembre 1987; Walter R.Stahel.

**5. CONTRIBUTIONS REGULIERES / REGULAR CONTRIBUTIONS**

Praktische Fallstudien, "prüf mit", Zeitschrift des Konsumentinnenforums der deutschen Schweiz, Zürich, 1986.

Séminaires, Institut Universitaire des Etudes Européennes, Genève, par Max Börlin et Walter R.Stahel, 1985 - : stratégie de la durabilité et notion de la valeur d'utilisation / stratégie de la conservation de la nature et développement économique : un défi pour l'économie des services.



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INSTITUT DE LA DUREE, GENEVE  
THE PRODUCT-LIFE INSTITUTE, GENEVA  
INSTITUT FUER PRODUKTDAUER-FORSCHUNG, GENF

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une organisation sans but lucratif  
a not-for-profit association  
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Max Börlin (téléphone direct 022-76.25.09)  
Orio Giarini (022-47.09.38)  
Walter R. Stahel (022-46.86.84)

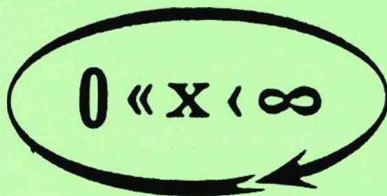
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# THE PRODUCT-LIFE INSTITUTE

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For calling any of the directors on  
his direct line, please consult page 8.



*INSTITUTE FOR THE STUDY OF THE LIFE-CYCLES  
OF PRODUCTS AND SERVICES*

## THE PRODUCT-LIFE INSTITUTE

is a not-for-profit organization domiciled in Geneva, Switzerland, since its formation in 1982.

## THE PRODUCT-LIFE INSTITUTE

is to open new frontiers of economic development based on the critical analysis and the optimization of the PRODUCT-LIFE of goods and services. The Institute and its associated research fellows can be contracted by any company or organization to do research and consulting work, in the field of product life of goods and services.

The INSTITUTE uses appropriate means of communication to publish its research results of non-confidential nature, i.e. reports, conferences, brochures and books.

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## THE OBJECTIVES OF THE PRODUCT-LIFE INSTITUTE ARE:

- to identify the problems and to stimulate the research in the field of wealth creation and welfare development, especially through the optimization of the product-life of goods and services.
- to promote the studies, research and ideas linked to Wealth and Welfare along the lines inspired, among others, by:

the report to the Club of Rome:

"DIALOGUE ON WEALTH AND WELFARE"

by Orio Giarini

published by Pergamon Press, Oxford, 1980.

the book

"JOBS FOR TOMORROW: THE POTENTIAL FOR  
SUBSTITUTING MANPOWER FOR ENERGY"

by Walter R. Stahel and Geneviève Reday-Mulvey

published by Vantage Press, New York, 1981.

and the publications related to these themes.

- to make known the results of these studies and research activities in the scientific, industrial, intellectual and political circles, as well as to a wider public.

THE SERVICES PROVIDED BY THE PRODUCT-LIFE INSTITUTE  
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- CONSULTANCY: Briefings to give specific information to client related problems
- Policy evaluation and definition for the product-life of a set of products, or services
- Seminars and meetings to discuss problems and opportunities involved
- RESEARCH: Critical analysis of the optimization of the product-life of goods or services
- Concrete proposals of how to improve the economic feasibility of goods by extending their useful life through reconditioning, repairs, selective recycling, long-life components or products
- Definition of new strategies that consider product-life, and related market research
- Project definition, evaluation and management
- Employment and product-life studies
- Integration of industrial and services activities
- Integration of formal and informal economic activities
- Economics of the use of resources and environmental impact
- INFORMATION: Comparative studies of international trends of markets and legislation with regard to product-life
- Publications: writing/editing of articles, revues, conference papers, books on product-life

**Max BOERLIN**

studied economics, econometrics and business administration in St. Gallen (Switzerland), Ames (Iowa) and Berkeley (California). After a 'tour d'horizon' in Swiss economic policy at large (including central banking, food and agriculture, housing), Dr. Börlin joined Battelle Geneva Research Centers. For the next ten years he was active in the areas of national and regional planning, transportation, construction and R & D policy, holding at last the position of Head - Environment and land use planning Mission.

Today, Max Börlin joins in the quest for solutions to problems in the broad area of environment and natural resources management (anticipatory and conservation strategy, economic incentives, economics of pollution damages). He works as independent consultant in Economics of environment, resources and development at the national and international level (including international organisations like UN/ECE, IUCN, OECD, WHO, UNEP) and for post-graduate courses.

He acted as a coordinator of complex Swiss national and international projects on environmental impact assessment (Assessment of the Motorway Rawyl project; Elaboration of aesthetic and environmental impact assessment guidelines for the Trans-European North-South Motorway TEM (UNDP/ECE TEM/INF 2 & 4, March & April 1985), and his publications include

- "Digest on Methods and Models for Environmental Impact Assessment", UN-ECE Env/R 81, 1977.
- "Banken und Umweltschutz", Brochure 4/1981, Bank Vontobel, Zurich.
- "Environmental Impact Assessment in Switzerland", in: Special Issue on EIA, Zeitschrift für Umweltpolitik (Journal on Environmental Policy), Berlin 4/1984.
- "Consequences of Advanced Industrialization and the Management of common Property Resources and Private Industries. For: UNESCO, Vienna Centre, Conference "Environmental Training of Economists", September 1985 (joint authorship).

## Orio GIARINI

An economist who studied at the Universities of Trieste and Texas, for several years Dr. Giarini worked in the chemical industry, mainly with polymers and nitrogen fertilizers.

He later joined the Battelle Geneva Research Centers where he remained for eight years, rising to the position of director of the Division of "Industrial Economics and Services" which covered the fields of macroeconomics, the textile industry, agriculture, electronics and service activities including banking.

Today, Dr. Giarini's activities are chiefly concerned with economic analysis and research related to the service sector.

He is a member of the Club of Rome and teaches at the Graduate Institute of European Studies in Geneva.

In addition to numerous research reports, some of his more significant publications have been:

- "Dialogue on Wealth and Welfare"  
(Report to the Club of Rome, Pergamon Press, Oxford, 1980).
- "Cycles, Values and Employment: Answers to the Economic Crisis"  
(to be published)
- "Economic Development and Wealth of Nations: the Return to Supply Side Economics"  
(in French - Revue Economique et Sociale, Lausanne, août 1981 (article).
- "Risk, Industry and Environment"  
(Centre for Extension Studies, Loughborough University, 1981 (article).
- "Managing Risk and Uncertainty in the Modern World"  
(Risk Management Reports, Chicago 1978 (article).

## Walter R. STAHEL

Mr. Stahel works today as an economist in the field of business management and industrial analysis.

An alumnus of the Swiss Federal Institute of Technology (ETH) in Zurich, where he received a diploma in architecture and town planning, Mr. Stahel worked for several years as a private architect in the UK and Switzerland.

In 1973, he joined the Battelle Geneva Research Centers as project manager in applied economics, working mainly in the fields of business strategy and feasibility studies. In 1979, he became personal assistant to the CEO of a holding company with worldwide activities in railway maintenance, shipping and real estate.

Today, Mr. Stahel works as an independent business consultant mainly on questions related to job creation through appropriate technologies, such as the re-use, repair, reconditioning and recycling of components, goods and systems.

Mr. Stahel is the author of books and articles on strategies for improved use of resources and job creation. In 1978, he was awarded first prize in a German competition in the field of job creation. In 1982, with a paper on the Product-Life Factor of components and goods, he became one of the winners in the U.S. Mitchell-Prize competition on sustainable societies.

Mr. Stahel's publications include:

- "Jobs for Tomorrow, The Potential for Substituting Manpower for Energy"  
(Vantage Press, New York, 1981).
- "The Product-Life-Factor"  
(Mitchell Prize 1982, Houston, Texas).
- "Unemployment, Occupation, Profession"  
(Prize-winning papers of the GZ-competition 1978, Minerva Publications, Munich 1980).
- Several conference papers for, among others, OECD, CEE, BBC TV.



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Please indicate if the paper is accepted your willingness to present:-

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c) Either

Title    Technical and Commercial Innovations in a Durability Strategy  
          for Effective Use of Resources and Waste Prevention

Author's name    Dr. Max Börlin, The Product-Life Institute Geneva  
and address        18, ch. Rieu, CH-1208 Geneva (Switzerland)  
                      Tf. 022.46 39 32      Telex 022. 47 20 78

Abstract:-

The paper resumes a study "The economic durability strategy" (1) launched by 'Société suisse pour la protection de l'environnement - Branche romande' Genève, - with the financial assistance of the Swiss Bank Corporation, - followed by an Accompanying Group from the Swiss Environmental Protection Agency, business, research, local government - mandating Max Börlin in collaboration with Walter R. Stahel, from PRODUCT-LIFE INSTITUTE.

The Report mentions some 30 examples of durability strategy already applied in the Swiss economy and then studies 6 cases about recuperation of vehicle parts, repair center for training and development, reconditioning of tyres, commercialisation of durables without transfer of ownership, impregnation of new walls and injection into existing walls. These examples cover several forms of durability: long life products, product life extension (re-utilization after cleaning; repair; reconditioning; technological upgrading) and re-utilization of components, as well as technological and commercial innovations.

A standard format gives for every case study: commercial, energy and environmental evaluation, generalization within the domaine and applicability in other domaines.

Finally, the Report shows how private economy and government can promote a nation-wide durability strategy, the central point remaining that the examples and case-studies presented show situations in which private economy has a commercial interest in durability - already now.

1. Société de Banque Suisse, "Stratégie économique de la durabilité - éléments d'une valorisation de la durée de vie des produits en tant que contribution à la prévention des déchets".

Cahier SBS No 32, Novembre 1987.

Schweiz. Bankverein, "Wirtschaftliche Strategie der Dauerhaftigkeit - Betrachtungen über die Verlängerung der Lebensdauer von Produkten als Beitrag zur Vermeidung von Abfällen".

Bankverein-Heft Nr. 32, November 1987.



PROGRES

Programme de Recherche sur l'Economie des Services  
Research Programme on the Service Economy

To Prof. E. Nann - Borgese

*Avec nos compliments*  
*Mit freundlichen Empfehlungen*  
*With our compliments*

*Das Paul*

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file  
**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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Dr. Elisabeth MANN BORGESE  
DALHOUSIE UNIVERSITY  
International Ocean Institute  
Pearson Institute  
1321 Edward Street  
Halifax, Nova Scotia

CANADA B3H 3H5

January 19, 1989  
44/MB/mp

Dear Professor Mann Borgese,

Following Prof. Giarini's letter of January 3, 1989 I now have pleasure in sending you also in Orio's name a proposal "Construction of a simulation model representing the contribution of oceans and ocean development to wealth and welfare - A teaching instrument".

This first discussion paper should facilitate the calibration of a pilot simulation project. We remain at your disposal for discussion and finalization.

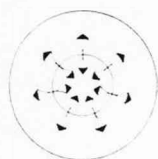
With kind personal regards.



Dr. Max Börlin

Enclosed proposal as mentioned.

→ Copy with the proposal to Mr. Gary C. Vernon, President of the International Centre for Ocean Development ICOD.



# PROGRES

Programme de Recherche sur l'Economie des Services  
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## CONSTRUCTION OF A SIMULATION MODEL REPRESENTING THE CONTRIBUTION OF OCEANS AND OCEAN DEVELOPMENT TO WEALTH AND WELFARE - A TEACHING INSTRUMENT

Genève, le

Proposal submitted in January 1989

to Prof. Elisabeth Mann Borgese, International Ocean Institute, Halifax/Malta,  
and Chairman of the Board of Directors of the International Centre for Ocean  
Development, Halifax.

by Prof. Orio Giarini\*, Geneva, and Dr. Max Börlin\*\*, Founex.

(\*) Institut Universitaire d'Etudes Européennes, Genève; Programme de Recherche sur l'Economie de Service (PROGRES).

(\*\*) Consultant en Economie de l'environnement, des ressources et du développement, Founex (Suisse).

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  - 6.2 Dr. Max Börlin

FIGURE 1

"The simulation model: Applications, ingredients, work steps a-q, team"

ANNEX

1. Table of marine accounting
2. List of pertinent projects of Dr. Börlin

## CONSTRUCTION OF A SIMULATION MODEL REPRESENTING THE CONTRIBUTION

### OF OCEANS AND OCEAN DEVELOPMENT TO WEALTH AND WELFARE - A TEACHING INSTRUMENT

#### 1. INTRODUCTION

This proposal is based on:

- Giarini/Börlin, "The contribution of oceans and ocean development to wealth and welfare - With particular reference to developing countries", Discussion paper for the ICOD Seminar of 2 December 1988; called "Report" in what follows
- Working papers being the appendices and complements of the annexes to the Report, submitted to ICOD on 15 December 1988 further to the presentation of the Report
- "Accounting of marine resources" - A revised, still very preliminary version of the "Table" presented at the Seminar, with explanatory references to the Report, submitted to ICOD on 15 December 1988; called "Table" in what follows and given as Annex 1.

The proposal is a response to suggestions expressed by Prof. Mann Borgese in the context of the Seminar and in letters dated 29 October and 21 December 1988.

In nuce, the Report's final suggestion is the publication, at regular intervals, of reports giving quantified information on the real developments concerning the wealth of the oceans. These reports would be comparable to the one done by World Bank on the basis of GNP, they would however integrate a wider notion of economic development and provide an analogous instrument within a broader economic framework (Report p. 28).

Before arriving at such reports or Tables, four questions have to be answered according to the Report:

- (1) What is value in the view of a new economic theory ? (Report p. 15, 16, 22, 23, 70)
- (2) What is value according to the latest discoveries in the ecological discipline ? (Report p. 3, 25, 70; an expression of the two-way economic-ecologic foundation of wealth are the "environmental functions" mentioned in Table 1 p. 35a of the Report)
- (3) How should representative monetary and non-monetary indicators of value be selected ? (Report p. 13, 15, 26, 70)
- (4) How can these indicators be condensed into one report or table ? (Report p. 28, 29).

In the 1988 publication "Rural development, World Bank experience, 1965-86", the Operations Evaluation Department of the World Bank concludes that every second evaluated rural development project in Africa South of Sahara is a flop. Institutions such as IOI and ICOD are in the privileged position of contributing to the elaboration of a methodology for ocean development which excludes a similar future statement about present ocean projects. The Report mentions the following potential contributions:

- (1\*) Application of the "new wisdom" in in-house ocean management programmes and training courses (Report p. 2, 25, 71)
- (2\*) Keeping a well-informed eye on the developments in fundamental economic and ecologic research and applying them in in-house data base and monitoring programmes, perhaps identifying and exploiting a very specific line

of data research which is feasible and not yet taken care of by other institutions (Report p. 3, 20, 27,71)

- (3\*) Operate in a role of co-ordinator of all the work already being done all through the world in these data and indicators collection (Report p. 26, 27, 71).

## 2. OBJECTIVES AND APPLICATIONS

### 2.1 Overall

-----

The objective of the proposal is to describe the preparation of a teaching instrument applicable in simulation exercises performed within IOI's training programmes with the aim of evaluating real past and potential future development programmes and paths of an island developing country.

As mentioned in the column headings of the Table in Annex 1, it is assumed:

State 31.12.1985	
+ Values added during 1986	) where impacts can come from non-ocean and
<u>- Values deducted during 1986</u>	) ocean developments (III), and affect ocean assets (rows 2-9) as well as non-ocean assets (row 12); see ad III of the Note.

= State 31.12.1986.

### 2.2 Ex post simulations

-----

The Report implicitly considers stock at the present time and development projects when they have taken place, that is the ex post approach leading to statistical reviews and state of the environment reports (see Fig. 1).

#### 2.2.1 Straightforward simulation of the state end of 1986 IV

Here, the state end 1985 ex post II is given, the state one year later ex post IV is simulated, and the values added net of values deducted during 1986 ex post III obtained as difference between the two states (III = IV - II).

All variables have the units of the corresponding rows 2-9 and 12 of the Table.

#### 2.2.2 Straightforward simulation of the developments during 1986 III

In this second application, the state end of 1985 ex post II is again given. The net changes (values added and deducted) during 1986 ex post III are simulated, and the state 31.12.86 ex post IV obtained by addition (IV = II + III).

Again, all variables have the dimensions of the rows of the Table.



FIGURE 1 THE SIMULATION MODEL: Applications, work phases, ingredients, work steps a-q, team (with ref. to chapters of the text)

Applications	Ingredients (3.2)							Results (endogenous)	
	Set of indicators (3.1)	Inputs (exogenous)			Modelling				Man-machine Interaction procedures
		II Stock end 1985	III Flow during 1986	IV Stock end 1986	Equa-tor	Black box	Forecasting box		
<b>2.2 EX POST</b>									
2.2.1 Straightforward ex post IV	X (a)	ex post (b)		ex post (c)	X (d)			III ex post	
2.2.2 Straightforward ex post III	X	ex post	ex post (f)		X			IV ex post	
2.2.3 Coherent ex post III and IV	X	ex post	ex post III	ex post	X		Balancer (h)	balanced III* and IV* ex post	
<b>2.3 EX ANTE</b>									
2.3.1 Ex ante evaluation	X	ex post	ex ante development projects (j)			X (k)	X (l)	Selector (m)	best III ex ante; best IV ex ante
2.3.2. Ex ante targeting	X	ex post		ex ante IV target (o)	X	X	X	Generator (p)	best III ex ante and best dev. projects
<b>TEAM SCENARIOS (5)</b>								<u>Testing</u> (e,g,i,n,q)	
A. Geneva effort	Geneva	Geneva				. Geneva . Consultations Dalhousie	Geneva	Geneva	G. + D.
B. Joint D. + G. effort	Geneva	Geneva				. Logic/Math: G. + D. . Programming: Dalhousie	Dalhousie	Dalhousie	G. + D.
C. Dalhousie effort	Geneva					Dalhousie	Dalhousie	Dalhousie	G. + D.

### 2.2.3 Coherent simulations of developments during and resulting state at end of 1986 III/IV

A balancing procedure eliminates probable discrepancies between III and IV in 2.2.1 and 2.2.2 (IV simulated = IV endogenous; III endogenous = III simulated).

### 2.3 Ex ante simulations

-----

The more demanding ex ante or anticipatory approach as used in environmental impact assessment and cost benefit analysis allows to evaluate projects before they are applied in view of an accept/reject decision (see Fig. 1).

#### 2.3.1 Evaluation of development projects

Starting with the state 31.12.85 ex post II as given, projects and programmes of developments of ocean and non-ocean resources are simulated ex ante, translated into the units of the rows 2-9 and 12 of the Table and the best of them selected and added to a best III ex ante developments during 1986. The state 31.12.86 ex ante IV is again obtained according to  $IV = II + III$ . Note however that II, III and IV are expressed in units of the rows of the Table, whereas the projects and programmes are expressed "in project terms" (e.g. a port of a capacity of x).

#### 2.3.2 Generation of development alternatives

In a last application envisaged, a target state 31.12.86 ex ante IV can be simulated and the state 31.12.85 ex post II be given; the needed developments during 1986 ex ante III would result from a subtraction  $III = IV - II$ , and matching best projects be generated.

Again, II, III and IV are expressed in the units of the Table, and the development projects and programmes "in project terms".

### 2.4 Reference island

-----

Three situations can be imagined:

- (i) A totally invented island; all the parameters of the Table - in the Note this means  $11 \times 14 = 154$  figures - would be invented; this variant is futile, but allows to specify the next one;
- (ii) The island could be a "well-informed invention", such as "Atlantis" or "Iniraig Island". The parameters would no longer be taken at random, but come close to production functions, economic impacts, environmental damage functions etc. possibly existing somewhere. Such a pilot project would provide a focus for further studies possibly leading to
- (iii) a full-scale model for a real island. Criteria for the selection of the real island include the generation of country data in an ICOD project such as the one aiming at a Pacific Information Centre for a Pacific Islands Marine Resource Information System, possibly as a sub-activity of such a Technical Assistance Programme; participation in the relevant UNEP Regional Seas Programme; island nation (as opposed to an island within a country) with own traditional national accounts, GNP, balance of

Further subdivisions of the rows 2-9 in the light of the theory of wealth and welfare.

Row 12 for non-ocean assets.

No elaboration of a theory of economic-ecological value with a coherent system of indicators as asked for in questions 1 and 2 of the introduction and in (ii\*)/(iii\*) above.

Step b) Numerical definition of ex post 1985 assets Stock II.

Step c) Numerical definition of ex post 1986 non-ocean and ocean developments Flow III. Only 1 + 1 aggregate figure per row.

Step d) Modelling of the "equator"  $II + III = IV$  as defined in 3.2 above.

Step e) Testing. Revision of former steps if needed.

#### 4.1.2 Straightforward ex post III

Step f) Numerical definition of ex post 1986 assets Stock IV.

Step g) Testing. Revision of former steps if needed.

#### 4.1.3 Coherent ex post III and IV

Step h) Balancer for coherence between III and IV, according to 3.2 above, a man-machine interaction procedure.

Step i) Testing. Revision of former steps if needed.

### 4.2 Ex ante simulations

-----

#### 4.2.1 Ex ante evaluation

Step j) Numerical definition of ex ante ocean development projects III\*, III\*\*, III\*\*\* ... As many figures per row of the Table as projects/programmes, expressed "in project units".

Step k) Modelling of the "black box" as defined in 3.2 above. Logical functions and programming consistent with the configuration of the local hardware.

Step l) Modelling of the forecasting box as defined in 3.2 above. Logical functions and programming consistent with the configuration of the local hardware.

Step m) Selector as explained in 2.3.1 a manual tatonnement as opposed to an optimization model e.g. of the integer programming type. Lists best ex ante III and best ex ante IV.

Step n) Testing. Revision of former steps if needed.

#### 4.2.2 Ex ante targeting

- Step o) Numerical definition of ex ante 1986 target assets Stock IV. Represents planning goals to be aimed at.
- Step p) Generator, a procedure for man-machine interaction. Although not being an optimization model, helps to generate best ex ante III. And, together with the "black box", to translate III in units of the Table into projects/programmes "in project units".
- Step q) Testing. Revision of former steps if needed.

#### 5. TEAM, TIME, BUDGET

Three variants of the research team can be thought of:

- A. Geneva effort: The work will be performed by Geneva experts who will consult Dalhousie experts for specifications of available simulation procedures, hardware etc. and for assisting in the test steps.
- B. Joint Dalhousie/Geneva effort, with the Dalhousie Team being responsible for the procedures for man-machine interaction and for the software programmes, the Geneva Team for a specification of the set of indicators, the numerical definition of the exogenous II, III and IV, and both Teams together for the logical and mathematical modelling and for testing.
- C. A Dalhousie effort, where Geneva experts supply the set of isolated indicators and can be consulted for the numerical definition of exogenous II, III and IV as well as for testing.

In the Geneva Team, Dr. Börlin will take over acting responsibility and will rely on Prof. Giarini for aspects of the theory of wealth and welfare. Depending on the scenario, a programmer will join the Team. Consulting with other experts, for example for environmental functions, is also possible if needed (the Report mentions on p. 71 the following relevant institutions: UNEP, World Resources Institute, UN-ECE, IUCN, Conservation Monitoring Centre).

The Geneva Team would be in favour of a Joint Dalhousie/Geneva effort, assuming that the co-ordination problems can be solved. The Geneva Team would also be interested in taking over responsibility following the model A., as it would also be willing to contribute expertise and consultations following the lines of a "Dalhousie Effort".

Time needs depend on the structure of the team and its possibility of interacting. For the present pilot project, Dr. Börlin could contribute up to three men/month.

Budgeting requires further specifications. It will take into account existing expertise (already applied simulation models, ocean expertise, development of the theory of wealth and welfare, the Seminar Report, the present proposal); on the other hand, the proposal makes clear that the preparation of a simulation goes far beyond the filling of the Table with 150 random figures as mentioned in (i) of the Objectives and therefore requires a not totally negligible budget.

## 6. CAPABILITIES OF THE GENEVA TEAM

### 6.1 Prof. Orio Giarini

-----

Prof. Giarini's contributions to the development of a theory of wealth and welfare are mentioned in Part One of the Report, and three major papers had been submitted in its annex. Relevant titles include:

- Dialogue on wealth and welfare - Report to the Club of Rome. Pergamon Press Oxford 1980
- The notion of economic value in the post-industrial society: Factors in the search for new economic paradigms (Annex 1 of the Report)
- Developing productive activities for the wealth of nations in the service economy (Annex 2)
- The service economy and the management of risk (Annex 3).

Presently, Prof. Giarini is developing new projects on the service economy as well as on risk (including environmental), uncertainty and vulnerability of a modern economy and the role of the insurance sector.

### 6.2 Dr. Max Börlin

-----

Dr. Börlin has worked in fields relevant to the present proposal, including regional development, environmental economics, environmental impact assessment, econometric and simulation projects, as appears from the following Curriculum vitae and list of courses.

Moreover, Annex 2 contains

- a list of publications 1981-88 in the environmental field
- a list of econometric/simulation projects 1962-88
- details about some of the mentioned relevant projects.

DR. MAX BÖRLIN

Born, Nationality Italy, 1929. Swiss.

Education St. Gall (Switzerland) Graduate School of Economics, Business and Public Administration (Dr.oec.1954, OR 1960). Visiting Scholar Iowa State University and University of California at Berkeley 1963/65.

Languages German, Italian, French, English (Spanish, Portuguese).

Specialization Regional, transportation, environmental planning; EIA. Macroeconomics (input-output, math. programming). R&D.

Professional Qualifications

- (1) Swiss Society for Statistics and Economics.
- (2) Int. Assoc. of Agricultural Economists.
- (3) Comité Romand de la Société Suisse pour la Protection de l'Environnement SPE.
- (4) Association Suisse des Ecologues Professionnels.
- (5) Chairman, European Committee for National Conservation Strategies of IUCN's Commission on sustainable development.

Present position Since 1982 Independent Consultant for Economics of environment, resources and development, Chemin des Bosquets, CH-1297 Founex, Switzerland.

Free Collaborator of Barbe SA Zurich and of Kienbaum International AG Zollikerberg/Zurich.

Associated director of the Product-Life Institute, Geneva.

Past Experiences 1955-59 Economist, Swiss National Bank, Zurich.

1959-63 Co-Director, Agricultural policy Institute at St. Gall Graduate School.

1965-66 Secretary General of the National Conference for Construction, Ministry of the Economy, Berne.

1966-76 Battelle, Geneva Research Centre. Head, Environment and Land Use Planning Mission.

1976-82 Barbe Ltd. Civil Engineering and Planning Consultants, Zurich Switzerland. Member of the Board. Environment and transportation economics.

Consultant OECD, UN-ECE Economic Commission for Europe, UNEP, WHO, IUCN.

Lecturer 1971-74 IBM-ESRI Geneva. Economic Theory and models.

1972-81 EPFL Lausanne/WHO. Problèmes économiques dans la protection de l'environnement; EIE.

1979 EPFL Lausanne. Planification du développement.

1981 WHO Sofia. Ecological and economic aspects of air pollution

1985-87 IUEE Inst.Univ.Etudes Europ. Geneva. Stratégie européenne de la conservation de la nature et développement économique: Un défi pour l'économie des services.

1986 City University Seattle Zurich. MBA Graduate Course on legal and economic aspects of environmental protection.

1988 IHTTI Intern. Hotel and Tourism Training Institutes, Luzern (Switzerland). All five levels of Economics (Samuelson; actual problems).

Countries Switzerland, Italy, CSSR, Portugal, USA, Iran, Morocco.

Sept. 1988

COURS UNIVERSITAIRES ET POST GRADES

1969; 1971	Università Catania; Erice	Met odologie di pianificazione di risorse idriche e bacini fluviali
1971-1974	IBM-ESRI Geneva	Economic Theory and models
1972-1975	EPFL Lausanne	Problèmes économiques dans la protection de l'environnement
1979	EPFL-ISM, WHO Lausanne	Socio-Economie et méthodologie d'évaluation des impacts de la pollution atmosphérique
1979	EPFL Lausanne	Planification nationale, pays en voie de développement
1981	WHO Sofia	Ecological and economic aspects of environmental pollution
1981	EPFL Lausanne	Méthodologie des études d'impact
1980; 1981; 1983	ETHZ; HSG St. Gallen	Gastvorlesungen (Variantenvergleiche; Vwl. Auswirkungen der Waldschäden)
1985/6/7	IUEE Inst.Univ.Etudes Europ. Genève	Stratégie européenne de la conservation de la nature et développement économique: Un défi pour l'économie des services
1986	City University Seattle/ Zurich	MBA Graduate Course on legal and economic aspects of environmental protection
1987 27. Oktober 1983 MB/es Rev. Sept. 1987	IDHEAP Lausanne	Instruments internationaux dans la politique de protection de l'environnement

ANNEX 1



ACCOUNTING OF MARINE RESOURCES

Presented by Max Börlin

The considerations of the report are now presented in a synoptical way (see the table). This very first, tentative draft table should give an idea about one possibility of implementing the proposals of the report.

Ad I

- (a) Following the elements of chapters 3.1 and 5; as well as the functions of chapters 3.2 and 6.
- (b) Aggregation in row 10 following chapter 4.3.1.
- (c) GNP following chapter 4.3.3.

Ad II to IV

Stock at the beginning of the period, +/- flows during the period = stock at the end of the period, according to chapter 4.1.

Ad II and IV

- (a) Quantity and quality according to chapter 4.2.
- (b) Functions according to chapters 3.2 and 6.
- (c) Market value according to chapter 4.3.3.
- (d) Interior of the columns.
  - Theory: 4.3.1, 4.3.2, 4.3.3.
  - Practical situations: 1.3.
  - Available information: chapters 5 and 6; section (a) for quantity, (c) for quality, (f) and Table 4 concerning state of information.
  - (8) p. 71 ICOD-data.

Ad III

- (a) Value deducted or pollution can be represented as "impact to" and "impact from":

FROM TO	Non Marine e.g. General Development .	Marine e.g. Tourism
Non Marine	Not relevant	Perhaps
Marine	1 . . . 9 (e) by polluted marine resource	(d) by polluted marine resource (g) by polluter marine sector

- (a) III refers to the polluted marine resources in the lower part of this table.
- (b) Moreover, each polluting activity should be subdivided as in II and IV, with Table 3 of the report giving examples of market value.
- (c) Interior of the columns.
- Theory: 4.3.1, 4.3.2, 4.3.3.
  - Practical situations: 1.3.
  - Available information; quantity: (b); quality: (d, e, g); (f) and Table 4.
  - (8) p. 71 ICOD-data.
- (d) According to Table (a) above, one further column for impacts of marine resources on the non-marine environment should perhaps be added; it would represent the non-marine deductions because of the development of ocean resources.

Ad V

This column, when appropriately designed, should recall that all previous columns are time dependent.

Ad VI

Means should be found to represent the degree of uncertainty attached to the information in columns II to IV.

44/MB/OG/mp  
Geneva, December 1988

PATRIMONY (ASSETS)

II STATE 1 JAN. 1995

III DEVELOPMENT POLICY IN 1995 \*\*

	QUANTITY	QUALITY	FUNCTION UTILIZATION	MARKET VALUE *	GENERAL DEVELOPMENT	MARINE FUNCTION TOURISM : RESSORT CONSTRUCTION OPERAT.	
1 POPULATION		TRAINING LEVEL					
2 NAVIGATION							
. PORT INFRASTRUCTURE					++ TELECOM.		
. ACCESSIBILITY (DREDGED)							- LIMITATIONS
3 MANGANESE				ESTIMATE	+ TECHNOL.		
4 TOURISM						++	++
. HOTEL INFRASTRUCTURE						++	
. WATER	SHORES, m	"FLAGS"			- POLLUTION		
5 CORAL REEFS	LENGTH	BLEACHING			- DESTRUC-TION	PURPOSELY CONSERVED	PURPOSELY CONSERVED
6 MANGROVES	AREA				- DESTRUC-TION		
7 FISHERY	TOTAL BIOMASS	TOXICITY		ESTIMATE	- DUMPING OF WASTE	- INADVERTED KILLING	- POLLUTION
8 SELF-CONSUMPTION PRODUCTS							
9 ETC. ETC.							
<hr/>							
10 TOTAL (IN % OF REL. IMPORTANCE)							
<hr/>							
11 GROSS NATIONAL PRODUCT GNP							

\* Where appropriate

\*\* + positive impacts  
- negative impacts

PATRIMONY (ASSETS)	IV STATE 1 JAN. 1996				V TIME HORIZON		VI DEGREE OF UNCERTAINTY
	QUANTITY	QUALITY	FUNCTION UTILIZATION	MARKET VALUE *	10 YEARS	50 YEARS	
1 POPULATION		TRAINING LEVEL					
2 NAVIGATION							
. PORT INFRASTRUCTURE							
. ACCESSIBILITY (DREDGED)							
3 MANGANESE				ESTIMATE	X	X	
4 TOURISM							
. HOTEL INFRASTRUCTURE							
. WATER	SHORES, m	"FLAGS"					XX
5 CORAL REEFS	LENGTH	BLEACHING					XX
6 MANGROVES	AREA						XX
7 FISHERY	TOTAL BIOMASS	TOXICITY		ESTIMATE			X
8 SELF-CONSUMPTION PRODUCTS							
9 ETC. ETC.							
<hr/>							
10 TOTAL (IN % OF REL. IMPORTANCE)							
<hr/>							
11 GROSS NATIONAL PRODUCT GNP							

\* Where appropriate

ANNEX 2

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1988  
123/MB/mp



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MB/vp  
4 Jan. 1989

MODELLO-STRUMENTO DECISIONALE  
DELLO SVILUPPO AGRICOLO  
DELLA REGIONE SICILIANA

---

RAPPORTO FINALE

per

l'E.S.A.

Ente Sviluppo Agricolo

PALERMO

Ginevra, Marzo 1976

BATTELLE

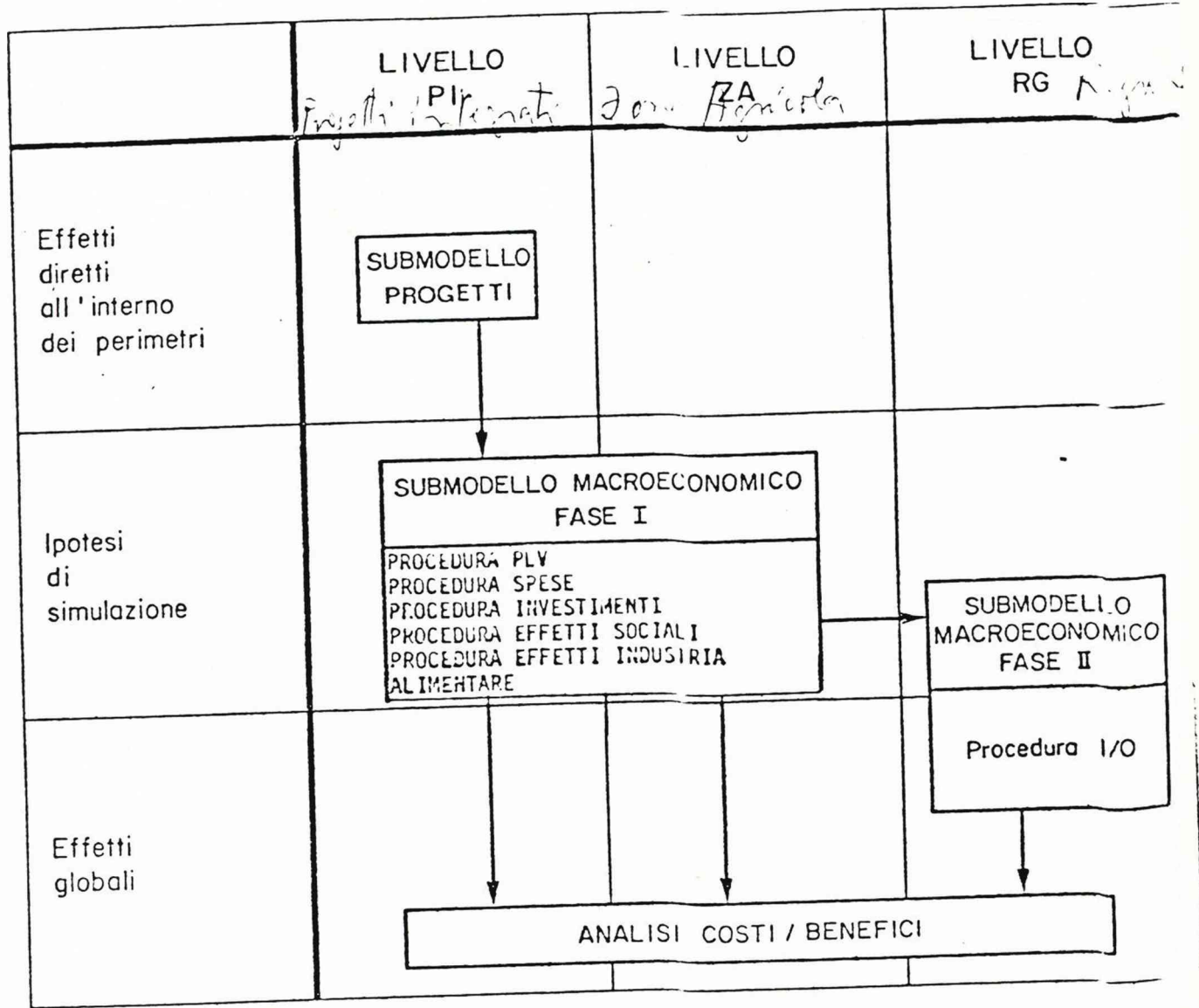
Centre de Recherche de Genève

7, route de Drize

1227 Carouge-Genève

Modello - Strumenti di valutazione della sviluppo - 1° ciclo della Regione di 1.

DIAGRAMMA 1



by

Max BÖRLIN

Battelle - Geneva Research Centre  
Switzerland

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# ENERGY AND ENVIRONMENT

**Methods to Analyse  
the Long-term Relationship**

# ENERGIE ET ENVIRONNEMENT

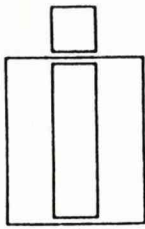
**Méthodes d'Analyse  
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2. An Economy-Environment classification of th  
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  - 2.1. Extension to emissions (first quadrant)
  - 2.2. Extension to input of ecologic commodities  
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  - 2.3. Extension to immissions and their effects  
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3. Extension of the static linear model :  
Conclusions

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT  
ORGANISATION DE COOPÉRATION ET DE DÉVELOPPEMENT ÉCONOMIQUES

PARIS 1974



# SIXTH INTERNATIONAL CONFERENCE ON input-output techniques

(Vienna, 22-26 April 1974)

Session 9: Applications in developing regions and countries

## THE GENERATION OF AN INPUT-OUTPUT/LINEAR PROGRAMMING MODEL OF THE ECONOMY OF IRAN

by

Max Börlin  
W. Halder Fisher  
Battelle's Geneva (Switzerland) Research Centre  
Battelle's Columbus (Ohio, USA) Laboratories

Received on 4.3.1973

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## III. THE LINEAR PROGRAMMING MODEL

The Linear Programming Model will be explained in terms of

- (a) its variables,
- (b) its constraints, and
- (c) its data and computer set-up.

### A. The Variables

The subscripts of the variables stand for:

- $i = 1, \dots, 17$  Producer sectors; these correspond to 16 productive sectors and the "non-competitive imports".
- $j = 1, \dots, 17$  User sectors; column 17 is empty.
- $h = 1, 2, 3$  User sectors; an aggregation of the 17 sectors into agriculture, industry (excluding construction), and services (including construction).

The variables refer to the year 1977 except those with a superscript (<sup>0</sup>) which indicates a base year 1969. They are listed in Table 1.

### B. The Constraints

The model consists of the objective function and of 148 single constraints enumerated in the Master Table of the Linear Programming Model (Table 2). These equations are aggregated into 21 types of relations explained below.

Equation Type 1, output determination, requires that the total demand for each commodity does not exceed the availability of the commodity. The  $a_{ij}$  represent technology of the final year of Plan V, but without Plan V; they have been estimated as explained before.

Equation Type 2, consumer demand, distributes total personal consumption expenditure over sectors according to sectoral proportions estimated for 1977. The distribution 1977 is based on expenditure elasticities 1977, and is therefore different from the distribution 1972. For the time being, availability of statistics does not allow us to consider introducing a response of sectoral consumption to relative prices and relative scarcities into the model.

Incremental consumption is limited by the domestic savings constraint (Equation Type 4), presented in more detail in the Mathematical Appendix.



Dalhousie University

International Ocean  
Institute



I.O.I. - Malta

February 11, 1989

Dr. Max Börlin  
Chemin des Bosquets  
CH - 1297 Founex VD  
Switzerland

Dear Dr. Börlin, Caro Max:

Thanks for all the material which arrived, first by fax, then bodily.

I was away, in India, and then in Los Angeles, but now I have read the proposal twice. The first time, my head began to spin. The second time, I think I got it, but I am afraid, ICOD will have remained in the head-spinning phase. I have not yet had occasion to discuss it with Gary Vernon because he is away, checking things out with the World Bank, with Satya Nandan's office, etc.

I find the project very exciting. I am sure, however, that by the time we get it done, it must look far simpler: The language must be simpler. It is way over the head of our average trainee.

But they ought to get a thing like this. It is the only way ever to get the Brundtland Report translated into action.

I would see a team consisting of: You, Orio, Professor Gil Winham and Mike Staley (Dalhousie and Vancouver: our two simulation experts; Mike, who has worked at the IIASA, is a computer expert); Aldo Chircop; Jackie McGlade; and myself as much as time will permit. Perhaps somebody from Nandan's office: Stella Valleja is the specialist. Perhaps that chap from Boston (Bob Bowen).

I will discuss with Gary, when he comes back, whether we could get very modest funding for this from ICOD, to develop this training tool. Otherwise we'll find the money somewhere



else.

So this is my first reaction.

As for Easter, it turned out, we will be quite a tribe: besides myself, there will be my daughter, son-in-law and grand-daughter (5). I am afraid that would burst Orio's flat. So we have booked a hotel in Pontresina. It is only three days anyway. But I hope I can take a rain (or snow) check for Verbier.

All the very best, and more soon,

Yours cordially,

A handwritten signature in cursive script, appearing to read 'Elisabeth'.

Elisabeth Mann Borgese

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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Dr. Elisabeth MANN BORGESE  
DALHOUSIE UNIVERSITY  
International Ocean Institute  
Pearson Institute  
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Halifax, Nova Scotia  
Canada B3H 3H5

2 February 1989  
44/MB/mp

Dear Elisabeth,

It was a pleasure for me to react to your suggestion of an ocean simulation game; I hope the telefax and then the complete proposal by air (sent also by air to Mr. Vernon) have meanwhile reached you, as well as some annexes and appendixes to our Report sent for you to ICOD.

From Orio Giarini I learned about your Easter holidays for skiing; with my wife, I plan almost the contrary, namely to go from 23 March to 1 April to the Tunisian desert. It would be a pleasure indeed meeting you before, anywhere and any time up to Thursday 23 4 o'clock; if needed, we could pursue our conversation about your simulation project.

With best personal regards.



Dr.oec. Max Börlin

Copy to Orio Giarini.

DOCUMENTS SUBMITTED TO ICOD FURTHER TO THE PRESENTATION OF  
THE REPORT BY GIARINI AND BÖRLIN

1. Originals of the Final Report

1a - Text pages 1-73  
- Annex 4 to 14

1b - Annex 1, 2, 3: Papers by Prof. Giarini

2. One set of complements to the Annex of the Final Report (Working documents)

Annex 4 A: Minerals

Annex 5 to 9: Tables mentioned

Annex 10: This is Appendix 2

Annex 12 and 13: Tables mentioned

3. One set of Appendix of the Final Report (Working documents)

Appendix 1: Two UNEP brochures given in Halifax

Appendix 2: Systematic description and documents to most of the 24 marine resources programmes mentioned in Annex 10 of the Final Report (some already given in Halifax)

Appendix 4: Table included

Appendix 5: Table included; see reference on page 43 of the Final Report and Publication 67 b of the Bibliography

Appendix 6: Florida case study included

4. Old Annex 8 Mediterranean

See UNEP Programme 17 (2.1.2) in Appendix 2)

5. Transparents presented by Börlin at the Conference, with explanatory references to the Final Report (very preliminary considerations)

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22 May 1989  
44/MB/vp

To : Prof. E. MANN BORGESSE  
Dalhousie University  
International Ocean Institute  
Halifax - fax 902 424 2319

re: PIM XVI Proceedings

Following your fax 10 May and our reply 12 May, the following was sent by air mail 19 May:

- Annex 10 List of programmes
- Appendix 2 Programmes (list, standard description, complements)
- Annex 14 List of publications
- Appendix 3 Description of these publ. from catalogues etc.
- Annex 4 (ex 1) Importance of marine resources
- Complements of Annexes 4, 7, 8, 9, 10, 12, 13.

Appendix 3 not being too interesting, it was not sent to you and ICOD in December 1988. All other material is already in your possession, Annex 4, 10 and 14 in the Final Report (see enclosed list of submitted docs Dec 1988).

As you can imagine, there was no common measure between our efforts and the available resources; hence these documents exist only in the working paper format. They were ment as a starting point for any sort of a follow-up, as mentioned by you and Mr. Ver and which would interest us very much.

Best regards.



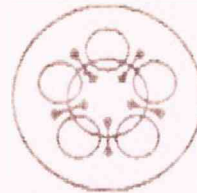
Dr. oec. Max Börlin



encl. ment.

cc/ Prof. Giarini

ASSOCIATION INTERNATIONALE POUR L'ÉTUDE  
DE L'ÉCONOMIE DE L'ASSURANCE



TELEFAX

---

18, CHEMIN RIEU, CH- 1208 GENEVA - PHONE: (22) 47,09,38 / FAX: 47,20,78

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To : Prof. Elisabeth MANN BORGESÉ  
HALIFAX - Fax Nr 001 902 424 2319

FROM: <sup>f.6</sup> Dr. Max BÖRLIN

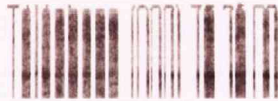
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**MAX BÖRLIN** Consultant en Services de l'aménagement, des ressources et du développement

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Mr. S. Scott Coffen  
Economic Development Division  
Economics Branch, Scotia-Fundy Region  
Department of Fisheries and Oceans  
P.O. Box 550 Station M  
Halifax, Nova Scotia  
B3J 2S7  
CANADA

Founex, 5th June 1989

Dear Mr. Scott Coffen,

Prof. Giarini passed me over your letter of 18th May, and we thank you for your interest.

Some papers by Prof. Giarini has been sent to you separately; they cover theoretical questions of your project concerning the economic valuation of the oceans, on a zonal basis, assessing the economic contribution made by each of these use sectors to the local ocean economy.

Ideas about the practical implementation have been collected in the written report to ICOD. I hence would suggest to you to contact Mr. Vernon.

Prof. Mann Borgese, 101 at Dalhousie University, has some ideas about a simulation model for economic valuation of the oceans. I therefore take the liberty to send her copies of our exchange of letter, and you might wish to contact her also for a copy of our Report.

Perhaps her and your initiatives could merge, and we would be glad to act as consultants to such a project.

Yours truly,

Dr. oec. Max Börlin

Copy to Prof. Mann Borgese, Halifax, and Prof. Orio Giarini, Geneva



Fisheries and Oceans / Pêches et Océans

(1)



MAX BÖRLIN  
fait-il lui envoyer  
quelques choses?  
à répondre.  
Dum.

Economic Development Division  
Economics Branch, Scotia-Fundy Region  
Department of Fisheries and Oceans  
P.O. Box 550 Station M  
Halifax, Nova Scotia  
B3J 2S7  
CANADA

May 18, 1989

Dr. Orio Giarini  
University Institute for European Studies  
and Research Programme on the Service Economy  
(Programme de recherche sur l'économie  
de services - PROGRES)  
18, chemin Rieu  
CH-1208, Geneva  
SWITZERLAND

Dear Dr. Giarini:

I am a recent graduate student of the ICOD-sponsored Marine Affairs Programme at Dalhousie University, Halifax, Canada. Fortunately, I had the pleasure to attend the ICOD Forum on Ocean Development concerning the contribution of the ocean and ocean development to wealth and welfare, given by you and Dr. Max Börlin on December 2nd, 1988, in Halifax, which, I might add, was most enlightening. Currently, I am employed at the above address where I am conducting a research project to ascribe economic values to the various marine resource-use sectors of the economy of Nova Scotia. This will essentially involve an economic valuation of the oceans, on a zonal basis, assessing the economic contribution made by each of these use sectors to the local ocean economy. As you might agree, this is rather a substantial undertaking. During the Forum I was very interested in your environmental accounting approach to this problem, and would appreciate receiving any recent documentation you have written on the methodology of assessing the value of the ocean economy and/or the subject of the wealth and welfare of the oceans. Thank you for your assistance.

Yours truly,

S. Scott Coffen

Canada



Fisheries and Oceans / Pêches et Océans

1



MAX BÖRLIN  
faut-tu lui envoyer  
quelques chose?  
et répondre?  
Olivier

Economic Development Division  
Economics Branch, Scotia-Fundy Region  
Department of Fisheries and Oceans  
P.O. Box 550 Station M  
Halifax, Nova Scotia  
B3J 2S7  
CANADA

May 18, 1989

Dr. Orio Giarini  
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Yours truly,  
  
S. Scott Coffen



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Prof. E. Damm Borgeau  
101 - Pearson Institute  
HALIFAX CAN  
CANADA

Message

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

9.1.1990.

Chemin des Bosquets 1  
CH-1297 Founex/VD  
Téléphone (022) 75 25 09

Prof. E. Damm-Borghese; International Ocean Data  
c/o Pearson Institute, Halifax N.S., Fx 902. 424-23  
001

Dear Mrs. Borghese,

Please find enclosed my CV in two versions.  
Could you please confirm to me that you are going  
to London on (January 31) February first, in  
which case I shall try to meet you at your layman  
speech?

Finally, I hear for the first time from Judy Noel  
about your Sustainable Development conference  
Fr 12-12-14. However, I do not see the resources  
for joining - and NOYES will hardly be ready  
at that time!

With sense - Le sciro tri due Premi.  
Suo Max Börlin.

End. 2 CV.

THIS IS FIRST OF THREE SHEETS

DR. MAX BÖRLIN

Born, Nationality Italy, 1929. Swiss.

Education St. Gall (Switzerland) Graduate School of Economics, Business and Public Administration (Dr.oec.1954, OR 1960). Visiting Scholar Iowa State University and University of California at Berkeley 1963/65.

Languages German, Italian, French, English (Spanish, Portuguese).

Specialization Regional, transportation, environmental planning; EIA. Macroeconomics (input-output, math. programming). R&D.

Professional Qualifications (1) Swiss Society for Statistics and Economics.  
(2) Int. Assoc. of Agricultural Economists.  
(3) Comité Romand de la Société Suisse pour la Protection de l'Environnement SPE.  
(4) Association Suisse des Ecologues Professionnels.  
(5) Chairman, European Committee for National Conservation Strategies of IUCN's Commission on sustainable development.

Present position Since 1982 Independent Consultant for Economics of environment, resources and development, Chemin des Bosquets, CH-1297 Founex, Switzerland.  
  
Free Collaborator of Barbe SA Zurich and of Kienbaum International AG Zollikerberg/Zurich.  
  
Associated director of the Product-Life Institute, Geneva.

Past Experiences 1955-59 Economist, Swiss National Bank, Zurich.  
  
1959-63 Co-Director, Agricultural policy Institute at St. Gall Graduate School.  
  
1965-66 Secretary General of the National Conference for Construction, Ministry of the Economy, Berne.  
  
1966-76 Battelle, Geneva Research Centre. Head, Environment and Land Use Planning Mission.  
  
1976-82 Barbe Ltd. Civil Engineering and Planning Consultants, Zurich Switzerland. Member of the Board. Environment and transportation economics.

Consultant OECD, UN-ECE Economic Commission for Europe, UNEP, WHO, IUCN.

Lecturer 1971-74 IBM-ESRI Geneva. Economic Theory and models.  
1972-81 EPFL Lausanne/WHO. Problèmes économiques dans la protection de l'environnement; EIE.  
1979 EPFL Lausanne. Planification du développement.  
1981 WHO Sofia. Ecological and economic aspects of air pollution  
1985-87 IUEE Inst.Univ.Etudes Europ. Geneva. Stratégie européenne de la conservation de la nature et développement économique: Un défi pour l'économie des services.  
1986 City University Seattle Zurich. MBA Graduate Course on legal and economic aspects of environmental protection.  
1988 IHTTI Intern. Hotel and Tourism Training Institutes, Luzern (Switzerland). All five levels of Economics (Samuelson; actual problems).

Countries Switzerland, Italy, CSSR, Portugal, USA, Iran, Morocco.

Sept. 1988

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

Chemin des Bosquets 1  
CH-1207 Founex/VD  
Téléphone (022) 76 25 09

Wiosketch (August 1989)

---

Born 1929 in Messina (Italy), grown up in Italy and Switzerland.  
Studied economics, business administration and operations research  
at St. Gallen (Switz.), Ames (Iowa) and Berkeley (Cal.).

1966/76 with the Battelle Geneva Research Center, Head - Environment  
and land use planning mission.

Since 1982 independent consultant for Economics of the Environment  
at Founex-Geneva, working i.a. for UN-ECE, UNEP, IUCN, OECD.

Since 1984 associated with the Geneva based Product-Life Institute.

Covered subjects include:

- pollution prevention at the source: durability strategy, clean technologies, clean products.
- indicators for sustainable ocean development (Halifax CND)
- costs of environmental pollution (Swiss inventory and State of the Art)
- economic-ecologic input output models
- environmental impact assessment (Federal commission 'Swiss motorway projects revisited'; coordinator for Guidelines for UNDP/ECE's Trans-European North South Motorway TEM; transboundary contexts)
- eco-industry's market

Chairman of IUCN's Commission for sustainable development's European  
Committee for National Conservation Strategies EC-NCS (observed UN-ECE's  
and Council of Europe's Strategy elaboration, prepares an own  
Position Paper)

LISTE DE PUBLICATIONS, CONFERENCES, ETC. (DES 1981)

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2. Aspects économiques des mesures d'antipollution. Dans "Radicalisme et Protection de l'Environnement - Contributions pour une journée d'étude", Revue politique 62ème 3/83.
3. Volkswirtschaftliche Auswirkungen von Umweltschäden. Referat gehalten anlässlich der Arbeitstagung "Umweltschutz und Marktwirtschaft" der Freisinning-Demokratischen Partei des Kantons Zürich, 20. August 1983.
4. Das statische Input-Output-Modell Grindelwald. Abbildung der Wirtschaft 1980 und Simulation von Trendentwicklungen und von wirtschaftspolitischen Massnahmen. Schulssbericht Nr. 5 zum Schweizerischen MAB-Programm. Bern 1983. (Existe aussi en français).
5. Environmental Impact Assessment for Motorways and Land-use Planning - Swiss Experiences. In: Industry and Environment, UNEP Paris, April/May/June 1983. (Also in Spanish and French).
6. Mountain regions: Environment and economics. Contribution to IUCN/UNU\* workshop on environmental planning and management for sustainable development. Montreal, Canada, 8.-12. April 1984.  
\* International Union for Conservation of Nature and Natural Resources/United Nations University.
7. The ECE/UNEP Guidelines for Environmental Impact Assessment within the UNDP/ECE Trans-European North-South Motorway (TEM) Project. UNDP/ECE/TEM/INF/2, 18 March and TEM/INF/4, 19 April 1985.
8. Environmental Impact Assessment in Switzerland: Experiences and Present Situation. In: Zs für Umweltpolitik (J of env. policy) Berlin, special issue on EIA, December 1984.
9. Oekonomie - Oekologie. Contribution au Séminaire annuel de l'Institut Suisse de Pédagogie pour la Formation professionnelle auprès de l'OFIAMT, Office Fédéral de l'Industrie, des Arts et Métiers et du Travail. Berne 7/8 décembre 1984.
10. Die neue Luftreinhalteverordnung - Für den Einbau marktwirtschaftlicher Anreize. Neue Zürcher Zeitung Nr. 225 vom 27.9.1984.
11. Zus. mit Prof. H.C. Binswanger: Consequences of advanced industrialisation and the management of common property resources and private industries. Contribution to UNESCO/Vienna Centre's ECOTRAIN Conference, Budapest, September 1985 (Publication in preparation).
12. Hidden Costs - Use of natural resources and pollution of the Environment. Contribution to the Special Issue "The Hidden Wealth", Science and Public Policy (UK) 13 (1986) 230-235. Résumé "De verborgen Kosten van Roofbouw en Vervuiling" in: "Natuur en Milieu" (NL) Fe.1987; and in: "Milieurama" (Be) Juni 1987.
13. Oekonomische Input-Output-Analyse im Umfeld der Oekologie. Geographisches Institut ETHZ, Mai 1985.

14. Union internationale pour la conservation de la nature et des ressources naturelles (UICN) Gland. Document relatif au lancement d'une Stratégie nationale de conservation en Suisse. Août 1985.  
Document principal : M. Börlin/P. Hunkeler, Stratégie Nationale pour la Conservation pour la Suisse SNC-CH. Projet du Groupe d'experts (OFPP, OFPE, AST, ISV/SGU, LSPN, WWF-Suisse), Version 25 août 1986.
15. La Commission économique pour l'Europe des Nations Unies et l'environnement. Europa - Revue suisse pour les questions européennes 2/1986.
16. Seminar on Aspects of environmental protection. 20 hours MBA Graduate Course at City University Seattle/Zürich, 17-19 October 1986.
17. Stratégie de la conservation de la nature et développement économique : Un défi pour l'économie de services. Institut Universitaire d'Etudes Européennes, Genève, 11 novembre 1986 et 24 février 1987.
18. Interview: Profile of Dr Max Börlin, Chairman of the International Union for Conservation of Nature and Natural Resources (IUCN) European Committee for National Conservation Strategies (EC-NCS). The Environmentalist (UK) 7 (Spring 1987) 4-7.
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20. Börlin/Stahel  
  
Société de Banque Suisse, "Stratégie économique de la durabilité - éléments d'une valorisation de la durée de vie des produits en tant que contribution à la prévention des déchets".  
Cahier SBS No 32, novembre 1987. Mandant : Société suisse pour la protection de l'environnement (Branche Romande).  
  
Schweiz. Bankverein, "Wirtschaftliche Strategie der Dauerhaftigkeit - Betrachtungen über die Verlängerung der Lebensdauer von Produkten als Beitrag zur Vermeidung von Abfällen".  
Bankverein-Heft Nr. 32, November 1987. Auftraggeber: Schweiz. Gesellschaft für Umweltschutz (Westschweiz).
21. Différentes présentations de la 'Stratégie économique de la durabilité' (IIe. Rencontres Romandes Recherche-Environnement, Yverdon; Entreprise de Demain, Genève; Lyceum della Svizzera Italiana e Unione di Banca Svizzera, Lugano).
22. 11 novembre 1987 : Club de l'Environnement du Grand Conseil, Fribourg : 'La protection de l'environnement : Promotrice de technologies propres rentables et de l'éco-industrie prometteuse'.
23. IDHEAP Lausanne : Cours de perfectionnement en politique de l'environnement 'De la législation vers l'action' 1.X.-17.XII 1987  
17 décembre 1987 : 4 h 'Economie de l'anti-pollution - Stratégies en milieu urbain et rural - Stratégie de la durabilité'.

24. The European Conservation Strategy Process. For IUCN's East European Programme. February 1988.
25. Les incitants économiques à la mise sur le marché de produits propres. Présenté au Séminaire "Un marché produits propres à l'horizon 1992", tenu le 6 juin 1988 dans le cadre du Parlement européen, Bruxelles.
26. Börlin et al. Elements for a draft framework agreement on environmental impact assessment in a transboundary context. UN-ECE ENVWA/AC.3/R.1, Geneva.
27. Forenergy 1988 Geneva "The economic impacts of damages to the environment" (7-10 November 1988).
28. UNIDO Vienna 13-17 November 1988: World Conference on Industrial Risk Management and Clean Technologies "The economic strategy for product durability".
29. Lyceum della Svizzera Italiana + Società di Banca Svizzera, Lugano Novembre 1988.  
"La strategia economica della durabilità quale contributo dell'economia alla protezione dell'ambiente".
30. Giarini/Börlin. Seminar of International Center for Ocean Development (ICOD), Halifax CND. December 1988. "Oceans: The evolution of property rights (EEZ, Common heritage of mankind) and the need for appropriate socio-economic-ecologic indicators for management of ocean and coastal resources".

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

Chemin des Bosquets 1  
CH - 1297 Founex/VD

NOUVEAU / NEW

☎ 022/776 25 09

Dear Prof. Mann Borgese,  
Dear Mrs. Noel,

Thank you for the kind invitation to the Sustainable Development conference. Due to other commitments I however am not in a position to accept the invitation. Best wishes for a successful work.

I am looking forward to meet you this Thursday in London.

Best regards.

Max Börlin

Telephone 022. 776.25.09

Founex, 29 January 1990

one fax to 001 902 8682818

another to 001 902 424 1216



**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

Chemin des Bosquets 1  
CH-1297 Founex/VD  
Téléphone (022) ~~7825.09~~ 776.25.09  
Fax: 41/22-776.09.37



Prof. E. Mann Borgese  
Dalhousie University  
Halifax CND  
by fax

July 4, 1991  
44/MB/es

Dear Elisabeth,

The resumé of our report in Pacem in Maribus XVI is really beautiful!

Meanwhile Orio received a personal call for papers for the commemorative Pacem in Maribus-book as well as an invitation for the ICOD Ocean day. We feel that it would be useful if a "call for ocean development indicators" would reach Rio 1992 and would be prepared to write such a contribution. Practically, I would submit the Pacem in Maribus article to IUCN and UNEP (perhaps to Brussels and IMO), and integrate their views in an article for ICOD. We would be ready and happy to write such an article under the assumption that it would reach somehow Rio 1992. Concerning presentation of the article however, I would depend on help for joining ICOD that day (travel and out-of-pocket).

Perhaps you see ways for such an article to come into the Rio-pipe, and have possibilities for the trip if needed.

Looking forward to meeting you soon again and thanking you for your attention.

*Dighiori enjmi paxanaki,*

  
Dr. oec. Max Börlin

Copie to: Orio Giarini



Dalhousie University

Seal

International Ocean  
Institute



I.O.I. - Malta

FACSIMILE TRANSMISSION

To: Max Börlin  
FAX No: 41 22 776 09 37  
  
From: Elisabeth Mann Borgese  
FAX No.: 1 902 868 2818

Date: July 24, 1991  
  
Subject: Your fax of July 4.

Dear Max:

Sorry to be late in answering your fax of July 4. I was travelling. I seem to be travelling most of the time this summer. it is terrible.

I was very enthusiastic about your proposal.

I don't know about ICOD. They have been so ineffective on this whole matter.

Tomorrow we shall have an Executive Meeting to make final decisions about that ICOD Ocean Forum. Unfortunately the November date clashes with the date for Pacem in Maribus XIX where, of course, we are also going to deal with the problem. Mohan Munasinghe and Ernst Lutz of the World Bank are presenting a paper; but what you are proposing is immensely interesting.

I will send you another FAX after tomorrow. I'll try to find out whether ICOD would pay your trip to Halifax. Alternatively you might do the whole thing for Pacem in Maribus XIX instead. I am sure it would be an interesting complement to what the World Bank people are doing, especially if you can get some EC input.

We definitely will send a set of recommendations to UNCED. In fact, Pacem in Maribus XIX and its preparation is solidly structured into the UNCED process. We are going to have another workshop in Geneva next week to start drafting recommendations. In any case, I'll give you and Orio a call.

Much love,

Elisabeth

Pearson Institute, 1321 Edward Street, Halifax, Nova Scotia, Canada, B3H 3H5  
Telephone: (902) 494-2034, Telex: 019 21 863 DALUNIVLIB, Fax: 902 494 1216

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

Chemin des Bosquets 1  
CH- 1297 Founex/VD  
Téléphone (022) 76 25 09

Prof. Elisabeth Mann Borgese  
Int.Ocean Institute  
Dalhousie University  
1321 Edward Street

HALIFAX, Nova Scotia  
Canada B3H 3H5

27 November 1991  
44/MB/es

Re.: PACEM IN MARIBUS XIX

Dear Elisabeth,

After living two experiences in Halifax (with ICOD and with your Pearce's Blueprint Conference), I had now the opportunity to participate, for the first time, to a PIM Conference. Please accept my thanks and my expression of appreciation for this personally and professionally much challenging opportunity and the general and individual arrangements accompanying it.

My modest conditions compel me to give my limited input to initiatives leading to immediate little results. This explains my insistence on identifying addressees for our accounting recommendations who -if willing- could make immediate use of them. With this "terre-à-terre" approach, as opposed to the "helicopter view" precluded to me, I took the liberty to draw the attention of the ECE "Task force" to the position of PIM XIX in the way shown in the enclosure.

With the expression of my deep feelings and personal best wishes.



Max Börlin

Encl. ment.

Chemin des Bosquets 1  
CH-1297 Founex/VD  
Téléphone (022) 76 25 09

Mr. Lucas ASUNCAO  
UNCED  
P.O.B. 80

1213 CONCHES

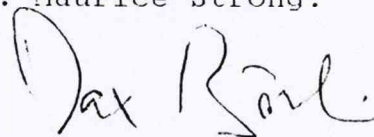
27 November 1991  
49F/MB/es

Re.: SEEA Environmental Accounting

Dear Sir,

The "Pacem in Maribus XIX" Conference of the International Ocean Institute, Halifax/Canada -held on 18-21 November 1991 in Lisbon, inaugurated by the President of the Republic of Portugal -delt also with "Environmental Accounting and Valuation in the Marine Sector". In this context, it was my privilege to discuss the paper of World Bank experts. I take the liberty of sending you copy of the revised discussion paper and should like to add that "Pacem in Maribus XIX" highly supports the elaboration of SEEA and recommends the explicit introduction of the marine sector. Mrs. Alicia Barcena brought to the Conference a Message of Mr. Maurice Strong.

Best regards.



Dr. oec. Max Börlin

Encl.ment.

Chemin des Bosquets 1  
CH-1297 Founex/VD  
Téléphone (022) 76 25 09

Mr. A. Kahnert  
Secretary of the Conference  
of European Statisticians  
UN-ECE ENHS Division  
Palais des Nations

1211 GENEVA 10

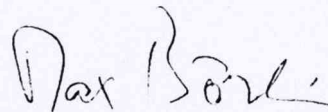
27 November 1991  
49F/MB/es

Re.: Meeting of the Task Force on environmental accounting  
13/12/1991 at UN-ECE Geneva

Dear Mr. Kahnert,

Thank you for the information you gave me concerning the work of the Task force. As you know, I used the information in the context of the Pacem in Maribus XIX Conference of the International Ocean Institute, Halifax/Canada, held on 18-21 November 1991 in Lisbon, which dealt also with "Environmental Accounting and Valuation in the Marine Sector". In this context, it was my privilege to discuss the paper of World Bank experts. May I take the liberty of submitting to you copy of the revised discussion paper and should like to add that "Pacem in Maribus XIX" highly supports activities like yours and the elaboration of SEEA and would appreciate an explicit introduction of the marine sector. The formal recommendations will appear in the Proceedings. You might wish to bring this recommendation to the attention of the Participants of your Meeting distributing the enclosed document.

With many thanks and kind regards.



Dr. oec. Max Börlin

Encl.ment.

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

Chemin des Bosquets  
CH - 1297 Founex VD  
Téléphone (022) 76 25 09

7.3.94.

COPY

FAX to  
Prof. E. Mann Borgese  
IOI Halifax

001 902 868 2455

THIS ONE  
PAGE

Addis Ababa African Seminar

Dear Elisabeth,

following your invitation of March 3 and my provisional reaction of March 5, I now can confirm that I could participate to your Seminar.

- Please confirm if the invitation still holds, indicating
- . the relevant sessions (probably the four of Tuesday?)
  - . the ticket: would IOI provide a pre-paid open, or should I make suggestions? (via ROME)
  - . the visa: I would do it from here, presuming no UN-diplomatic solution is envisaged
  - . the hotel: from Halifax, Malta, Lisbon I know IOI takes care of the reservation in the best possible way
  - . sending all the material.

Inversely, I could send you a CV etc. if needed.

I start warming up for this challenge. With best personal regards.

Max

remarks Börlin

COPY

SECTION V

- p. 46 coral reefs -p.85- not needed or implicit in one of the other items?
- p. 47 ...high employment clearly conflicts with conservation? High employment in the short run conflicts with high employment in the long run; high employment in the long run needs conservation
- p. 48 spiritual atmosphere: I expected something of the quality of my pro memoria about meditation (cf. Annex I), something beyond capitalism and socialism. Obviously, I am giving the wrong connotation to the term 'spiritual'.
- p. 49 externalities: also 'common goods', externalities being impacts beyond the decision maker, typically damages by water and air pollution
- p. 50 Questions: should the distinction between coastal, EEZ and high sea be recalled?

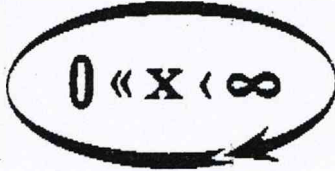
SECTION VI

- p. 52 2.nd al.: I 'stolperte' over the 'consecutio temporis': awareness of the limitations of the free-market came long before the collapse of State socialism. The most celebrated K.W. Kapp, Social costs of business enterprises 1950/Volkswirtschaftliche Kosten der Privatwirtschaft 1958; K.E. Boulding, Econ. as a science, Ecodynamics, Uncertainty, Reconstruction of Econ. between 1950 and 1978; are just two well-known examples.
- p. 52 Do I miss the third item R&D later in the text?
- p. 56 Inefficient allocation: somewhere I would have expected a pro memoria to a prominent cause of inefficiency in industrialised countries, namely State's fiscal policy distorting relative prices of production factors, i.e. taxing labour and not natural resources. Hence the slogan "tax energy and not labour", e.g. in Delors' Whitebook. An energy tax used to finance social security would disincentive robots and promote labour intensive maintenance, repair, remanufacturing and upgrading services (Ekins' 4R).
- p. 58 Last sentence: a layman's question: at what time horizon, within useful time? (Keynes: in the long run we are all dead).
- p. 67 I was looking for a hint to the last PIM in Malta and the four (?) Common Heritages.

SECTION VII

- p. 68 IUCN/UNEP/WWF's Caring for the earth (II. World Conservation Strategy) would find more pardon?

SECTION VIII No remarks.



INSTITUT DE LA DUREE, GENEVE  
 THE PRODUCT-LIFE INSTITUTE, GENEVA

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 Téléphone direct

M. Börlin direct :  
 Tél. direct : (022) 776 25 09  
 Fax direct : (022) 776 09 37  
 1. chemin des Bosquets  
 CH-1297 FOUNEX

Abfallvermeidung als Antwort auf die Strukturkrise? Oekologisch orientierte  
 Abfallwirt - Tagung an der Ev. Akademie Iserlohn 18-20. Februar 1994

Dr. oec. Max Börlin

NEUE PRODUKTE (LPN-STRATEGIEN\*) UND EFFEKTIVES CONSULTING ALS INSTRUMENTE FÜR  
 EINEN OEKOLOGISCH ORIENTIERTEN STRUKTURWANDEL

Inhalt

1. Heute gelebte LPN-Strategien
  - 1.1 Formen und Beispiele
  - 1.2 Beurteilung
2. Das LPN-Szenario für eine nachhaltige Wirtschaft
  - 2.1 Eckwerte
  - 2.2 Die obsoleten drei Obsoleszenzen von Vance Packard
3. Massnahmen zur Förderung von LPN-Strategien
  - 3.1 Bei Konsumenten, Produzenten und Berater
  - 3.2 Staatliche Rahmenbedingungen
4. Zusammenfassung: Thesenpapier
5. Bibliographie

Anhang

- A1. Zwei Dutzend praktische LPN-Beispiele im Haushaltsektor
- A2. Umweltschutz und struktureller Wandel (Schweiz)
- A3. Vermeidung an der Quelle im Abfallkonzept für die Schweiz
- A4. Katalog denkbarer Massnahmen (Schweiz)
- A5. LPN-relevante staatliche Instrumente (Bundesrepublik)
- A6. Thesenpapier

\*) Langzeitprodukte, Produktdauerverlängerung und effizientere Produktnutzung



### 3.1 Bei Konsumenten, Produzenten und Berater

LPN-Orientierung schlägt beim Produzenten auf Einzelmassnahmen, auf den umfassenden Unternehmungsstil und auf die Branchenebene durch. Ökodesign soll auf Langlebigkeit, auf Modulbauweise zur späteren technologischen Hochrüstung durch Komponentenaustausch, auf Vermeidungsengineering zur Minimierung des Wartungsbedarfes abzielen. Die systematische unternehmungsweite LPN-Strategie sodann forciert nicht mehr Modetrends und künstliche Obsoleszenz, sondern nutzt die Chance frühzeitiger Freiwilligkeit. Die Produktpalette wird weg von der Güterproduktion hin zur Dienstleistung umstrukturiert. So mausern sich grosse Anlagen- und Maschinenbauer zu Dienstleistungsunternehmen durch, und kleine und mittlere Unternehmen spezialisieren sich auf Öko-Serviceleistungen. Auf überbetrieblicher Ebene schliesslich resultiert daraus eine Strukturveränderung und nicht bloss eine ökologische Modernisierung. Neue Berufe entstehen, und das Instandhaltungs-Gewerbe wird aufgewertet, darin von Branchenorganisationen des industriellen Design, des Unterhalts, der Öko-Logistik, der Umweltsimulation und anderer mehr voll unterstützt; "Netze der Nutzung" organisieren die gemeinsame oder geteilte Nutzung (vgl. auch Giarini/Stahel 1989, Stahel 1993 a, Stahel 1993 b).

Das Kostensenkungspotential durch integrierte Umweltschutzmassnahmen wird auf 1-2 % der gesamten Produktionskosten, das Potential für Abfallreduktionen unter Berücksichtigung technischer und ökonomischer Aspekte auf 50-60% in den nächsten 10-50 Jahren geschätzt (Blazejczak/Löbke et al. 1993 bzw. gemäss BRD-Bericht zum UN-ECE-Seminar Warschau 1993). Den "LPN-Marktanteil" an diesem Öko-Potential zu sichern ist auch Aufgabe der Unternehmensberatung. Die Beispiele verdeutlichen den funktionalen Ansatz der LPN-Strategien; für eine gegebene Funktion werden Systemlösungen auf der nächsthöheren Ebene des Entscheidungsbaumes statt auf der niedrigeren des bisherigen Produktes oder der Dienstleistung gesucht. Unbelastet von Bisherigem, vermag der unternehmungsexterne Berater hier den betriebs-internen Experten nützlich zu ergänzen. Spezialisten des auf Originalität und Kreativität ausgerichteten "Neuro-Linguistic Programming NLP" könnten mit Seminaren "LPN dank NLP" Erfolg ernten namentlich bei Klein- und Mittelbetrieben

5

sowie im Bereich der Industriepolitik von Staat und Finanzinstituten (vgl. allgemein die Umweltmanagement-Broschüre des BDU, das Projekt "Ökoprofit" sowie die Vorreiter-Studie für das Umweltministerium von Baden-Württemberg; BDU 1993, Grazer Umweltamt/AG Stoff-Energie-Umwelt am Institut für Verfahrenstechnik der TU Graz 1992, Stahel 1991).

Nun ist aber die innere Einstellung der Mitarbeiter ausschlaggebend für das Umweltmanagement der Unternehmung (Farago/Bucher 1993). Die seit Jahren von Unternehmensberatern angebotenen Kurse für transformative Managementarbeit unterstützten den notwendigen Wertewandel. Anekdotisch soll zur Erläuterung aufgeführt werden:

- eine Londoner Unternehmensberatung lässt die teilnehmenden Manager Derwisch-Tänze zur Zentrierung vollführen;
- das "Osho Network for Transformation in Organizations" bringt Meditation in Betriebe, Spitälern usw. in Skandinavien, Deutschland und anderswo;
- Am "International Institute for Management Development IMD" in Lausanne lehrt der Autor von Büchern über das Selbst und "detached involvement" sowie über Intuition; auch leitet er Meditationskurse in Multis.

Beraterhilfe in transformativer Managementarbeit tritt also der betriebs-wirtschaftlichen Beratung zur Seite.

Auch Konsumenten sollte die Meditation nahegelegt werden. Das Streben nach Innen relativiert von selbst die Wünsche in der äusseren Welt; Prestigefaktoren, die Sucht nach immer Mehr verlieren an Dringlichkeit. Ein Wertewandel vollzieht sich, und ökologisch besser angepasster Konsum wird nicht mehr als Verzicht empfunden. Mutatis mutandis gilt dies auch für die Verantwortlichen des staatlichen Konsums, der öffentlichen Verwaltung also.

Letter sent to:

Statistisches Bundesamt  
zu Hd. von Herrn Carsten Stahmer  
Postfach 5528

D-6200 WIESBADEN 1

Instituto Nacional de las Estadísticas  
Baseo de la Castellano

E-183 MADRID

Statistics Office Canada  
RH Coates Building  
Holland Avenue and Scott Street  
Ottawa K1A 0T6

Netherlands Central Bureau of Statistics  
Att. Dr. Roefie Hueting  
Head of Dept. of Environment Statistics  
P.O. Box 959

NL-2270 AZ VOORBURG

M. J.L. Weber,  
Secrétaire général de la Commission Interministérielle  
des Comptes du patrimoine nature  
Secrétariat d'Etat chargé de l'Environnement - SRETIE  
14, bd. du Général Leclerc  
F-92524 NEUILLY-sur-Seine CEDEX

Oesterreichisches Statistisches Zentralamt  
Att. Dr. Alfred Franz  
Abt. Oekologische Volkswirtschaftliche Gesamtrechnung  
Hintere Zollamtstrasse 2B

A-1003 WIEN

Chemin des Bosquets 1  
CH- 1297 Founex/VD  
Téléphone (022) 76 25 09

November 27, 1991  
49F/MB/es

Re.: "Pacem in Maribus XIX" Recommendations covering Marine  
Sector Accounting

Dear Sirs,

The "Pacem in Maribus XIX" Conference of the International Ocean Institute, Halifax/Canada, held on 18-21 November 1991 in Lisbon, inaugurated by the President of the Republic of Portugal, dealt also with "Environmental Accounting and Valuation in the Marine Sector". In this context it was my privilege to discuss the paper of World Bank experts. May I take the liberty of submitting to you copy of the revised discussion paper and should like to add that "Pacem in Maribus XIX" highly supports activities like yours and the elaboration of SEEA and would appreciate an explicit introduction of the marine sector. The formal recommendations will appear in the Proceedings.

Best regards.

Dr. oec. Max Börlin

Encl. mentioned



Dalhousie University

International Ocean  
Institute

**FAXED**



FACSIMILE TRANSMISSION

To: Dr. Max Boerlin  
Fax: 41 22 776 09 37  
From: Elisabeth Mann Borgese  
Fax: 1 902 868 2455  
Date: February 19, 1997

Subject: Bucharest

Dear Max,

They were pretty slow, in Bucharest, to confirm arrangements for our workshop, and communications were difficult. But everything is in good order now. I expect they will get in touch with you, and you should get your prepaid ticket..

As to your "Rechte und Pflichten,"

1. I do believe that you have a copy of Chapter 3 of the book. If not, do let me know and I shall send it to you. Do you have e-mail? In Bucharest, I m sure, you will get the whole book, because we are going to discuss the whole book.
2. Yes, I think it will be useful if, at the appropriate time, you give a little introduction to the indicator section. I am sure there will be discussion, questions, and suggestions. I already have <sup>o</sup>me suggestions from UNDP, which I will bring along.
3. Travel, food, lodging, out of pocket expenses will be covered. There is no honorarium.

I hope all this is clear and acceptable and am looking forward to seeing you in Bucharest where you should plan to arrive on March 15.

All the very best,

Yours as ever,

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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Téléphone (022) 776 25 09  
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14 February 1997

RECEIVED FEB 24 1997

10/1/97  
Mentioned  
to EMS  
(Gen → St.  
Marty)

Prof. E. Mann Borgese  
International Ocean Institute  
Dalhousie University  
1226 LeMarchant Street  
CND-HALIFAX, Nova SCOTIA B3H3P7

re: Ocean perspectives - A report to The Club of Rome

Dear Elisabeth,

Orio Giarini gave me copy of his letter to you of 10/1/97, in which he recalls our 1988 work for/in Halifax and summarises basic points. As a complement, follow some remarks about existing and planned indicators. You may recall that we had delivered a full-scale final report in 1988, out of which you used some ideas in your 1989 contact with Hoyes Foundation, and that later PIM published main results in the Proceedings XVI August 1988. May I refer to this latter version, with its 3 Parts: I. Introduction, II. Practical Applications, and III Follow-up:

I C. WCED (p.235 and note 9) is now the UN Commission for Sustainable Development, with its Indicator Programme

II D. Approaches to Environmental Accounting: There are now new projects, including

- Health of the oceans, of GESAMP (p. 235, note 15, p.239)
- updated FAO fish stock indicators (note 16)
- UN ECE Environment Compendium (p.239, 244) /indicators for
- UN Dept. ...on Sustainable Development, Work programme on/Sustainable Development, approved by CSD; UNEP Plan of action 1996-1997 (cf. the Annex); UNEP regional SEAS Programme incl. the Mediterranean and the North Sea
- the OECD Environment Indicators System
- World Resources, up to 1996-97, whereas the paper mentions 1987 (note 8)
- other publ.like WRI's Hammond (enclosed), or 'Functions of Nature' by R.S. de Groot, and, overall
- IUCN's Oceans and Coastal Programme; I understand you have contacts with its Head Magnus Ngoalé

D., 2 & 3 Over-all systems in phys. and monetary terms: UN Guidelines 1993 and Eurostat & EEAgency SERIEE and other programmes

I know you are aware of these publications and programmes of the last almost 10 years; still, you may wish some checking and collection work. If so, I would suggest some days in the Geneva area (GESAMP, FAO, ECE, UNEP, IUCN and their specialised libraries), perhaps Paris (OECD, the French IFEN Agency), perhaps Luxemburg for Eurostat and the Eur. Env. Agency), with a financial help.

With best personal wishes.

encl: 2, as undelined

Copy to Orio Giarini.

**DALHOUSIE UNIVERSITY ARCHIVES DIGITAL SEPARATION SHEET**

**Separation Date:** July 2, 2015

**Fonds Title:** Elisabeth Mann Borgese

**Fonds #:** MS-2-744

**Box-Folder Number:** Box 282, Folder 32

**Series:** Administrative records of the International Ocean Institute

**Sub-Series:** Correspondence

**File:** Correspondence between Elisabeth Mann Borgese and Max Borlin

**Description of items:**

Borlin, Max, "Indicators for sustainable development: UNEP's role in a collaborative effort," *UNEP Industry and Environment*, September 1995, 21-24.

Lyon Dahl, Arthur, *The Eco Principle*, London, Zed Books, 1996, 90-93.

**Reason for separation:**

Pages have been removed from digital copy due to copyright and privacy concerns.

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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8.3.1997.

Prof. E. Mann Borgese  
zZ Hotel Suvretta House  
Fax 081 832 11 32

St. Moritz

Dear Elisabeth,

Thank you again for your invitation to contribute to your CoR Report and your training programme. Meanwhile, you should have received by today's fax my note-reply, and one copy - clean, complete - is here for you.

In his employment Report, Orio thinks that the older, at the age of 60, cannot simply envisage a future of at least 20 years of idleness. ... People will probably provide work without expecting monetary compensation (p. 178, 188). Well, as far as I am concerned, retired I now have the privilege to live my 'existential hobbies', such as Osho Sri Rajneesh; Lamparelli, Tecniche di meditazione orientale; bardo thödol, The Tibetan book of the Dead; Whirling, the Sufi/Dervish dance. The straitforward benefit-cost analysis for every other potential activity then is to find out how much it would help me to finance my 'existential hobbies' and, inversely, take me away from them!

The other facet of the budget question is already asked by you, and it seems to me that, in your Report, the vast subject offers two ways of response: either a full-scale research landing in a general result e.g. of the Costanza-type (but that is a book in itself), or the review and, as an addition to knowledge and praxis, an outline for merging conventional tables and consistent indicators, without numerically producing a revised/revisited table. I am prepared to discuss the budgetary implications of the alternatives, as well as other relevant constraints (human resources, pages in ch. 3, time horizon - finished for week starting August 4? - availability of inputs from Sect. 1 and 2). I do hope that we can find a format 'utile e gradevole' to both.

I wish you a pleasant trip to the Léman (unfortunately not with the Glacier Express!) and shall enjoy hearing from you.

Max

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8.3.1997.

Prof. E. Maria Borgese  
c/o HOTEL SUVRETTA HOUSE  
Fax 081 833 85 24  
St. Moritz

## FACSIMILE TRANSMISSION

this first page	1 page
text	3 pages
annex	3 pages
TOTAL	7 pages

- - -

Subject: Sustainable Development - Report to CoR

Dear Elisabeth,

Thank you again for your letter; please find now the reply-note; a clean and complete copy is ready with me. I would love to see you again and to discuss the note with you.

With my compliments and  
molto cordiali auguri,

Dax



D/BÖRLIN

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**Indicators applying to the oceans - A contribution to the Report\***

The purpose of this note is to explore how the subject of ocean indicators could explicitly be introduced into the Report\*. Elisabeth Mann Borgese had suggested complements about ongoing indicator work, gaps, and development of the conventional tables to indicators for Common Heritage. These three directions are taken up in the following text and its annexes.

**A. OVERVIEW OF THE ONGOING OCEAN RELATED INDICATOR WORK**

**A.1 Main sources**

Several activities and initiatives of statistical offices, research centers, public administration etc. result in (ingredients to) ocean indicators:

- a) oceanography, marine science, such as the indicator development work at the World Resources Institute
- b) socio-economic studies of ocean sectors, development projects etc. such as Cost-Benefit Analysis, Environmental Impact Assessment
- c) the greening of national accounts, as described in two reports to the CoR and of WWF-International presented at the International Conference on the global adoption of green accounting, held in May/June 1995 at the European Parliament in Brussels. Cf. Van Dieren, ed., Taking nature into account, NY 1995 and Sheng, Real value for nature, Brussels 1995.
- d) the general indicators movement in the socio-economic area with OECD, UNDP, UNEP in its contribution to the WCSO programme, World Bank.

Some of these activities and initiatives were mentioned in the Giarini/Börlin ICOD-Report 1988 (cf. Annex p. A1, A2 f.). The more relevant ones will be up-dated and new ones introduced.

**A.2 Types of results**

These activities and initiatives result in:

- 1) isolated indicators in non-monetary terms
- 2) systems of consistent indicators in non-monetary terms
- 3) isolated information in monetary terms
- 4) systems of consistent indicators in monetary terms

IUCN's biodiversity indicators for policy-makers are examples of the first type. Systems of consistent indicators in non-monetary terms ask for an aggregation devise, such as energy content, vulnerability, an explicit weighting system. Examples of isolated estimates of sea resources in monetary terms (type 3) up to 1988 are listed in Annex p. A7 f. and, more recently, collected by de Groot (cf. de Groot,

\* E. Mann Borgese, Ocean Perspectives - A Report to the CoR; its ch. 3 Ocean perspectives: Economic (30 pages); its sect. 2 From traditional economics to economics of Common Heritage

Functions of nature, Wolters-Noordhoff (NL) 1992). Finally, systems of consistent indicators in monetary terms (type 4) are illustrated by

- . the estimates of the socio-economic value of environmental functions provided by the Dutch Wadden Sea and the Galapagos National Park (Annex p. A6 and A9)
- . the assessment of the ocean's sector's contribution to GNP tentatively tried out for USA, Korea and the Philippines by Cortez (in EEZ and economic development, PIM XV 1987)
- . the estimate of average global value of annual ecosystem services by 16 elements and 17 functions, just presented by Costanza at the WCSD workshop February 1997 in Lisbon
- . some results of the work for greener national accounts.

### A.3 Overview by source and results

Ideally, main publications and programmes can now be presented by source and results. Repetitions of the conventional tables discussed in Section 1 of the Report\* will have to be avoided.

A standard format of presentation includes parameters like

- i the type of results (according to para. A.2)
- ii space
  - . national/regional/planetary; supranational comparability
  - . biome: coastal zone (beaches, wetlands, swamps, shallow waters), continental margins (shelves, slopes, rises), deep sea-bed of the open ocean
- iii elements of marine resources, namely sea water, minerals, energy, natural areas, flora and fauna ((as listed on p. A5), and functions in respect to human needs, namely regulation, carrier, production and information functions (cf. p. A6)
- iv quantity and quality: IUCN's 'red data books' about threatened marine plants and animals etc. is the example of a quantitative stock indicator; levels of organochlorine compounds in fish flesh for the North Sea is a qualitative stock indicator

as well as, if needed and possible, appropriate requirements from Common Heritage Economics (according to B.1 below).

## B. INDICATOR GAPS IN THE OCEAN SECTOR - IT'S A LONG WAY TO INDICATORS FOR COMMON HERITAGE ECONOMICS

We are looking for a set of usable ocean indicators that will properly assess and monitor the generation of real wealth. The material alluded to in the overview is voluminous; still, it cannot hide the fact that "indicators for the environment are just beginning to be formulated" (Hammond et al., Environmental indicators, Earthscan 1994), as well as its inconsistency for Common Heritage Economics as developed in Section 2 of the Report\*. Hence the question about indicator gaps.

### B.1 The goal of consistent ocean indicators - Requirements from Common Heritage Economics

Section 2 of the Report\* deals with the new theory of economics of Common Heritage as developed mainly by Giardini. It follows that consistent ocean indicators should respond to the general parameters i to iv mentioned above and, most importantly,

- v rest on utilization value instead of exchange value
- vi cover also non-remunerated work (i.e. exchanged but not paid with money and not exchanged)
- vii account for deducted values, i.e. external costs stemming from

pollution and destruction of marine resources as a result of general human activity as well as of unregulated exploitation of marine resources. Environment related deductions take the forms recalled on p. A10; see also p. A5

- viii preferably address stock rather than flow magnitudes; the latter, namely additions and deductions during the period, transform a stock magnitude, i.e. the inventory at the beginning of the period, into a new stock magnitude, namely the inventory at the end of the period
- ix make the uncertainty inherent in complex systems (parameter uncertainty, model structure uncertainty, and uncertainty due to variable data quality) explicit. The IOOD-Report mentions a normalized resource abundance index plotted against a normalized 'vulnerability' index for each of the 96 countries with data, and the risk index as function of both. Since then, UNEP is working on a Vulnerability index for the sustainable development of Small Islands Developing States

**B.2 Goal oriented screening of the reported publications and programmes (A.3 vs.B.1)**

For gap identification, the material presented in para. A3 will be screened in the light of general parameters such as i to iv and especially of the specific requirements for Common Heritage economics v to ix. Non-relevant dimensions will be disregarded, and, if needed, new items such as the consistent aggregation of isolated, partial indicators into a unique, overall indicator added.

**B.3 Follow-up**

- Possible follow-ups will be suggested, perhaps
  - . the development of ocean indicators consistent with Common Heritage economics for a specific pilot area
  - . the pursuit of Champ/McLain/Vadus' initiative for generating and collecting estimates of the economic benefits/estimated value of 15-20 ocean sectors going from mariculture up to state and national marine parks; their call for a joint venture appeared in Sea Technology September 1995.

**C. FROM CONVENTIONAL TABLES TO INDICATORS FOR COMMON HERITAGE ECONOMICS (Section 1 of the Report\* vs. B.1)**

Section 1 of the Report\* gives an overview of the economic potentials of the oceans. These conventional tables will only partially reflect Common Heritage economics. The flow indicator of fish caught e.g. must be questioned for over-exploitation of fish stock. Similarly, an indicator for coastal tourism money earned probably is limited to remuneration in money and takes a short-run outlook, thus disregarding medium and long-term environmental damages, i.e. deducted values as counterpart to value added.

Hence, the question arises how conventional tables evolve into consistent indicators. A tentative reply will be gained comparing the set of requirements for consistency of ocean indicators (para. B.1 above) with the conventional tables presented in Section 1 of the Report\*.

---

The contribution to the Report\* envisaged herewith must remain consistent with the limited human and financial resources and with space constraints (30 pages for ch. 3 of the Report\* overall).

Founex, 8.3.1997.

Annex: p. A1 to A 10

PROGRAMMES	Nr.	PROGRAMMES
UNESCO Action Plan for Biosphere Reserves UNESCO World Heritage Convention IUCN-CMC UN List of Nat. Parks and Protected Areas GEC-CORINE	17	UNEP (inter alia) 2.1.1 GEMS Climate 2.1.2 GEMS Oceans: Oceans and Coastal Areas Programme, including Regional Seas Programme
<del>Council of Europe European Network of Biogenetic Reser</del>		2.3 GRID Global Resource Information Database
<del>IUCN Ramsar Wetlands</del>		3.5 Environmental Accounting Workshop IBRD
UN-ECE European Red Data Book		3.6 Compensation Mechanisms for Conservation
UNEP-IUCN Marine Mammals	18	Baltic Marine Environmental Protection Commission HELCOM
Convention on the Conservation of European Wildlife and	19	OECD
Natural Habitats (Bern Convention)	20	World Resources Institute
Charter on Invertebrates	21	FAO
Marine Pollution Monitoring Pilot Project MAPMOPP	22	IUCN, CMC (inter alia) a) Coastal and Marine Programme b) Wetlands Conservation Programme c) Plants Conservation Programme d) Species Conservation Programme e) Protected Area Management Programme f) Conservation Science Programme g) CMC Conservation Monitoring Center h) Habitat Monitoring Unit
GESAMP Group of Experts on Scientific Aspects of		
Marine Pollution		
Nature Conservancy International		
Global Warming and the Greenhouse gases (Villach)		
International Geosphere-Biosphere Programme IGBP		
UN-ECE and Conference of European Statisticians (CES)		
1.1 Environmental Economics		
1.3 Economics and Flora, Fauna, Habitats		
2.1 Environmental Statistical Compendium		
2.2 Standard Classifications	23	EPA Sea Level Rise Project
2.3 Environmental Indicators	24	Coastal Resources Management Project ASEAN-USAID
3 Overall Perspective to the year 2000		

**Functions of natural environment**

**Socio-economic value of environmental functions provided by the Dutch Wadden Sea (based on maximum sustainable use levels)**

(values are expressed qualitatively (++) or in US\$/ha/year).  
Total surface area of the study area: 270,000 ha

**Regulation functions**

1. Protection against harmful cosmic influences
2. Regulation of the local and global energy balance
3. Regulation of the chemical composition of the atmosphere
4. Regulation of the chemical composition of the oceans
5. Regulation of the local and global climate (incl. the hydrological cycle)
6. Regulation of floods and flood prevention (watershed protection)
7. Watercatchment and groundwater-recharge
8. Prevention of soil erosion and sediment control
9. Formation of topsoil and maintenance of soil-fertility
10. Fixation of solar energy and biomass production
11. Storage and recycling of organic matter
12. Storage and recycling of nutrients
13. Storage and recycling of human waste
14. Regulation of biological control mechanisms
15. Maintenance of migration and nursery habitats
16. Maintenance of biological (and genetic) diversity

**Carrier functions**

- providing space and a suitable substrate for*
1. Human habitation and (indigenous) settlements
  2. Cultivation (crop growing, animal husbandry, aquaculture)
  3. Energy conversion
  4. Recreation and tourism
  5. Nature protection

**Production functions**

1. Oxygen
2. Water (for drinking, irrigation, industry, etc.)
3. Food and nutritious drinks
4. Genetic resources
5. Medicinal resources
6. Raw materials for clothing and household fabrics
7. Raw materials for building, construction and industrial use
8. Biochemicals (other than fuel and medicines)\*
9. Fuel and energy
10. Fodder and fertilizer
11. Ornamental resources

**Information functions**

1. Aesthetic information
2. Spiritual and religious information
3. Historic information (heritage value)
4. Cultural and artistic inspiration
5. Scientific and educational information

Types of values (based on Table 3.0.1. for explanation, see text)

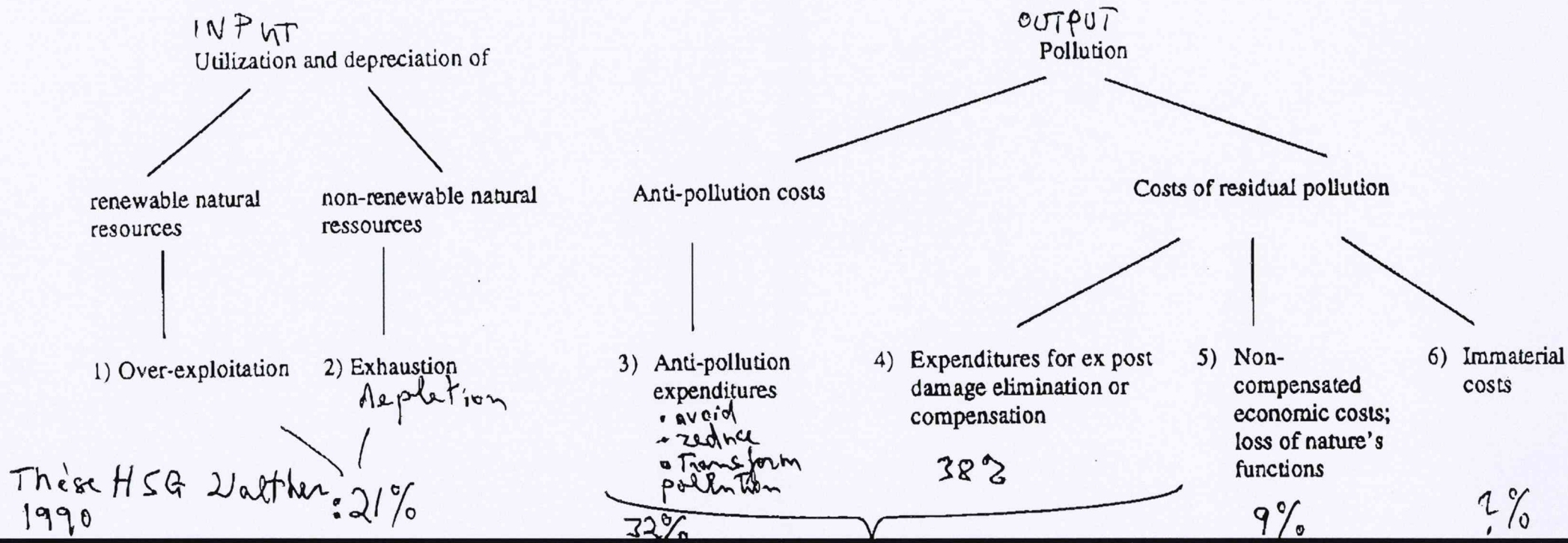
	Ecological	Existence value	Social values	Consumptive use value	Productive use value	Value to employment (# people)
<b>Regulation Functions</b>	> 5,120	++	++		++	
Climate regulation	++		-		*	
Flood prevention	500		+		*	
Erosion prev./sediment.	++				*	
Bio-energy fixation	13000				*	
Storage rec. org. matter	2000		+		*	
Storage/rec. nutrients	2500		++		*	
Nursery/Emigration hab.	120	++	++		*	
Maintenance of biol. div.	--	--	++		*	
<b>Carrier Functions</b>	15	++	++		> 522	> 263
Aquaculture					22	160
Recreation			+		500	>> 10
Nature protection	15	++	++		*	93
<b>Production Functions</b>			++	+	> 475	> 207
Food/nutrition			++		450	207
Raw materials for constr. (sand/shells)				+	25	--
Fuel and energy						
<b>Information Functions</b>	15		++	++	> 16	> 65
Aesthetic information			++	++	+	
Spiritual/religious inform.	15		++	++	*	
Cultural/artistic insp.			+	+	+	
Educ. & scientific inf.				+	16	65
<b>TOTAL ANNUAL VALUE</b>	> 5,150	++	++	++	> 1,013	(535)

\* Social values consist of the importance of environmental functions to human health and the option value provided in a safe future.  
If a figure is given between brackets it was not used in calculating the total value because the calculation is too speculative.  
Figures in this column refer to \$ or people and US\$.  
These functions do contribute to economic products, either directly or indirectly, but no market or shadow prices could be determined due to lack of information and/or shortcomings of the market mechanism.

The ecological value of environmental functions can often only be described in qualitative terms; quantification will usually only be possible in "natural" dimensions (e.g. number of species, amount of runoff prevented).  
Social values may be quantified by setting standards for minimum requirements for the availability of a given function (e.g. air-quality or maximum limits to ensure sustainable harvesting of natural resources).  
The economic value of environmental functions may be expressed in their "natural" dimensions (e.g. quantity of resources harvested), in monetary units (i.e. the value of the resources harvested) or by the number of people employed by activities which depend on a given function.

8, 4, 7, 9, 5

Economy-Environment Interface: Environment related costs



Environmental expenditures

Environmental costs

5. non-compensated economic costs (in production, income, assets) and losses of ecological functions of media, ecosystems, and species
6. immaterial welfare losses to individuals and the society at large, such as damage to landscape and cultural patrimony, long-run ecological risks.

IDV/SORLIN  
1/3

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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Founex, 14 March 1997

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- . by fax to 1 902 494 2034  
or 1 902 868 2455; total 3 p.

re Indicator contribution to CoR Report

Dear Elisabeth,

it was a pleasure to me to meet you again in Geneva, and I appreciated the opportunity to discuss with you a possible indicator contribution to your CoR Report. Meanwhile, I drafted the enclosed the enclosed "Agreement concerning a contribution "ocean indicators" and hope it reflects your intentions. Please let me know your suggestions for modification, if any; or else your agreement with the draft, and I shall start working.

With best personal wishes.

  
Max Börlin

encl. a 2 p.- Agreement

Chemin des Bosquets 1  
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Téléphone (022) 776 25 09  
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**Agreement concerning a contribution "ocean indicators"**

In a letter of February 26, 1997, Prof. E. Mann Borgese stated her intention

- A. to include in Sect. 2 of Chapter 3 of her Ocean Report to the Club of Rome  
an overview of the ongoing indicator work applied to the oceans
- B. and of gaps in the ocean sector; as well as
- C. to take the conventional tables in Sect. 1 (fish caught, oil shipped, coastal tourism money earned, etc.) and see how they are modified by the indicators.

As a reply, Max Börlin submitted on March 8, 1997, a Note "Indicators applying to the oceans - A contribution to the Report", which was discussed with Prof. Borgese in Geneva on March 10, 1997. Hereupon, the contribution can be described as follows:

a. Subject

The included Synopsis is based on the three-pages Note and resumes the programme of work. Research will show if and how far in para.C. the qualitative description can be illustrated with a partial transformation of a conventional table. Synopsis and Note reflect the Report to ICOD, Halifax "The contribution of oceans and ocean development to wealth and welfare" by Giarini and Börlin, Geneva 1988.

b. Output: A report of 30 to 40 pages

c. Time schedule

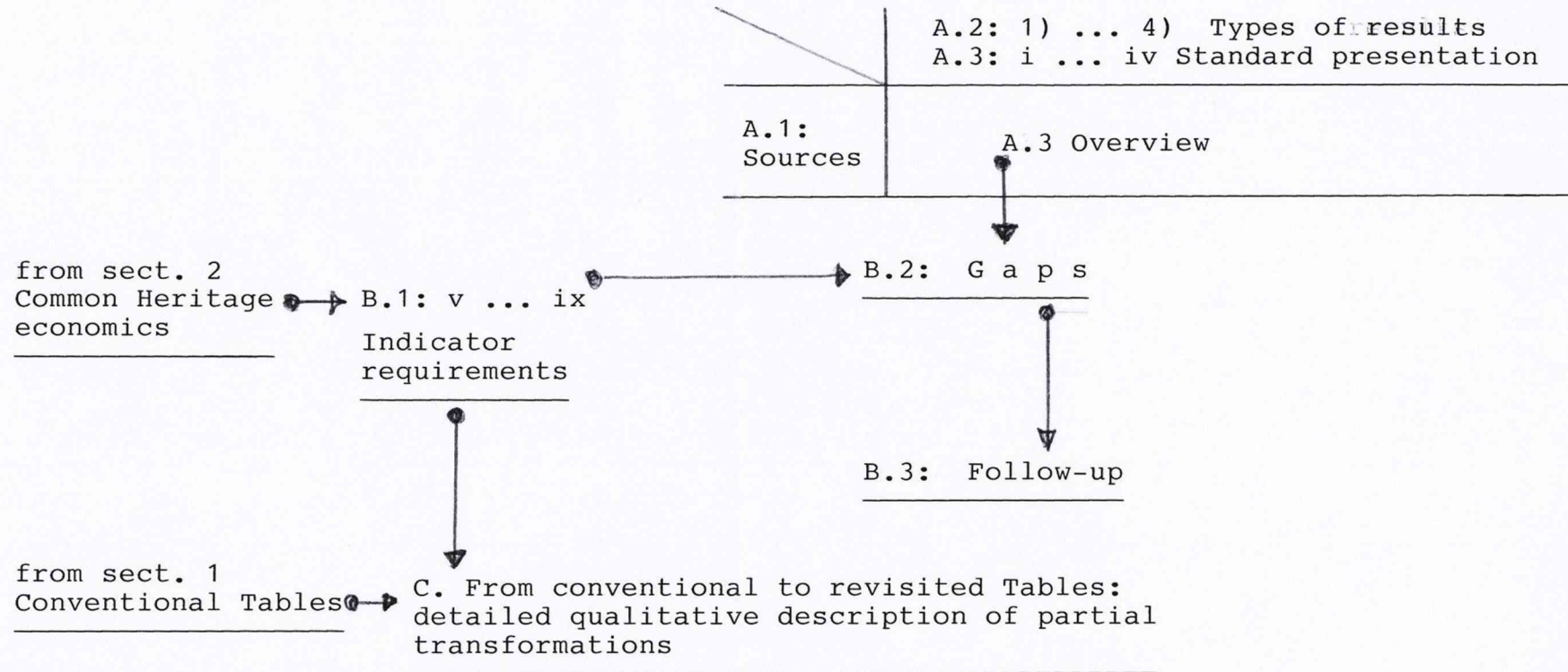
- in March research starts after acceptance of this draft agreement and transfer of the account
- early April discussion in Geneva
- early May list of conventional tables of Section 1 as input into A.3 Overview is made available
- end of May an outline of Section 2 Common Heritage Economics as input into B.4 definition of indicator requirements is made available
- end of June the conventional tables of Section 1 to be revisited in para. C. are now an available input into C.
- early August oral presentation of large parts of the draft report at IOI Halifax; after acceptance, proceeding to the final report
- 30 September submission of the final report

d. Budget, fee: US\$ 10.000, due 50% at the start of the research and the rest upon receiving the Final report.  
Payable to MB, Swiss Bank Corporation, Nyon, for account EO-669,555.3.

encl. Synopsis (ad a. Subject)



S Y N O P S I S    ad alinea 'a. Subject'



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## Indicators applying to the oceans - A contribution to the Report\*

The purpose of this note is to explore how the subject of ocean indicators could explicitly be introduced into the Report\*. Elisabeth Mann Borgese had suggested complements about ongoing indicator work, gaps, and development of the conventional tables to indicators for Common Heritage. These three directions are taken up in the following text and its annexes.

### **A. OVERVIEW OF THE ONGOING OCEAN RELATED INDICATOR WORK**

#### **A.1 Main sources**

Several activities and initiatives of statistical offices, research centers, public administration etc. result in (ingredients to) ocean indicators:

- a) oceanography, marine science, such as the indicator development work at the World Resources Institute
- b) socio-economic studies of ocean sectors, development projects etc. such as Cost-Benefit Analysis, Environmental Impact Assessment
- c) the greening of national accounts, as described in two reports to the CoR and of WWF-International presented at the International Conference on the global adoption of green accounting, held in May/June 1995 at the European Parliament in Brussels. Cf. Van Dieren, ed., Taking nature into account, NY 1995 and Sheng, Real value for nature, Brussels 1995.
- d) the general indicators movement in the socio-economic area with OECD, UNDP, UNEP in its contribution to the WCSD programme, World Bank.

Some of these activities and initiatives were mentioned in the Giarini/Börlin ICOD-Report 1988 (cf. Annex p. A1, A2 f.). The more relevant ones will be up-dated and new ones introduced.

#### **A.2 Types of results**

These activities and initiatives result in:

- 1) isolated indicators in non-monetary terms
- 2) systems of consistent indicators in non-monetary terms
- 3) isolated information in monetary terms
- 4) systems of consistent indicators in monetary terms

IUCN's biodiversity indicators for policy-makers are examples of the first type. Systems of consistent indicators in non-monetary terms ask for an aggregation devise, such as energy content, vulnerability, an explicit weighting system. Examples of isolated estimates of sea resources in monetary terms (type 3) up to 1988 are listed in Annex p. A7 f. and, more recently, collected by de Groot (cf. de Groot,

\* E. Mann Borgese, Ocean Perspectives - A Report to the CoR; its ch. 3 Ocean perspectives: Economic (30 pages); its sect. 2 From traditional economics to economics of Common Heritage

Functions of nature, Wolters-Noordhoff (NL) 1992).

Finally, systems of consistent indicators in monetary terms (type 4) are illustrated by

- . the estimates of the socio-economic value of environmental functions provided by the Dutch Wadden Sea and the Galapagos National Park (Annex p. A6 and A9)
- . the assessment of the ocean's sector's contribution to GNP tentatively tried out for USA, Korea and the Philippines by Cortez (in EEZ and economic development, PIM XV 1987)
- . the estimate of average global value of annual ecosystem services by 16 elements and 17 functions, just presented by Costanza at the WCSD workshop February 1997 in Lisbon
- . some results of the work for greener national accounts.

### A.3 Overview by source and results

Ideally, main publications and programmes can now be presented by source and results. Repetitions of the conventional tables discussed in Section 1 of the Report\* will have to be avoided.

A standard format of presentation includes parameters like

- i the type of results (according to para. A.2)
- ii space
  - . national/regional/planetary; supranational comparability
  - . biome: coastal zone (beaches, wetlands, swamps, shallow waters), continental margins (shelves, slopes, rises), deep sea-bed of the open ocean
- iii elements of marine resources, naimly sea water, minerals, energy, natural areas, flora and fauna ((as listed on p. A5), and functions in respect to human needs, naimly regulation, carrier, production and information functions (cf. p. A6)
- iv quantity and quality: IUCN's 'red data books' about threatened marine plants and animals etc. is the example of a quantitative stock indicator; levels of organochlorine compounds in fish flesh for the North Sea is a qualitative stock indicator

as well as, if needed and possible, appropriate requirements from Common Heritage Economics (according to B.1 below).

## B. INDICATOR GAPS IN THE OCEAN SECTOR - IT'S A LONG WAY TO INDICATORS FOR COMMON HERITAGE ECONOMICS

We are looking for a set of usable ocean indicators that will properly assess and monitor the generation of real wealth. The material alluded to in the overview is voluminous; still, it cannot hide the fact that "indicators for the environment are just beginning to be formulated" (Hammond et al., Environmental indicators, Earthscan 1994) as well as its inconsistency for Common Heritage Economics as developed in Section 2 of the Report\*. Hence the question about indicator gaps.

### B.1 The goal of consistent ocean indicators - Requirements from Common Heritage Economics

Section 2 of the Report\* deals with the new theory of economics of Common Heritage as developed mainly by Giarini. It follows that consistent ocean indicators should respond to the general parameters i to iv mentioned above and, most importantly,

- v rest on utilization value instead of exchange value
- vi cover also non-remunerated work (i.e. exchanged but not paid with money and not exchanged)
- vii account for deducted values, i.e. external costs stemming from

pollution and destruction of marine resources as a result of general human activity as well as of unregulated exploitation of marine resources. Environment related deductions take the forms recalled on p. A10; see also p. A5

- viii preferably address stock rather than flow magnitudes; the latter, namely additions and deductions during the period, transform a stock magnitude, i.e. the inventory at the beginning of the period into a new stock magnitude, namely the inventory at the end of the period
- ix make the uncertainty inherent in complex systems (parameter uncertainty, model structure uncertainty, and uncertainty due to variable data quality) explicit. The ICOD-Report mentions a normalized resource abundance index plotted against a normalized 'vulnerability' index for each of the 96 countries with data, and the risk index as function of both. Since then, UNEP is working on a Vulnerability index for the sustainable development of Small Islands Developing States

### **B.2 Goal oriented screening of the reported publications and programmes (A.3 vs.B.1)**

For gap identification, the material presented in para. A3 will be screened in the light of general parameters such as i to iv and especially of the specific requirements for Common Heritage economics v to ix. Non-relevant dimensions will be disregarded, and if needed, new items such as the consistent aggregation of isolated partial indicators into a unique, overall indicator added.

### **B.3 Follow-up**

Possible follow-ups will be suggested, perhaps

- . the development of ocean indicators consistent with Common Heritage economics for a specific pilot area
- . the pursuit of Champ/McLain/Vadus' initiative for generating and collecting estimates of the economic benefits/estimated value of 15-20 ocean sectors going from mariculture up to state and national marine parks; their call for a joint venture appeared in Sea Technology September 1995.

### **C. FROM CONVENTIONAL TABLES TO INDICATORS FOR COMMON HERITAGE ECONOMICS (Section 1 of the Report\* vs. B.1)**

Section 1 of the Report\* gives an overview of the economic potentials of the oceans. These conventional tables will only partially reflect Common Heritage economics. The flow indicator of fish caught e.g. must be questioned for over-exploitation of fish stock. Similarly, an indicator for coastal tourism money earned probably is limited to remuneration in money and takes a short-run outlook, thus disregarding medium and long-term environmental damages, i.e. deducted values as counterpart to value added.

Hence, the question arises how conventional tables evolve into consistent indicators. A tentative reply will be gained comparing the set of requirements for consistency of ocean indicators (para. B.1 above) with the conventional tables presented in Section 1 of the Report\*.

- - -

The contribution to the Report\* envisaged herewith must remain consistent with the limited human and financial resources and with space constraints (30 pages for ch. 3 of the Report\* overall).

107/SÖRLIN



Dalhousie University

International Ocean  
Institute

**FAXED**



FACSIMILE TRANSMISSION

To: Dr. Max Boerlin  
Fax: 41 22 776 09 37

From: Elisabeth Mann Borgese  
Fax: 1 902 868 2455

Date: March 15, 1997

Subject: Our project

Dear Max,

Thanks for your prompt and positive communication.

On the whole, I think everything is fine, although I am sure both of us will have to be a little flexible. Projects like this make their own laws and take shape as they move along!

But we are ready to go. I am transferring the \$5,000.

Keep me posted, and send me some stuff as you go along.

It was indeed nice to see you again. Don't whorl too hard!

All the best,

Yours as ever,

*Elisabeth*

## PROGRAMMES

UNESCO Action Plan for Biosphere Reserves  
 UNESCO World Heritage Convention  
 IUCN-CMC UN List of Nat. Parks and Protected Areas  
 CEC CORINE  
 Council of Europe European Network of Biogenetic Reser

IUCN Ramsar Wetlands  
 UN-ECE European Red Data Book  
 UNEP-IUCN Marine Mammals  
 Convention on the Conservation of European Wildlife and  
 Natural Habitats (Bern Convention)  
 Charter on Invertebrates

Marine Pollution Monitoring Pilot Project MAPMOPP  
 GESAMP Group of Experts on Scientific Aspects of  
 Marine Pollution  
 Nature Conservancy International  
 Global Warming and the Greenhouse gases (Villach)  
 International Geosphere-Biosphere Programme IGBP

UN-ECE and Conference of European Statisticians (CES)  
 1.1 Environmental Economics  
 1.3 Economics and Flora, Fauna, Habitats  
 2.1 Environmental Statistical Compendium  
 2.2 Standard Classifications  
 2.3 Environmental Indicators  
 3 Overall Perspective to the year 2000

## Nr. PROGRAMMES

17 UNEP (inter alia)  
 2.1.1 GEMS Climate  
 2.1.2 GEMS Oceans: Oceans and Coastal Areas Programme,  
 including Regional Seas Programme

2.3 GRID Global Resource Information Database  
 3.5 Environmental Accounting Workshop IBRD  
 3.6 Compensation Mechanisms for Conservation

18 Baltic Marine Environmental Protection Commission HELCOM

19 OECD

20 World Resources Institute

21 FAO

22 IUCN, CMC (inter alia)  
 a) Coastal and Marine Programme  
 b) Wetlands Conservation Programme  
 c) Plants Conservation Programme  
 d) Species Conservation Programme  
 e) Protected Area Management Programme  
 f) Conservation Science Programme  
 g) CMC Conservation Monitoring Center  
 h) Habitat Monitoring Unit

23 EPA Sea Level Rise Project

24 Coastal Resources Management Project ASEAN-USAID

ANNEX 8

PROGRAMMES CONCERNING THE MEDITERRANEAN (encl. 1)

A. Barcelona action plan for the protection of the Mediterranean

As explained in the Annexes from UNEP's Regional Bulletin for Europe June 1987 and UNEP's Achievements, this Action Plan was elaborated in the Barcelona Convention 1976 and is co-ordinated by a UNEP Co-ordinating Unit for the Mediterranean action plan which is part of UNEP's regional seas Programme, now in OCA/PAC, Ocean and Coastal Areas Programme Activity Centre. Ingredients of this action plan are:

- MED POL or Mediterranean Pollution Monitoring and Research Programme covering the quality of waters, sediments and marine organisms as well as sources, concentrations, pathways and effects of pollutants;
- the Blue Plan, which reflects on the future of the Mediterranean basin and on the perspectives of a development that is compatible with the protection of the environment and its judicious management. Its Regional Activities Centre is located in Sophia Antipolis, France;
- other regional activity centres include the Centre for Specially Protected Areas (SPA) in Tunis, the Centre for the Biology Actions Programme (BAP) in Split, Yugoslavia and the Regional Oil Combating Centre in Malta.

Common action following monitoring and the definition of common environmental criteria is slow to come (World Resources 1987, p. 189-193).

B. A strategy and a plan of action for the protection of the Mediterranean (MEDSAP), of the European Communities

The EC Fourth Action Programme stretches integration of the different policies e.g. with a Programme for the protection of the environment in the Mediterranean basin called MEDSAB with the following four areas:

- quality and availability of water resources
- waste management
- management of the natural environment (management of natural resources and measures for balancing capacity and demand taking into account special areas or species of Mediterranean fauna and flora of interest to conservation; in future also problems in connection with development of tourism, soil and coastal erosion, protection of coastal regions)
- co-ordination of international measures within MED POL.

(cf. Docter 1987/Publication 75, p. 672-675)

C. Second plan of action of the European Charter of the coast 1986-1989

This plan of action stems from more than 50 regions grouped in the Permanent Conference of the EEC's Peripheral Maritime Zones (CRPN) and is linked with EEC's Integrated Mediterranean Programme (Docter 1987/Publication 75, p. 513-514).

D. Joint plan for the protection and exploitation of the Mediterranean heritage

Jointly prepared by the Permanent Conference for the EEC's Peripheral Maritime Zones (CRPN) and Council of Europe's Regions of the Mediterranean basin (CPLRE) (see Docter 1987/Publication 75, p. 513-514).



E. EUROMAR: Entwicklung eines europäischen Meeresüberwachungs- und Informationssysteme

-A4-

This initiative aims at improving the European position in the marine technology and covers the ECE and EFTA countries including Yugoslavia.

F. World Bank

May 1986 President Conable mentioned the possibility of designing a broad, longterm, international project to improve and strengthen the environment of the Mediterranean region.

Three Annexes as mentioned.

*See Ocean Yearbook 6, page 572-573*

TABLE 4

## STATISTICS BY ELEMENTS (Ch. 5)

Elements	Quantity		Quality		State of information (f)
	Stock (a)	Deductions (b)	Stock (c)	Deduction Pollution (d, e)	
5.1 Sea Water	Sea-level rise		A8		+
5.2 Minerals, Energy		X			
5.3 Natural Areas					
1 Coasts, Estuaries	A7				
2 Coral reefs	A5			X	-
3 Wetlands	A5	A5			+
4 Parks, Reserves	A5				
5.4 Flora					
2 Mangroves	A13	A13			-
3 Seagrass, algae	A13	A13			-
4 Aquaculture		A7			
5.5 Fauna	Threatened species	A7			
2 Mammals	A6, A12	A12			-
3 Reptiles	A6				
4 Fish	X	A7	A8	X	
5 Invertebrates	X	A7	A8		

Explanation: A Annex  
+, - Relatively good/bad informations  
X Some information available

## Functions of natural environment

### Regulation functions

1. Protection against harmful cosmic influences
2. Regulation of the local and global energy balance
3. Regulation of the chemical composition of the atmosphere
4. Regulation of the chemical composition of the oceans
5. Regulation of the local and global climate (incl. the hydrological cycle)
6. Regulation of runoff and flood-prevention (watershed protection)
7. Watercatchment and groundwater-recharge
8. Prevention of soil erosion and sediment control
9. Formation of topsoil and maintenance of soil-fertility
10. Fixation of solar energy and biomass production
11. Storage and recycling of organic matter
12. Storage and recycling of nutrients
13. Storage and recycling of human waste
14. Regulation of biological control mechanisms
15. Maintenance of migration and nursery habitats
16. Maintenance of biological (and genetic) diversity

### Carrier functions

*providing space and a suitable substrate for*

1. Human habitation and (indigenous) settlements
2. Cultivation (crop growing, animal husbandry, aquaculture)
3. Energy conversion
4. Recreation and tourism
5. Nature protection

### Production functions

1. Oxygen
2. Water (for drinking, irrigation, industry, etc.)
3. Food and nutritious drinks
4. Genetic resources
5. Medicinal resources
6. Raw materials for clothing and household fabrics
7. Raw materials for building, construction and industrial use
8. Biochemicals (other than fuel and medicines)
9. Fuel and energy
10. Fodder and fertilizer
11. Ornamental resources

### Information functions

1. Aesthetic information
2. Spiritual and religious information
3. Historic information (heritage value)
4. Cultural and artistic inspiration
5. Scientific and educational information

## Socio-economic value of environmental functions provided by the Dutch Wadden Sea (based on maximum sustainable use levels)

(values are expressed qualitatively (++) or in US\$/ha/year)

Total surface area of the study area: 270,000 ha

Types of values (based on Table 3.0-1, for explanation, see text)

	1 Conservation value	2 Existence value	3 + 4 Social values	5 Consumptive use value	6 Productive use value	7 Value to employment (# people)
<b>Regulation Functions</b>	> 5,120	++	++		++	
Climate regulation	++		.		*	
Flood prevention	500		.		*	
Erosion prev./sediment.	++				*	
Bio-energy fixation	(3000) <sup>2</sup>	.			*	
Storage/rec. org. matter	2000		.		*	
Storage/rec. nutrients	2500		.		*	
Nursery L/migration hab.	120	++	..		*	
Maintenance of biol. div.	..	..	..		*	
<b>Carrier Functions</b>	15	++	++		> 522	> 263
Aquaculture					22	160
Recreation			.		500	>> 10
Nature protection	15	++	..		*	93
<b>Production Functions</b>			++	+	> 475	> 207
Food/nutrition			..		450	207
Raw materials for constr. (sand, shells)				.	25	++
Fuel and energy						
<b>Information Functions</b>	15		++	++	> 16	> 65
Aesthetic information			..	..	.	
Spiritual/hist. inform.	15		..	..	.	
Cultural/artistic insp.			.	.	.	
Educ. & scientific inf.				+	16	65
<b>TOTAL ANNUAL VALUE</b>	> 5,150	++	++	++	> 1,013	(535)

Social values consist of the importance of environmental functions to human health and the option value placed on a safe future.

If a figure is given between brackets it was not used in calculating the total value, because the calculation is too speculative.

Figures in this column refer to # of people, not US\$.

These functions do contribute to economic productivity, either directly or indirectly, but no market or shadow price could be determined, because of information and/or short-comings of the market mechanism.

The ecological value of environmental functions can often only be described in qualitative terms; quantification will usually only be possible in "natural" dimensions (e.g. number of species, amount of runoff prevented).

Social values may be quantified by setting standards for minimum requirements for the availability of a given function (e.g. air-quality or maximum limits to ensure sustainable harvesting of natural resources). The economic value of environmental functions may be expressed in their "natural" dimensions (e.g. quantity of resources harvested), in monetary units (i.e. the value of the resources harvested) or by the number of people employed by activities which depend on a given function.

2  
1, 3, 6, 9, 5

MONETARY VALUE ESTIMATES OF SEA RESOURCES

Sources

a) Economic value of the information functions of the Galapagos Islands 1987: US\$ 3 mio per year, or almost US\$ 4/ha/year (of which 80 % for research)	1
b) Monetary value of some functions of the Dutch Wadden Sea: DFL 226 mio/year; of the nursery function: 25 mio, 1986	1
c) Extracted minerals, 1969, US\$ 412 billion	2
d) Ocean mineral resources, suspended	2
e) Value of minerals from oceans and beaches in US\$ 1972 and 1980	3
f) Value of marine mineral production, 1977	4
g) Estuaries waste water purification function USA-Report £ 15'000/ha/p.a.	5
h) Services provided by tidal marshes (USA) based on replacing natural services with a waste water treatment plant: US\$ 120'000/ha	6
i) Annual yield of the estuaries, 1975	5
j) Value of landing of fisheries in the Wadden Sea, 1960-1973	7
k) Fish production, 1975-1985, OECD, per country	8
l) 1968 World fish catch: £ 70'000 mio	5
m) Natural fish <u>capital</u> (at 5 % interest): £ 131'000 mio	5
n) Dockside value of the Wadden Sea - based on fishery: US\$ 110 mio (1983)	9
o) Yield of fish and shellfish dependent on wetlands, more than US\$ 700 mio (1976)	9
p) Schrimp annual retail trade worth: US\$ 2,3 billion	10

q) Shellfish net annual turnover: £ 1'700/ha (1968 ?)	5
r) Value added from fisheries to US GDP 0.31 %; US commercial fishery landings, commercial landings of fish and shellfish in US	11
s) Ornamental and pet species and/or their products	11
t) US expenditures on saltwater (includes sea run) recreational fishing: 1975 US\$ 4,5 billion, 1980 US\$ 2,4 ++ billion	11

SOURCES:

- 1 De Groot/UNEP, Publication 67 (1988)  
De Groot, Wadden Sea, Publication 49 (1986)
- 2 Giarini et al., Publication 85 p. 99, 101 (1977)
- 3 Mann Borgese, Publication 40 (1980 ?)
- 4 Earney, in Publication 48 (1982)
- 5 Van Dieren/Hummelinck. Publication 68 (1979) p. 146-152
- 6 OECD State of the Environment 1985. Publication 29 p. 147
- 7 Annex 7 p. 7. 1987
- 8 OECD Compendium. In Annex 7 p. 6. 1987
- 9 World Resources 1987, Publication 24 p. 132
- 10 World Resources 1986, Publication 24 p. 86
- 11 C. and R. Prescott-Allen, Publication 88 p. 52-55, 69, 364

**Table 4.3.5-1 Socio-economic value of the functions of the Galapagos National Park (based on maximum sustainable use levels)**

(values are expressed qualitatively (++) or in US\$/ha/year) except column 7  
Total surface area of the study area: 1,150,000 ha

Types of values (based on Table 3.0-1, for explanation, see text)

Environmental Functions	1 Conser- vation value	2 Existence value	3 + 4 Social values <sup>1</sup>	5 Consump- tive use value	6 Productive use value	7 Value to employment (* people)
<b>Regulation Functions</b>	<b>&gt; 63.00</b>	<b>++</b>	<b>++</b>		<b>++</b>	
Watercatchm./erosion prev.	0.30		+		*	
Bio-energy fixation	(1,200.00) <sup>2</sup>	+			*	
Storage/rec. human waste	58.00 <sup>2</sup>		+		*	
Biological control	++	+	+		*	
Nursery f./migration hab.	7 <sup>2</sup>	++	++		*	
Maintenance of biol.div.	4.90	++	++		*	
<b>Carrier Functions</b>	<b>0.50</b>	<b>++</b>	<b>+</b>		<b>&gt; 45.00</b>	<b>&gt; 833</b>
Aquaculture					0.02 <sup>2</sup>	+
Recreation		+	+		45.00	772
Nature protection	0.55	++	++		*	61
<b>Production Functions</b>			<b>++</b>	<b>+</b>	<b>&gt; 8.00</b>	<b>&gt; 160</b>
Food/nutrition			++	+	0.70	156
Genetic resources					+	+
Raw materials for constr.					5.20	4
Biochemicals					++	+
Energy resources					1.50 <sup>1</sup>	+
Ornamental resources					0.40	+
<b>Information Functions</b>	<b>0.50</b>		<b>++</b>	<b>++</b>	<b>&gt; 3.00</b>	<b>&gt; 67</b>
Aesthetic information			+	++	+	
Spiritual information	0.52		++	++	*	
Historic information			+	++	*	
Cultural/artistic insp.			+	+	0.20	+
Educ. & scientific inf.				+	2.70	67
<b>TOTAL ANNUAL RETURN</b>	<b>&gt; 64.00</b>	<b>++</b>	<b>++</b>	<b>++</b>	<b>&gt; 56.00</b>	<b>(1,060)</b>

<sup>1</sup> This function applies to the terrestrial area only (720,000 ha).

<sup>2</sup> This function applies to the marine area only (430,000 ha of which 4,100 intertidal zone)

<sup>3</sup> Social values consist of the importance of environmental functions to human health and the option value placed on a safe future.

<sup>4</sup> If a figure is given between brackets it was not used in calculating the total value because the calculation is too speculative.

<sup>5</sup> These functions do contribute to economic productivity, either directly or indirectly, but no market or shadow price could be determined due to lack of information and/or shortcomings of the market mechanism.

**Table 4.3.5-2 Land use, monetary value and employment of economic activities which (largely) depend on the natural characteristics of the Galapagos environment (data for 1983)**

Source: De Groot, 1988

	Land use (km <sup>2</sup> )	Annual retur (in million US\$)		Employment
		Actual	(potential)	
Cultivation	271	1.70	(4.40)	358
Fishery	-	0.30	(0.30)	156
Black coral harvest	-	0.10	(-)	?
Mining (sand, rock, gravel)	?	5.00	(6.00)	4
Energy conversion	?	?	(1.10)	?
Recreation and tourism (and related 'industries') <sup>1</sup>	?	26.80	(52.40)	772
Env. education	-	0.32	(0.60)	?
Env. research	-	1.25	(2.50)	67
Nature conservation	7,200	0.32	(0.60)	61
<b>TOTAL</b>		<b>28.75</b>	<b>48.29</b>	<b>1,418</b>

<sup>1</sup> Public services, bars, restaurants, kiosks, handieraft, ship construction, transportation, etc

## Economy-Environment Interface: Environment related costs

INPUT  
Utilization and depreciation of

OUTPUT  
Pollution

renewable natural resources

non-renewable natural resources

Anti-pollution costs

Costs of residual pollution

1) Over-exploitation

2) Exhaustion

Depletion

3) Anti-pollution expenditures

• avoid  
• reduce  
• Transform pollution

4) Expenditures for ex post damage elimination or compensation

38%

5) Non-compensated economic costs; loss of nature's functions

9%

6) Immaterial costs

2%

These HSG Walther: 21%  
1990

32%

Environmental expenditures

Environmental costs

5. non-compensated economic costs (in production, income, assets) and losses of ecological functions of media, ecosystems, and species
6. immaterial welfare losses to individuals and the society at large, such as damage to landscape and cultural patrimony, long-run ecological risks.



Dalhousie University

13V/BÖRLIN  
COPY + Two papers  
(Cocossis,  
Chemosphere)  
International Ocean  
Institute



March 30, 1997

Dr. Max Boerlin  
Chemin des Bosquets 1  
CH-1297 Founex/VD  
Switzerland

Dear Max,

I am back home. It is Easter Sunday.

Enclosed please find some perhaps interesting documents. Perhaps you know them already. They were sent to me by UNESCO.

Happy Whirling

Edna W



**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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31 March 1997

Prof. E. Mann Borgese  
IOI

fax 1 902 868 2455

HALIFAX, CND

RE: Our project; Y/f 15 & 18 March 1997

Dear Elisabeth,

Thanks for your agreement, the \$5 000 (arrived) and the CSD info.

I enjoyed your remark about whirling; it is an ... indicator that the flexibility in the terms of reference you suggest does not touch at my 'existential hobbies' !

Please let me know when you will soon be in Geneva; perhaps we can have a business meeting for discussing preliminary experiences and stuff I shall give you, followed by a more social evening.

In your fax 21 February to Orio you think that with INTERNET one could fairly easily fill into our ICOD report the up-dated data. Well, my tentative and incomplete review leaves me less optimistic; if at ALL; GENERAL DESCRIPTIONS OF data sets are available that do not disclose ocean relevance (cf. annex). Perhaps IOI has a more complete list of addresses for www?. Mid-April 'Association de Genève' should have an operational www-contact.

Orio has the Ocean Yearbook up to no. 8 (1989); the newer are ordered, and hopefully they arrive in time. Also, his PIM series stops at PIM 17 (Lisbon); do you think it would be useful IOI to lend/send him the missing ones?

Soon I shall find out more about the CSD Work Programme on Indicators of SD (your fax 18/3/97). A previous massive book (Indic. of SD - Framework and Methodologies. August 1996) proposes three ocean specific indicators (pop. growth in coastal areas; oil discharges; max. sustained yield for fisheries), as well as more generally interesting ones (threatened species and protected areas in biodiversity; atmosphere).

A rivederLa presto, e con migliori auguri.

*Dax*

1 this one page  
1 encl.

2 pages, total

OCEAN INDICATORS ON INTERNET

tentative, 31.3.97.  
incomplete

100) Rep. 1

- 16 UN-ECE
  - .general xyz\*unece.org
  - .e.g. monthly bu.
- 17 UNEP
  - 1.1 infoterra guide to env. & dev. cf. annex infoterra
  - incl. comprehensive listing of www sites etc.
  - 2.3 GRID
    - . GRID Baltic <http://www.grida.no/prog/annex/Ballerina> /norbal/ballerin
    - . Grid-Sioux Falls: access to envir. data and info using Internet tools
    - . unep/deia/grid-geneva summary catalog of eur. and global data sets (21/11/96)
    - . <http://www.grid.unep.ch/gridhome.html>
- 21 FAO Roma exists
- 33,4 European Union
  - 4. Corine
  - 33.0 general server: <http://europa.eu.int>
  - specialised web servers: <http://>
    - . LM.Europe: market of electr. info services [www.echo.lu](http://www.echo.lu)
    - . Cordis: Community R&D programmes [www.cordis.lu](http://www.cordis.lu)
    - . ISPO: info society projects [www.ispo.cec.be](http://www.ispo.cec.be)
- 41 UNDP exists
- 33.2 . EEA Eur. envi. agency <http://www.eea.dk/>  
incl. EIONET (Eur.env.Info & Observation NETWORK), EEA products & services like Dobris Assessm. etc.
- 42 WMO World Meteor. Organ. [xyz\\_j\\*gateway.wmo.ch](http://xyz_j*gateway.wmo.ch)

**INFOTERRA Internet Guide to Environment and Development**

This Guide is a joint publication of the Institute of Development Studies at University of Sussex, U.K. and INFOTERRA, UNEP's Global Environmental Information Exchange Network. The Guide lists environment and development information sources on the Internet and includes a comprehensive listing of World Wide Web, (WWW) sites, gophers, telnet hosts, ftp sites and listservers.

500pp  
Published by UNEP 1996  
ISBN: 92 807 1537 2  
Available from: UNEP-INFOTERRA/PAC and IDS  
Price: US\$30  
Stock No. 001625



**BALLERINA**

GRID-Arendal hosted a workshop in Stockholm on 18 June to develop a Baltic Sea region environmental network of ~~members~~. The cooperative partnership network is called BALLERINA.

BALLERINA stands for Baltic Sea Region On-Line Environmental Information Resources for Internet Access. It has two main objectives:

- bring more substantive and relevant environmental information from the Baltic Sea region to Internet, and
- make it easier for the increasing number of Internet users to find Baltic Sea region environmental information by offering a "top-level" BALLERINA WWW home page.

Funds for initial development of BALLERINA has been provided by the Swedish EPA and UNEP/DEIA.

Contact: Sindre Langaas, GRID-Arendal  
Tel: +(46-8) 161737  
E-mail: [Langaas@grida.no](mailto:Langaas@grida.no)  
<http://www.grida.no/prog/norbal/ballerin/>

21.96

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27 April 1997

Prof. E. Mann Borgese  
Geneva

Dear Elisabeth,

Thank you for the Unesco and the Biodiversity papers ( end of March and yesterday).

Meanwhile I had a usefull and pleasebt discussion with Dr. Arthur L. Dahl, Geneva ( Stanford & UC; South Pacific Comm., IUCN, OCa-PAC, UNEP deputy assistant executive dir and coordinator, Earthwatch).

A very draft and incomplete bibliobigraphy is included. I can pass over to you

12 Dahl, Islands Directory

69 UN CSD Indicators of sustainable development

70 Dahl, Earthwatch.

Also, many thanks for your Pharma-paper.

Please find also an updated Note.

Para 2 of the Introduction can be completed with CSD's dimensions: i.e. again social, economic and environmental (besides 'by chapters of the Agenda 21'). As for para 3 Role/types of indicators, this report and most of the others follow OECD's trilogy driving forces/ pressures, state, response. An ocean development project would be a driving force, and social, economic and environmental effects state parameters, with indicators for the state of oceans and coastal areas being the subject of this contribution.

I am glad to meet you this afternoon.

Dax

Encl.: - note on my contribution, versdion two  
- bibliogtaphy  
- your pharma paper  
- 3 books

13V/SÖRLIN



Dalhousie University

International Ocean  
Institute



**FAXED**

FACSIMILE TRANSMISSION

To: Max Boerlin  
 Fax: 41 22 776 09 37

From: Elisabeth Mann Borgese  
 Fax: 1 902 868 2455

Date: July 28, 1997

Subject: Club of Rome project

Dear Max,

What is there is fine, but I think we are running a bit behind schedule. And I am looking forward to the second draft which should be more complete and have some of the things marked "SPAETER"!

The chapter now has 4 parts, and yours is part 2. I am attaching some pages. The figures may be of interest to you. I have done the first part, and the third part, and I am working on the fourth part (conclusions), which I really cannot finish without having your part. Probably I will have to break the chapter up because it is too long!

The book is coming along. This chapter, and another one on institutional framework, will really be the meat of the book!

All the best, see you soon,

*Elisabeth*

*Do you want us to send a prepaid ticket,  
or did you buy your own and we refund?*

ID ✓

**MAX BÖRLIN**

Consultant en Economie de l'environnement, des ressources et du développement

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RECEIVED JUL 31 1997  
JULY!  
Founex, 31 August 1997

RECEIVED JUL 31 1997

Prof E. Mann Borgese

IOI, Halifax

COPY

Dear Elisabeth,

Thank you for your Report pages I read with interest.

Meanwhile you should have received the second draft, with less SPAETERS. Are you asking for style and length homogeneity? We should have an interesting conversation. Hopefully you will let me know where and when meeting you. ; I shall be picked up at the airport Saturday 14.30 hours and brought to the Cambridge Suites Hotel (phone 902 420-0555).

September and October I am out; so I look forward to a fruitfull conversation and this pause, in order to round up before the end of August.

With best wishes,  
amivednes presto,  
Max

10 ✓  
Elisabeth Mann Borgese

OCEAN PERSPECTIVES - A REPORT TO THE CoR

Chapter 3 of 6 Ocean Perspectives: Economic

Section 2 of 4 Ocean related indicators

including:

- overview of the ongoing "indicator" work, insofar as it is applied to the oceans
- gaps in the ocean sector
- take conventional tables in Section 1 and see how they are modified by the indicators

Max Börlin, Founex, Switzerland

## NOTE ON OCEAN RELATED INDICATORS

draft and incomplete, for discussion only

- 30 July 1997

to Prof. Elisabeth Mann Borgese  
International Ocean Institute,  
Dalhousie University,  
Halifax, Canada

## DRAFT TABLE OF CONTENT July 97

Content, List of boxes, List of tables

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- B. Issues and role of indicators
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- I-2 Comparison of social, economic and environmental sustainability
- I-3 Environment related costs
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A.II-1b UNEP Global environment outlook 1997 (GEO-1)  
A.II-1c EU The Dobris assessment  
A.II-1d UNEP Island Directory

## I. INTRODUCTION

### A. Purpose, outline

The purpose of this analysis is to help explicitly introducing the subject of indicators into the Report of E. Mann Borgese to the Club of Rome about ocean development. Indicators in fact are needed in a more comprehensive theory of wealth and welfare rooted in the concept of Common Heritage of Mankind of UNCLOS and in the concept of Dowry and Patrimony of Giarini to perform measurements of monetarized and non-monetarized resources.

To this end, this note presents the ongoing initiatives relevant to ocean related indicators, discusses gaps in ocean related indicators and finally explores the validity of the existing and the projected ocean related indicators in the light of the new economics of Common Heritage of Mankind and Dowry and Patrimony. Conclusions round up the analysis.

### B. Issues and role of indicators

Traditionally, indicators are defined as a piece of information which (a) is a part of a specific management process and can be compared with the objectives of that management process; and (b) has been assigned a significance beyond its face value.

General-purpose statistics produce results that have important applications in their own right; one of the applications may be to serve as input for the production of indicators/indices. After data collection and analysis (and distinct from it) comes the development of indicators/indices. Finally, follow their uses.

At the macro level, indicators of the wealth and welfare of a nation are taken into account for instance by international lending institutions in their funding decisions, or for the participation in certain international boards (e.g. the G8), or for joining later the euro-club. At the micro level, any development project should be judged against its effects on the wealth and welfare of the nation or region. In general, it is necessary to ensure that the social, economic and environmental aspects of development are, as far as possible, brought into account at policy decisions. One way of doing this is to use indicators to summarize the findings. And between these two levels, indicators are used in national performance reviews.

### C. Dimensions, including uncertainty

In his Report to the Club of Rome, Giarini (Giarini, 1980) introduces Dowry and Patrimony as being a combination of natural or physical, biological, man made (cultural) and monetarized (capital)

phenomena (cf. Table I-1). Serageldin of World Bank develops a somewhat similar trilogy of social, economic and environmental objectives asking for social, economic and environmental sustainability (cf. Table I-2, from Serageldin 1993). Finally, the UN-CSD distinguishes social, economic, environmental and institutional aspects of sustainable development (UN CSD, 1996). Examples of social issues are education and literacy, work and unemployment, consumption, distribution of income and wealth, and health. Economic aspects include over-all income, wealth, efficiency. Water and biodiversity are relevant parameters of the environmental dimension. And "International legal instruments and mechanisms" is a chapter dealing with indicators for institutional aspects of sustainable development.

In his comments on the "sustainability trilogy", Serageldin recalls that environmental sustainability seeks to improve human welfare by protecting the source of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans. We are thus reminded that, besides being rooted in philosophy, the preservation of the environment in the long run is a prerequisite for social and economic well-being. In some countries in West Asia e.g. coastal areas and marine environments have come under increasing pressure, and the degradation of the ecosystem has adversely affected both fisheries and tourism, one of the largest sources of foreign exchange revenue for several countries. Similarly, many beaches in the Caribbean now have average tar levels 10 times higher than that estimated to adversely affect the use of beaches by tourists - levels at which beaches become virtually unusable for recreation. Declining fish stocks have resulted in the collapse of the East Coast fisheries, with a devastating impact in eastern Canada. A last example comes from Europe: Contaminants originate from a wide range of land-based sources and activities, as well as from shipping and other offshore activities. Depending on type, the contaminant can harm marine organisms through physical damage or toxicity, turn bathing water and seafood into a human health hazard, and decrease the amenity value of beaches, thereby damaging local tourist industries (Examples from GEO-1, 1997, p. 68, 85, 100, 110). 4

#### D. Ocean elements; forms of pollution

In the present ocean related context, the natural environment is formed by sea water, minerals, flora, fauna and natural areas of the coastal and marine zones, from deep sea beyond exclusive economic zones EEZ up to coastal watersheds under national jurisdiction, as listed in Table II-1b.

## II. ONGOING OCEAN RELATED INDICATOR WORK

### A. Generalities

In 1994, OECD published its core set of environmental indicators. Other institutions had already developed or followed with global and sectoral indicators. Generally, they are descriptive measures reflecting actual developments (taking a picture).

At the UN Conference on Environment and Development in Rio in 1992, the International Community committed itself to achieving sustainable development. Agenda 21 comments specifically on the need for indicators in Chapter 40:

"Indicators of sustainable development need to be developed to provide solide bases for decisionmaking at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems."

This chapter also recommends that the United Nations system work with other relevant organizations to develop a harmonized set of indicators of sustainable development. These are normative indicators, reflecting developments towards sustainability.

It was recognized that there are fundamental and culturally-bound value judgments inherent to sustainability indicators which naturally would vary from country to country. The danger was also recognized of producing an indicator system which could become a developed country-biased evaluation system which would be inappropriate and unusable for developing countries and countries in economic transition.

Mainstreams of action towards indicators are recalled in Table II-0a. We call the explicite development of indicators "(1) Indicator mouvement"; other initiatives strongly support it. Thus, to ensure that the economic and environmental aspects of development are, as far as possible, brought into account at policy decisions, greener national accounts are being developed in a variety of shape and form. These "(2) greener national accounts" deserve attention as consumers and producers of indicators.

In the present context of Common Heritage of Mankind and modern service economy, one will ask for the environmental functions performed by the physical elements of the environment. This central question arises in greener national accounts as well as in other contexts including in integrated management of coastal and marine areas, in investment planning, in environmental policy. We shall deal with "(3) functions of nature" as being one element of the system of positive and negative interactions between man and the environment identifying regulation, carrier, production and information functions.

Finally, at the micro level, regulative and executive requirements for benefit analysis have promoted the institutional use of cost-

benefit-analysis and environmental impact assessment (CBA/EIA) asking i.a. that development projects should be judged against their effects on the wealth and welfare of the community. This incentive brought about a development of methodologies and applications usefull to the indicator mouvement and for greening national accounts, to be delt with as "(4) CBA/EIA".

As Table II-0a also shows, the efforts in the four mainstreams concentrate on sustainability or rather on descriptive indicators, as well as on their expression in physical or rather in monetary terms.

These four mainstreams of action will now be considered more in detail. The main programmes and reports are listed in Table II-0b, where they are classified according to the four mainstreams and the dimensions involved; the latter are introduced below.

## B. Four mainstreams of action

### (1) The indicator mouvement: Major programmes and activities

#### i The dimensions of indicators

Wealth and welfare have several dimensions; in the Introduction, social, economic, environmental and institutional aspects were mentioned (cf. I.C). One more aspect is uncertainty. In shorthand, we call these parameters "the S.E.E.U.I. dimensions". Programmes and reports of "(1) Indicator movement" deal with one or more of these dimensions, as indicated in the list of Table II-0b.

UNDP's Human Development Index, described in Box II-1, is ment to measure the social and economic situation in the 174 countries covered. In the 1996 Report, the Human Development Indicators possibly relevant to oceans are GDP/GNP, employment and unemployment, and income distribution; for countries other than small island or coastal states, it is important to learn that efforts to develop methods of disaggregation according to subnational regions are ongoing. The 1997 Report was published in the last days and could not yet be taken into account.

National accounts provide traditional economic measures such as GNP. More about national accounting is said in (2) below.

Environmental indicators sometimes deal with ocean elements; they are analysed in (ii) below.

Finally, uncertainty. The development and use of indicators happens in a world of uncertainty: about the statistical data, the causal relations, the models to represent reality. One way to deal with uncertainty, is to develop a vulnerability index and to merge it with the more traditional social, economic and environmental indicators. Examples of a vulnerability index are the vulnerability index for small islands developing States (Briguglio 1995), or the reef vulnerability index of WRI (??).

BOX II-1

UNDP's HUMAN DEVELOPMENT REPORT HDR WITH THE HUMAN DEVELOPMENT INDEX  
HDI

UNDP's Human Development Report, published first in 1990 and then annually, presents a number of Human Development Indicators and the Human Development Index. The indicators concern the human development/deprivation profile, wealth, and economic performance, whereas the Human Development Index reflects achievements in three dimensions of basic human capabilities: a long and healthy life, knowledge, and a decent standard of living. Both appear for the whole world, for all developing and all industrial countries together, for each of 10 regions (8 developing regions, Eastern Europe and CIS, all industrial countries together), for each of 174 countries, and finally within countries for rural and urban population; efforts to develop methods of disaggregation according to subnational regions are ongoing (HDR 1996, p. 31 f.).

In the 1996 Report, the Human Development Indicators possibly relevant to oceans are (a) total and per capita GDP and GNP (for developing and industrialized countries respectively Table 24, 25, 26 and Table 45, 46), (b) employment, unemployment (Table 16, Table 32, 33), and (c) income distribution (Table 17, Table 36).

The Human Development Index has three key components: (a) life expectancy at birth; (b) knowledge or educational attainment, comprising an adult literacy ratio with two third weight and a schooling enrolment ratio with one third weight; and (c) income represented by an adjusted value of real GDP per capita.

The HDI is constructed by (1) defining a country's measure of relative achievement in each of the three basic variables and (2) taking a simple average of the three indicators. In (1), the straightforward descriptive step ends with life expectancy in years, the two education ratios in %, and real GDP per capita accounting for the local cost of living and hence in PPP\$. Moreover, real income is adjusted for the diminishing utility of higher levels of income to human development, the premise being that people do not need an infinite income for a decent standard of living; so the HDI defines a threshold for income regarded as adequate for a reasonable standard of living, and proposes and "adjusted real GDP per capita", again expressed in PPP\$. Still in (1), follows the normative valuation step, in that minimum and maximum values are established for each of the three components of the HDI. The HDI value for each country then indicates how far that country has to go to attain certain defined goals. Also, this procedure reduces all three basic partial indicators to a common rod by measuring achievement in each indicator as the relative distance from a desired goal: the closer a country's HDI is to 1, the less the remaining distance that country has to travel.

END OF BOX II-1

In (2), the three partial indicators are combined into the one single HDI. Since they are already expressed in a common measure, straightforward aggregation is possible, and a simple average of the three partial indices is taken.

The HDI accounts for the social and the economic dimension. Proposals to include material intensity of economies, to adjust existing components of the HDI, or to construct an all-new Green Index to stand alongside the HDI tend to introduce the environmental dimension. In the later respect, the Green HDI by Meghnad Desai and being published by the New Economics Foundation is a measure of the intensity of environmental exploitation, taking a limited number of readily available components (e.g. energy consumption, water, CO2 emissions). Calculated according to several methods, the basic finding is that the green index moves some countries which rank high on HDI down toward the bottom of the list and promotes some countries ranked low on HDI (SCOPE p. 42).

## ii Environmental indicators

Environmental indicators deal with one or more ocean elements and reflect stock and/or flow realities. Major programmes and reports will be analysed in these respects. The concept of "ocean elements" having already been introduced (cf. I.D. above), some remarks about dynamics with the stock/flow concepts are still needed.

In a dynamic context, at the beginning of a period quantity and quality of ocean resources start with an opening stock, during the period man-made and natural flows result in additions and deductions, and at the end of the period the ocean resources exhibit a new closing stock. This relation between stock and net flow explains also why methodologies for compiling stock and flow indicators have to be compatible.

In the economy-environment interface, flows result from losses of natural resources (input from environment to economy) (1) through over-exploitation of renewable resources beyond sustainability and (2) through depletion of non-renewable resources; from pollution (output of the economy to the environment) resulting in environmental expenditures (i.e. actual financial transfers) as (3) anti-pollution expenditures to avoid, reduce or transform pollution and as (4) expenditures following residual pollution for ex post damage elimination or impact compensation; as well as resulting in other environmental costs of residual pollution in the form of (5) non-compensated economic costs (in production, income, assets) and losses of ecological functions of media, ecosystems, and species and in the form of (6) immaterial welfare losses to individuals and society at large, such as damage to landscape and cultural patrimony or long-run ecological risks (Table I-3). Also wealth and welfare from oceans have a quantity and a quality aspect. Threatened marine plants and animals or sea level rise are quantitative phenomena, levels of organochlorine compounds in fish flesh and standards of bathing water are qualitative phenomena.

The two parameters - ocean elements and stock/flow magnitudes - are now chosen to describe major programmes and reports in the indicator movement (listed in Table II-0b). A standard presentation is applied to each indicator (cf. Tables A.II-1a to A.II-1d). UN-DPCSD is developing a provisional core set of indicators for sustainable development for the CSD; for our presentation of its first SPAETER doc. Summit+5 publication (UN CSD 1996. Also, Van Dieren 1995 p. 152 f., 260 ff.), some more parameters are taken into consideration (Table II-1a). These individual presentations are then summed up in Table II-1b called "Ocean related indicators: Elements covered". Finally, more programmes and reports will have to be analysed and introduced at a later stage; for the time being, they are listed on Table II-1c.

Beyond the parameters "ocean elements" and "stock/flow" of the standard presentation, the unit of the indicators, the type of the later



(driving force, state or response indicator) and the sustainability target are also analysed for the CSD Report on indicators for sustainable development (Table II-1a). Within a dozen ocean related indicators, one only is expressed in monetary terms, namely EDP, the environmentally adjusted Net Domestic Product; hence Table II-0a states that sustainability indicators rarely appear in monetary terms.

A somewhat longer explanation is needed for the distinction between driving force, state and response indicators. In its indicator programme, OECD developed the Pressure-State-Response PSR framework. The PSR framework is based on a concept of causality: human activities exert pressures on the environment and change its quality and the quantity of natural resources (their "state"). Society responds to these changes through environmental, general economic and sectoral policies (the "societal response") (cf. OECD 1994). Today, an example of a response are the arrangements under way for implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities. Concerning the issue "marine resources" e.g., World Bank mentions for A. Pressure: contaminants, demand for fish as food; for B. State: stock of marine species; and for C. Response: coverage of international protocols/conventions. Finally, the working list of indicators of the UN-CSD is organized in the so-called Driving Force-State-Response framework. Driving forces indicate human activities, processes and patterns that have impact on sustainable development, state indicators indicate the state of sustainable development and response indicators indicate policy options and other responses to changes in the state of sustainable development. Out the 12 ocean related indicators, one is a response indicator, three are driving forces and eight are state indicators.

Finally, we also ask for the sustainability target applied to the CSD indicators. The descriptive indicators are compared with these targets or goals in order to see how far, or how close actual development is from sustainable development. Only for three out of the dozen ocean related indicators targets are defined: for sustained yield for fisheries, for threatened species and for protected areas. For the other indicators, targets are not yet available. This reminds us of the fact that the CSD core set of sustainable indicators is still being developed. The production process started, but has not yet reached the stage of an international series of figures covering all countries, e.g. like UNDP's Human Development Index.

Turning now to the summary Table II-1b "Ocean related indicators: Covered elements", we see that indicators are available for the stock of almost all ocean elements, and for the flow concerning half of them. This first statement however SPAETER has to be checked going back to the original reports and integrating further information (cf. the pro-memoria Table II-1c).

## (2) Greener national accounts

The relation between the efforts for greener national accounts and the indicator movement are twofold: Indicators can be an input into greener accounts, and greener accounts generate indicators; we are interested in this latter relation.

i Drawbacks of the present national accounts and solutions of interest to the indicator movement

With respect to the environment, national accounts aggregates such as Gross Domestic Product GDP have three major drawbacks:

- \*a the neglect of the depletion of natural resources
- \*b the inadequate treatment of "defensive expenditure"
- \*c the failure to account for the degradation of environmental quality and its effects on human health and welfare.

Accordingly, three approaches are devised for solving these drawbacks as recalled in Table II-2a.

\*a) The adjustment of national accounts to arrive at a 'green' national product has for the time being been rejected. The Club of Rome and WWF-International on the other hand are strongly in favour of it. A conference "Taking Nature into Account" was held from May 31 to June 1 1995 in the European Parliament; it was jointly organized by the European Commission, the European Parliament, WWF-International and the Club of Rome. On this occasion, WWF-International and the Club of Rome presented an Action Plan whose Preface reads: "Macroeconomic indicators such as Gross Domestic Product (GDP) and National Income calculated under the United Nations System of National Accounts (SNA) do not accurately reflect economic activity's impact on Nature, despite the 1993 revision of the SNA. . . . This Plan calls for global actions to develop and implement a new, Nature-adjusted SNA by incorporating, to the extent possible, the value of Nature's resources and services as key economic factors into the core accounts and indicators of the SNA" (see Sheng, 1995; van Dieren (ed.), 1995). Moreover, efforts towards such an over-all aggregated figure are pursued with the elaboration of the Index of sustainable economic welfare (ISEW).

\*b) Three roles of satellite accounts are:

- . disaggregation of SNA with regard to environmental aspects;
- valuation of stocks of natural resources and of nonmarket services of the environment;
- . valuation of environmental damage due to economic activity.

A very broad, systematic approach has been developed by UNSTAT in the form of a Satellite system for integrated Environmental and Economic Accounting (SEEA). The SEEA Handbook (UN 1994?) offers a menu of five

alternative versions, with Version IV being concerned with satellite accounts.

Several methods of valuation of environmental resources have been developed and applied; they will be discussed in Part IV below. The Statistical Office of the European Communities, EUROSTAT, has launched the European System for the Collection of Economic Information on the Environment (SERIEE, from the French Systeme integre de recolte d'information economique et environnementale)

\*c) Natural resource and environment accounts concern the two main categories:

- . environmental resource accounts for natural resources whose value is typically defined through multiple-use: as an input to economic activities, as a key factor in ecosystems and as a source of non-market utility such as recreation. Ocean related ex:wild life resource aac (F, Esp). Quantity: measuring pollution flows from economic activities to n.r.;
- . material resource accounts for natural resources whose value is typically defined through their single-use as an input to economic activities, like mineral and fossil fuel resources (e.g. energy accounts).

SEEA Version III offers a methodology.

#### ii The greening of national accounts and ocean related indicators

Green accounting represents a linkage between economy and environment; it is a necessary precondition for indicators which make environmental-economic interlinkages at a macroscopic level. Moreover, flow relations from natural resource accounts form the input needed to calculate indicators of sustainable use of natural resource quantities. These ideas were presented at a SCOPE Scientific workshop on indicators of sustainable development (see SCOPE 1995), as well as at an OECD Seminar on environmental accounting for decision-making (see OECD 1994a and Hamilton/OECD 1994b).

It hence is not surprising that countries including Finland, France, the Netherlands and the United Kingdom are integrating, in one way or another, the efforts towards greener national accounts and the generation of indicators in practical applications. Also, other ocean related results from efforts towards greener accounts exist, including those presented in Table II-2b.

Source: Antille/Boerlin, 1997; de Groot, 1992; Lutz/Munasinghe, 1991; OECD and OECD/Hamilton 1994; Sheng, 1995; Van Dieren (ed.), 1995

### (3) Functions of nature

#### i The concept

In the present context of Common Heritage of Mankind and modern service economy, one will ask for the environmental functions performed by the physical elements of the environment and rooted in the "Weltanschauung-dimensions" recalled above. Similarly, de Groot (De Groot, 1992) looks at environmental functions as being one element of the following system of positive and negative interactions between man and the environment:

- . natural processes and components
- . environmental goods and services, environmental hazards and risks
- . human needs and activities
- . environmental impact and environmental management;

and identifies around fifty functions of natural environment

(cf Table II-3a) grouped in regulation, carrier, production and information functions, where

- . regulation functions relate to the capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life support systems which, in turn, contribute to the maintenance of a healthy environment by providing clean air, water and soil;
- . carrier functions relate to ecosystems' providing space and a suitable substrate or medium for many human activities such as habitation, cultivation and recreation;
- . production functions cover the provision of many resources, ranging from food and raw materials for industrial use to energy resources and genetic material; and
- . information functions result from the natural ecosystems' contribution to the maintenance of human mental health by providing opportunities for reflection, spiritual enrichment, cognitive development and aesthetic experience.

#### ii Ocean related applications

As reported in sect. 1 above, the functional approach has already been applied at the level of the world oceans. At a less general level too, numerical examples exist, including those listed in Table II-3b.

#### (4) Cost-benefit analysis and environmental impact assessment CBA/EIA

Over the past decade, significant progress has been achieved in the development of techniques for the monetary valuation of environmental damage and benefit. In 1989, the OECD published a comprehensive survey of existing techniques and data. In a subsequent study, applications in six OECD countries were analysed on the basis of some fifty major and more general case studies (Barde/Pearce, eds., 1991). We take this collection of applications to illustrate ocean indicators related aspects of CBA/EIA.

spaeter, Table II-4.

## (5) Conclusions

spaeter

III. OCEAN RELATED GAPS: Requirements for minimum coverage

- A. By type of indicator
- B. By element of ocean resources
- C. Spacewise: national/regional/planetary

IV. INCONSISTENCY OF PRESENT INDICATORS WITH D&P/CHM ECONOMICS; an exploration

This paragraph explores the validity of the present and the projected ocean related indicators in the light of the new economics of Common Heritage of Mankind and Dowry and Patrimony.

A. Requirements for consistent indicators

Repeatedly, Orio Giarini insists on the fact that a more comprehensive theory of wealth and welfare of the kind proposed elsewhere in this Report, tries to provide a basis for a more consistent approach and actually encourages utilization of the indicators. The needed steps are:

- (a) define first a new theory of value (utilization value)
- (b) devise then the most appropriate methods and possibilities of measurement and the judgement (selection of indicators)
- (c) open in this way the possibility of defining new operational economic policies (for instance in the fiscal and monetary field as well as in the preservation and development of non-monetarized resources).

On this road to the new economics of Common Heritage of Mankind and Dowry and Patrimony, Giarini has already identified several requirements; relevant to the development of indicators are i.a.:

- i wealth and welfare is a combination of natural or physical, biological, man made (cultural tools) and monetarized (capital) phenomena (cf. I.C., Table I-1)
- ii uncertainty is inherent in complex systems, i.e. parameter uncertainty, model structure uncertainty, and uncertainty due to variable data quality
- iii utilization instead of exchange value is relevant
- iv non-remunerated work has to be included
- v deducted value, i.e. external costs of man-made pollution and over-exploitation of ocean resources has to be taken into account
- vi address stock rather than flow magnitudes must be addressed.

How far do present-day ocean related indicators fullfill these requirements? The next paragraph offers some pieces of a reply.

B. Screening of ocean related indicators in the light of the required adjustments

a. General considerations, incl. valuation

For each single component of the mainstream (1) to (4), we compare the present practice with the CHM requirements. Before doing so however, we take a look at the distinction between indicator and index and at how it is delt with (Table IV-0).

In order to add indicators of various aspects of the environment together, we need some sort of weighting. There are three ways of doing this: natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen . At the level of the three overall social, economic and environmental indicators, they can be expressed in their own units (e.g. 'people' for human and social capital, 'monetary' for economic capital, and 'physical' for environmental capital) and not aggregated at all; or they can remain expressed in a common unit at the outset, in which case aggregation is not needed (e.g. the World Bank's monetarization of all forms of capital; or UNDP's Human Development Index HDI, where valuation of the partial index is obtained through crossection-wise comparison with an average over the whole set of countries); or, again, assigning weights by experts or by citizen groups. HDI, other ex.??

In a measurement situation, one possibility is to select from the multitude of variables a representative single-parameter indicator. At the other extreme, single-valued indices are developed combining various variables into one; the Human Development Index devised by UNDP e.g. incorporates both social and economic factors. Between indices and single-parameter indicators are sets of indicators; they consist of a limited number of harmonized single-parameter indicators, together representing a larger issue.

~~In order to add indicators of various aspects of the environment together, we need some sort of weighting. There are three ways of doing this: natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen . At the level of the three overall social, economic and environmental indicators, they can be expressed in their own units (e.g. 'people' for human and social capital, 'monetary' for economic capital, and 'physical' for environmental capital) and not aggregated at all; or they can remain expressed in a common unit at the outset, in which case aggregation is not needed (e.g. the World Bank's monetarization of all forms of capital; or UNDP's Human Development Index HDI, where valuation of the partial index is obtained through~~

cross-section-wise comparison with an average over the whole set of countries); or, again, assigning weights by experts or by citizen groups.

This spectrum of solutions will be taken into account in the following analysis where needed.

(1) Indicator movement

Table IV-0 above, Table IV-1

(2) Greener national accounts

Table IV-0 above.

I Valuation in non-market situations

based on direct and indirect market information, such as property values and expenditure on related goods

- a HPM Hedonic pricing: studying the influence of environmental quality changes on the prices of properties like land and houses
- b TCM Travel-cost method: looking at what people pay in travel costs to get to the recreational site
- c CVM Contingent valuation method; asking people by means of questionnaires or gaming situations what they would be
  - . WTP willing to pay for the conservation of a certain asset
  - . WTA willing to accept as compensation for an environmental deterioration

II Valuation in situations with available market prices

d

MPM Market pricing: for the massive area of market situations, where market prices are available

- ? . net-price method: Costa Rica, Indonesia
- ? . user-cost method: which aims at estimating the value-added element (true income) and the user-cost element (depletion costs), starting from GDP. Depends on discount rate. vDi 199-203.

Borne: market v.- EDP I: [deprec. of nonprod. nat assets] at market p.  
contingent v.- EDP II: idem & [] at contingent values

Caused: avoidance c. - EDP III: [] at avoidance (prev.) costs. ac if:

- a) nonr.NR: substitution costs for other NR
  - b) renew.NR: depl. net of nat. increase & necessary reduction of polluter activity and VA
  - c) landscape and their ecosystem and biodiversity: idem
  - d) preventing waste/residuals: prevention costs
- additional restoration activities - EDP IV: - [] at prevention costs + increase of nonp.nat.assets (gross cap. formation at restoration costs)

S E E A

1993 Handbook SEEA, 1994 rev. SNA:

\* vDi: SNA<SEEA 1. mon st/fl disaggregation  
235-251 2. linking ph and mon accounting by adding ph data;  
265-277

env to econ & econ to env. Does not imply changes of SNA

3. determination of imputed env costs of the econ uses of the nat envi. NDP - environmentally adjusted DP

cost accounting:

- . econ, narrow, SNA & revSNA, st: v. changes of nonprod. nat.assets due to econ act. if observable market v.  
5/267
- . comprehensive, revSNA & ++,st/fl: depl renew. & nonrenewables SEEA degr env/poll,land/~use. net price & user cost no nonmarketable; no impact on other countries, gl.ecosystem, future gen. fl: defensive exp.  
6/268
- . responsibility: env. an integral part of the economy SEEA st/fl: restoration/avoidance costs for nonmarket; modelling  
7/274

\* Sheng 63-65: 5 main objectives of SEEA:

a segregation and elaboration of all env.-related flows and stocks of traditional accounts; thus estim of defensive exp.

b linkage of ph acc with monetary envi acc. Nat res acc thus provide the ph counterpart of the SEEA's mon asset and flow account. Norw, France

c assessment of envi costs and benefits. costing the use (depl) of nat res in prod and final demand, and the changes of envi quality from poll and envi prot.

d accounting for the maintenance of tangible wealth, incl. nat capital: scarce renewable res, nonrenew. res and cyclical res of air and water  
e elaboration and measurement of indic of envir adjusted product and income

Cost of both depl and degr deducted from conventional NDP to arrive at and envi adj NDP, called EDP.

\*Antille/Bo

Version I: disaggr with respect to envi related mon flows and assets, to make visible envi exp for anti-poll and those due to residual poll. In diagr #2, #3

Version II: includes these disaggregations

Version III: ph flows are linked to the disaggregated monetary data

Version IV: imputed envi costs associated with diff econ transactions.



Version V: externalisation of internal envi prot activities etc.

Valuing methods

marketable resources: user-cost and net-price.

non-marketed r.: maintenance-cost app (avoidance-cost or replacement-cost).

(3) Functions of Nature      Table IV-3      IV-0 above

(4) CBA/EIA      cf Table II-4 above IV-0 above

Econ measures of envi ben (Barde 151):

A DIRECT 1 environmental gains

2 money value i via surrogate markets: a HPM

b TCM

ii via experimental markets: c CVM

B B INDIRECT 1 dose-response/effect

2 social c/b i eg corrosion: d MPM

ii eg fish population: c CVM

Markandya: Valuation m.

a dir and ind market info

b stated preferences in the absence of markets, questionnaires

c dose-response, linking env changes to pollutants

2.1 market based: Hedonic

2.2 "      CVM

2.3 "      TCM

2.4 d/r v procedures

2.5 valuation of mortality

2.6 v of morbidity

gegen intrinsic:

- intrinsic system of value

- individualist/anthropocentric system of value, derived from

. the use of a resource

. the prospect of the use of a resource: option value, existence value

Total economic value TEV = actual use v. + option v. + existence v.

actual use v.: market data AND non-market valuations

option v.: WTP for the preservation.

p. for future use - exp. v. = exp. consumer surplus

existence v.: they arise because of concern for, sympathy with, and

respect for the rights or welfare of non-human beings

(1, 2, 3, 4)

(5) Summing up

b. Comparing the present situation with the

requirements of D&P/CHM economics

V. CONCLUSIONS AND FOLLOW-UP

Table IV-all.a

Goods and services	stock or flow	type of natural resource	type of benefit	method	example	
marketable	stock	renewable	user	user-cost		
			??	??		
		non-renewable (1)	user	??		
			??	??		
	flow	ren	?	?		
		non-ren				
non-marketable	stock	ren	user	TCM, CVM WTP? (3)		
			option	replacement, avoidance, maintenance		
			existence			
			bequest			
			indirect value for ecological functions			

- 1) depletable natural resources = non-renewable resources + renewable resources beyond the possibility of regeneration.
- 2) CVP for determining WTP. CVP-CVM?
- 3) WTP is based on income distribution.

IV B b comparing: i to iv in requirements IV.A. versus II ongoing and  
IV B a present situation (18.7. 07h)

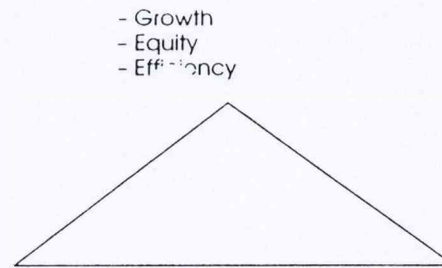
	(1)	(2)		(3)	(4)
		examples	SEEA		
IV-0	b valuation, social or environmental into monetary terms c from more indicators to one index c1 via aggregation if all in one single term, monetary, physical, or else c2 via multiaspect amalgamation, using relat. distance from target, weighting (Island Dictionary!), or else				
	IV-1 later  II-1(1) CSD	IV-2 *a: MPM, net-PM UCM *b *c	.SEEA I: act.def- ens.exp. .SEEA IV: val.dis- cussed, no clear depl/degr guidel. EDP?	.II-3 .IV-3 later .IV.C.  Galapag.	.II-4 MPM, TCM,  savings, CVM .TEV=(ac tual use+opti on+ existenc e) value
IV-all	Stock: Flow: 1) over-exploitation 2) exhaustion 3) preventive anti-pollution expenditures 4) damage elimination/compensation 5) loss of nature's functions 6) immaterial costs				
text	Marketable resources: . net-price M (= market prices - external costs); Costa Rica, Indonesia . user-cost M (starting from GDP, estimates the value added element (true income) and the user-cost element (depletion costs) Non-marketed resources (dir/indir. market info. incl. property values, exp. on related goods) . via surrogate markets:				

	<ul style="list-style-type: none"> <li>.. HPM Hedonic pricing: influence of env. quality changes on property prices (land, houses)</li> <li>.. TCM Travel cost M: travel costs to recreational site</li> <li>. via experimental markets: CVM Contingent valuation M: asking people (gaming situations, questionnaires) what they would be</li> <li>.. willing to pay WTP for the conservation of a certain asset</li> <li>.. willing to accept WTA as compensation for an environmental deterioration</li> <li>. maintenance cost approach <ul style="list-style-type: none"> <li>.. avoidance-cost M</li> <li>.. replacement-cost M</li> </ul> </li> </ul>
IV-all bis	Types of benefit: user b.; option, existence, bequest, indir. value for ecological functions
TEV based on an individualistic/anthropocentric system of value, derived from the present (actual) and the prospect of the use of a resource (option, existence value)	
M            Method CVM        Contingent valuat. M  EDP        Env.adjust.NDP HPM        Hedonic price M MPM        Market price M Net-PM     Net-price M TCM        Travel cost M UCM        User-cost M (discount rate) WTP]       Willingness to pay/ WTA]       accept as compens. (accounts for income distribution)	TEV total economic value = actual use v.: m.& nonm. v. + option v.: .WTP for preserv. .exp.cons.surplus = future (p-val) + existence v.: concern, sympathy, respect for non- hum. beings' rights/welfare

Table I-1     The Dowry and Patrimony (D & P)  
                 The source of utilization value (\*  
\* From: Giarini, 1980, p. 47

Table I-2     Comparison of social, economic, and environmental  
                 sustainability     (\*  
\* From: Serageldin, 1993, cit. by Van Dieren (ed.)1995, p. 264.

# Table I -



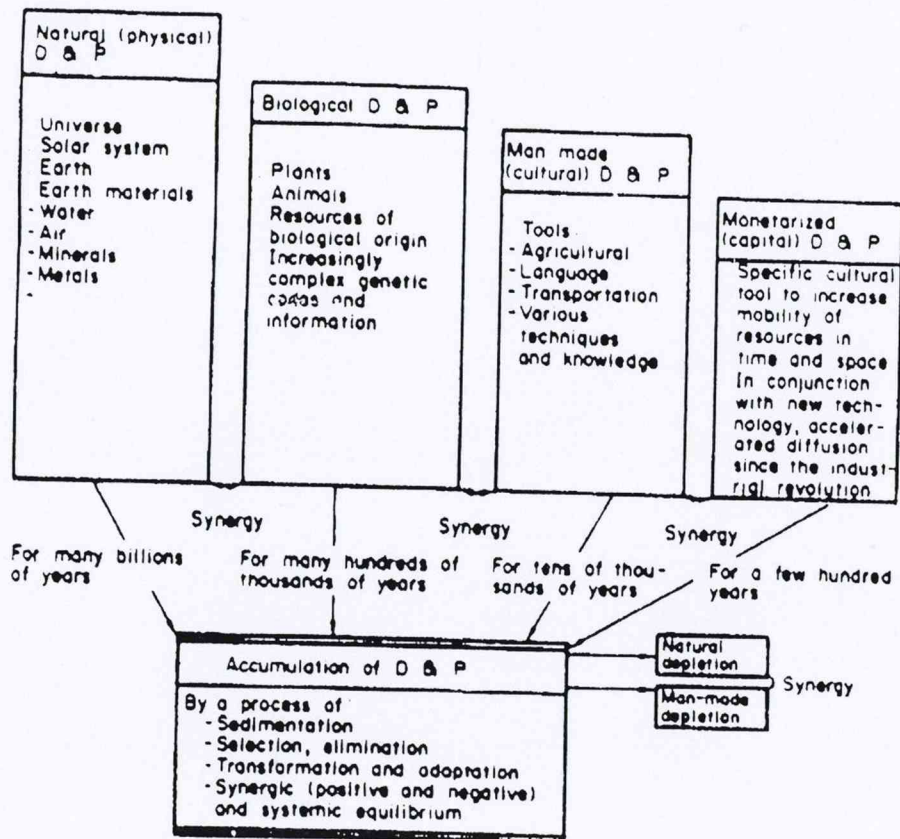
Social objectives:

- Empowerment
- Participation
- Social mobility
- Social cohesion
- Cultural identity
- Institutional development

Ecological objectives:

- Ecosystem integrity
- Carrying capacity
- Biodiversity
- Global issues

# Table I-1



## Social Sustainability ("SS")

ES needs SS—the social scaffolding of organizations that empower self-control and self-policing in peoples' management of natural resources (see Cernea, 1993). Resources should be used in ways which increase equity and social justice, while reducing social disruptions. SS will emphasize quality improvement over quantitative growth, and cradle-to-grave pricing to cover full costs, especially social. SS will be achieved only by strong and systematic community participation or civil society (Putnam, 1993 a, b). Social cohesion, cultural identity, institutions, love, commonly accepted standards of honesty, laws, discipline, etc., constitute the part of social capital that is least subject to measurement, but probably most important for SS. This "moral capital," as some have called it, requires maintenance and replenishment by the religious and cultural life of the community. Without this care it will depreciate as surely as will physical capital.

## Economic Sustainability ("ES")

The widely accepted definition of economic sustainability is "maintenance of capital," or keeping capital intact, and has been used by accountants since the Middle Ages to enable merchant traders to know how much of their sales receipts they and their families could consume. Thus the modern definition of income (Hicks, 1946) is already sustainable. But of the four forms of capital (human-made, natural, social, and human) economists have scarcely at all been concerned with natural capital (e.g., intact forests, healthy air) because until relatively recently it had not been scarce. Also, economists prefer to value things in money terms, so we are having major problems valuing natural capital, intangible, intergenerational, and especially common access resources, such as air etc. In addition, environmental costs used to be "externalized," but are now starting to be internalized through sound environmental policies and valuation techniques. Because people and irreversibles are at stake, economics has to use anticipation and the precautionary principle routinely, and should err on the side of caution in the face of uncertainty and risk. Human capital (investments in education, health, and nutrition of individuals) is now accepted in the economic lifestyle (WDR, 1990, 1991, 1995), but social capital, as used in SS, is not adequately addressed.

## Environmental Sustainability ("ES")

Although environmental sustainability is needed by humans and originated because of social concerns, ES itself seeks to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans. Humanity must learn to live within the limitations of the physical environment, both as a provider of inputs ("sources") and as a "sink" for wastes (Serageldin, 1993a). This translates into holding waste emissions within the assimilative capacity of the environment without impairing it and by keeping harvest rates of renewables within regeneration rates. Quasi-ES can be approached for non-renewables by holding depletion rates equal to the rate at which renewable substitutes can be created (El Serafy, 1991).

Figure 7.1 Comparison of social, economic, and environmental sustainability (from: Serageldin 1993a, b)

Van Bieren (1991) 2/66

PA 1

Environment related costs (\*  
\* From: Antille-Boerlin, 1997.

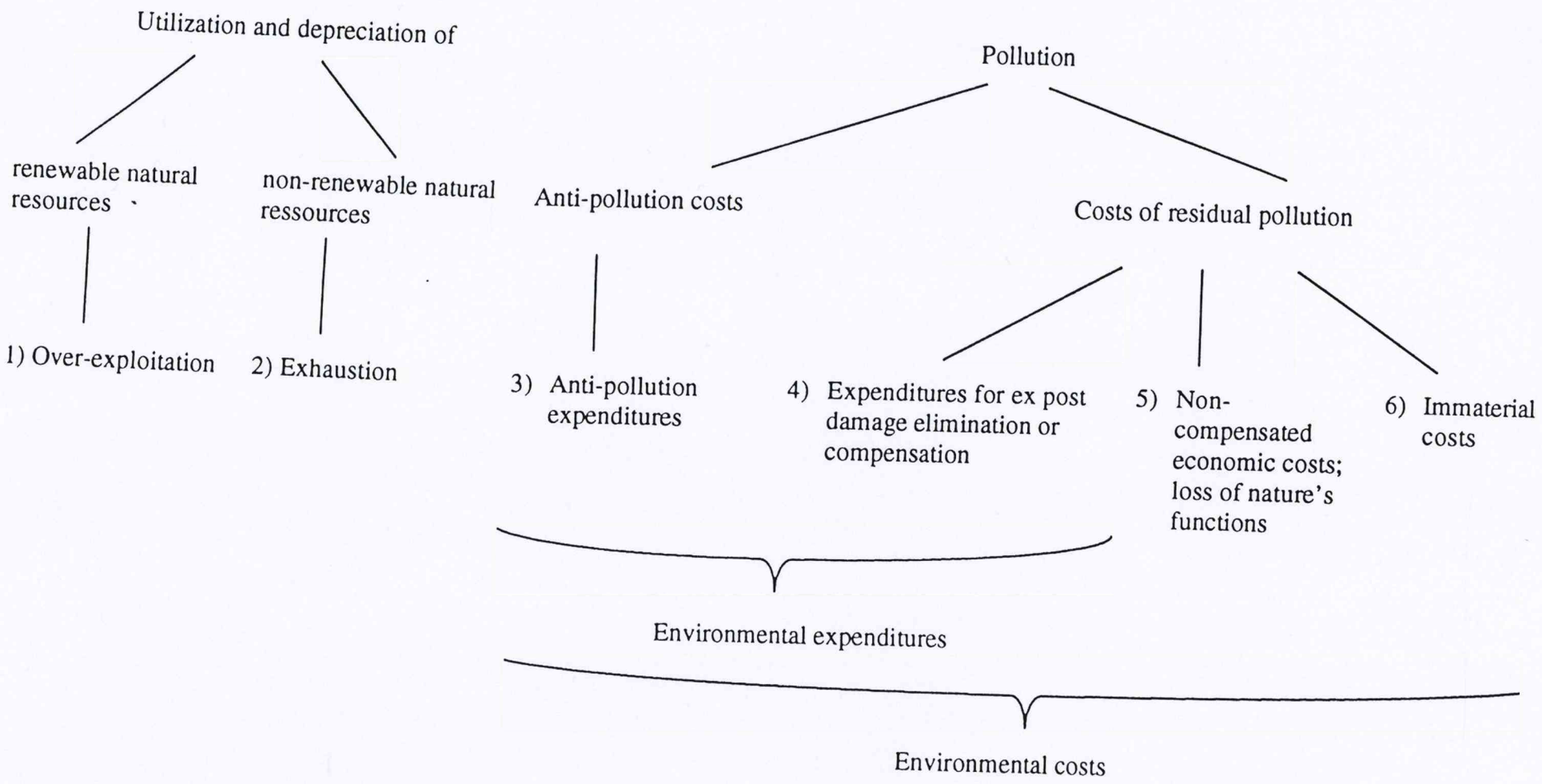


Table II-0a

Descriptive and sustainability approaches  
in the Mainstreams of indicator development

	(1) Indicator movement	(2) Greener accounts	(3) Functions of mature	(4) CBA/EIA
1 Descriptive. positive				
1.1 in physical terms	normally	satellite account	normally	. CBA: 1. step . EIA: nor- mally
1.2 in monetary terms	economic measures (e.g. EDP)	normally	normally	. CBA: 2. step, va- luation . EIA: ra- rely
2 Normative (sustainability)				
2.1 in physical terms	sometimes (e.g. CSD)	--	rarely	--
2.2 in monetary terms	rarely e.g. minimum income deficiency?	--	rarely	--



Table II-0b

## Programmes, Reports

Programmes, Reports	So- cial	Econ- omic	Envi- ronm.	Uncer- tainty	Aggrega- tion
<u>(1) Indicator mouv.</u>					
1 CSD *)	xx	xx	xx		(via sust. target)
2 WRI: WRR	xx	xx	xx	vulne- rabil.	
3 UNDP: HDI, HDR	xx	xx			interstate
4 IBRD: WDR	xx	xx	xx		monetariz.
5 UN: Soc.Ind.	xx				
11 UNEP: EnvDataRep	xx	xx	xx		
18 EU-EEA: Europe's *) envir. Dobris Ass.	(x)	xx	xx		
19 OECD: Env. ind.		xx	xx		
19b Briguglio: Small island st. SIDS		xx		vulne- rabil.	interstate ; weighting
23 UNEP: Island directory			xx	vulne- rabil.	
24 UNEP, BIONET, IUCN, GESAMP: Biodiversity					
27 FAO, OECD:Fishery					
10 UN: Earthwatch 12 UNEP: GEO-1 14 GESAMP: State of MarEnvRep 15 IOC: GOOS 21 ITO: Tourism  22 IMO, OECD: Mar. Transport 29 UNEP/FAO:Mar.mam. 31 UNESCO:B.sph.Res. 33 IUCN, CMC: Nat. parks,prot.areas 34 Council E.: Bio- genetic reserves					
<u>(2) Greener accounts</u>					
6a UN SNA/SEEA		xx	xx		monetariz.

Programmes, Reports	So- cial	Econ- omic	Envi- ronm.	Uncer- tainty	Aggrega- tion
6b EUROSTAT SERIEE, Greening		xx	xx		monetariz.
6c OECD Natural resource accounts		xx	xx		monetariz.
<u>(3) Envir. functions</u>					
27a Functions of Nature		xx	xx		monetariz.
27b Hueting - Dutch Stat. Office					
<u>(4) CBA/EIA</u>					
19a OECD CBA/EIA Programme		xx	xx		monetariz
*) Also with institutional indicators.					

Table II-1a UN-CSD Indicators of Sustainable Development

#1

Ch./p. *1) 1	Name, subject 2	Ocean element *2) 3	Unit 4	D/S/R ind. *3) 5	Sus- tain. target 6
Category: Social					
3/24	Gini index of income inequality	not applic.	dimen- sion- less	state	not avail.
Category: Economic					
2/160	EDP *4)	not appl.	\$ *5) SEEA	state	not avail.
4/171 u.dev.	Miner. reserves	2 stock	tons	state	??
4/172	Fossil fuel energy reserves	2 stock	oil equiv.	state	not avail.
4/174	Lifetime of proven energy reserves	2 stock	years	state	not avail.
Category: Environmental					
17/233 u.dev.	Population growth in coastal areas	not appl.	??	dr. force	??
17/234 u.dev.	Discharges of oil into coastal waters	1 flow	metric tons	dr. force	??
17/235	Release of N and Ph to coastal waters	flow 1 stock 4.2	tons p.a.	dr. force	not avail.
17/238	Maximum sustained yield for fisheries	4 flow stock	%	state	refer. points
17/244 u.dev.	Algae index	5.3 stock	algae /litre	state	??
15/311	Threatened species as % of total native species *6)	7/5-6 5.2-3 6.2-4 stock	%	state	nat. target
15/315	Protected area as a % of total area	4.5 stock	%	resp- onse	10%per ecol. region
Out of these 12 indicators:					

8 dev.  
targ.

9 re elem. 1 mon.

3

- \*1) Chapter of Agenda 21 / page of UN-CSD 1996
- \*2) Cf. Table I-4 Ocean elements (EEZ and beyond)
- \*3) Driving force, state or response indicator
- \*4) EDP: Environmentally adjusted Net Domestic Product; cf. par. II.B.(2)
- \*5) Monetary valuation following SEEA of UN; cf. par. II.B.(2)
- \*6) 4 sub-indicators giving an overall picture for plants and animals and for showing which classes are most threatened:
  - i/iii: % threatened vascular plant/vertebrate species, total
    - all classes
  - ii/iv: % threatened species within each vascular plant/vertebrate class.

Table II-1b Ocean related indicators: Elements covered

Ocean elements (EEZ and beyond)  1	Stock		Flow
	quant- ity 2	qual- ity 3	
0. All			#18 #23
1. Sea water	#11 #23	#11 #12	#11 #1, #12
2. Off-shore hydrocarbons and nonfuel minerals	#11 #1		
3. Built infrastructure (shipping, ports & harbours, touristic)			
4. Natural areas			
4.1. small islands	#12 #23	#12 #23	#12 #23
4.2. coasts, estuaries	#12 #23	#1 #12	#12
4.3. coral reefs	#11 #23, #12	#11 #12	#11 #12
4.4. wetlands	#11		
4.5. parks, reserves	#1, #11 #12, #23		
5. Flora (renewable)	#11		
5.1.			
5.2. mangroves	#1, #12		
5.3. seagrass, algae	#1		
5.4. aquaculture			
6. Fauna (renewable)	#23		
6.1.			
6.2 mammals	#1, #11 #12		#11
6.3 reptiles	#1, #11 #12		
6.4 fish	#1, #11 #12	#11	#1, #11 #12
6.5 invertebrates		#11	#12
6.6 aquaculture			#11
7. Biodiversity	#1, #11 #12, #23	#12	
# refer to reports mentioned in Table II-0			

Table II-1c Ocean related indicators: Pro-memoria with further  
information  
später

Table II-2a Approaches in greening national accounts

Approaches	Environmental categories to be taken into account	Characteristics of accounting
*a adjustment of national accounts	valuation of natural capital stock and env. expenditure, damages and services	modification of SNA framework and boundaries
*b satellite accounts	as above; corresponding phys. flows and stocks	complements SNA without modifying it; general coherence with SNA
*c natural resource and environmental accounts	phys. flows and stocks of nat. res.; phys. and mon. flows from exploitation of nat. res.	independent from and complementary to SNA

Table II-2b Ocean related greening examples

Conceptual solutions	Ocean relevant applications include
*a Neglect of depletion of	natural resources
<ul style="list-style-type: none"> <li>. World Bank's Genuine Saving</li> <li>. eco-domestic product EDP</li> <li>. net national welfare NNW: France, Japan</li> <li>. SERIEE ???</li> </ul>	<ul style="list-style-type: none"> <li>. off-shore minerals, oil; coast; recreational value of marine res.;</li> <li>wetlands, marine wilderness areas; mangroves, fishery, other flora/fauna; national patrimony</li> <li>. Costa Rica, Indonesia, Malaysia, Mexico, Nigeria, Papua N.G., Philippines;</li> <li>. Italy, Norway, Portugal, Spain, United Kingdom, USA</li> </ul>
*b Inadequate treatment of	"defensive" expenditures
<ul style="list-style-type: none"> <li>. ISEW: Denmark, France, Germany, Netherlands, UK, USA</li> <li>. SEEA Versions I, II</li> <li>. SERIEE</li> </ul>	<ul style="list-style-type: none"> <li>. Mexico: environmental protection services</li> <li>. Germany: defensive expenditures</li> </ul>
*c Failure to account for	the degradation of environmental
quality	
<ul style="list-style-type: none"> <li>. GIOM: UN-DESIPA's global i-o model which integrates poll. and poll. abatement activities and ren. and non-ren. resource use with prod./cons. patterns for 16 world regions</li> <li>. SEEA Version IV</li> </ul>	<ul style="list-style-type: none"> <li>. Mexico: pollution, degradation</li> <li>. Yellow Sea off Korea: oil and hazardous substances spills</li> <li>. Chesapeake Bay: herbicide pollutio</li> </ul>
Genuine saving	Output minus net depletion of natural resources.
EDP	Environmentally adjusted measure of net domestic product NDP.
ISEW	Index of Sustainable Economic Welfare; considers i.a. costs of pollution and non-renewable natural resource depletion

Functions of natural environment (\*  
\* From De Groot, 1992

## Regulation functions

1. Protection against harmful cosmic influences
2. Regulation of the local and global energy balance
3. Regulation of the chemical composition of the atmosphere
4. Regulation of the chemical composition of the oceans
5. Regulation of the local and global climate (incl. the hydrological cycle)
6. Regulation of runoff and flood-prevention (watershed protection)
7. Watercatchment and groundwater-recharge
8. Prevention of soil erosion and sediment control
9. Formation of topsoil and maintenance of soil-fertility
10. Fixation of solar energy and biomass production
11. Storage and recycling of organic matter
12. Storage and recycling of nutrients
13. Storage and recycling of human waste
14. Regulation of biological control mechanisms
15. Maintenance of migration and nursery habitats
16. Maintenance of biological (and genetic) diversity

## Carrier functions

*providing space and a suitable substrate for*

1. Human habitation and (indigenous) settlements
2. Cultivation (crop growing, animal husbandry, aquaculture)
3. Energy conversion
4. Recreation and tourism
5. Nature protection

## Production functions

1. Oxygen
2. Water (for drinking, irrigation, industry, etc.)
3. Food and nutritious drinks
4. Genetic resources
5. Medicinal resources
6. Raw materials for clothing and household fabrics
7. Raw materials for building, construction and industrial use
8. Biochemicals (other than fuel and medicines)
9. Fuel and energy
10. Fodder and fertilizer
11. Ornamental resources

## Information functions

1. Aesthetic information
2. Spiritual and religious information
3. Historic information (heritage value)
4. Cultural and artistic inspiration
5. Scientific and educational information



Table II-3b Functions of Nature, Comments and ocean related examples of numerical applications

All functions

Functions and values of the Galapagos National Park (cf. Table IV-3b) and of the Dutch Wadden Sea (a tidal wetland).

Regulation functions

. Waste treatment services provided by wetlands compared to restoring a wetland. Recycling of phosphorus by a wetland versus by an artificial purification plant (USA).

. Nursery function of estuaries and wetlands, usually not explicitly included in the market price of the harvested species, such as fish and shellfish, but shadow prices can be calculated: Primary productivity of some coastal marshes, which supports offshore commercial and recreational fishing industries (USA). Revenues lost from commercial and sport fisheries due to the destruction of coastal estuaries (USA). Dutch Wadden Sea, commercial North Sea catch of plaice, sole, shrimp, dab and herring.

Carrier functions

Value of natural ecosystems:

- .to indigenous cultures: Quite difficult; possibly as "Gross Tribal Product".
- .to (sustainable) cultivation: Wildlife farming, exotic fish raised on Florida fish farms. Harvest from aquaculture.
- .to recreation and tourism: The value of wildlife-related recreational activities exceeds by far the economic value of sport fishing or hunting (Canada).

Production functions

."wild" food and nutritious drinks: wild plants and animals, including fish, game mammals, algae/plankton (USA). Contribution of wildlife to the US economy, including fisheries, biological diversity, ecological services, recreation (from the full-scale numerical exercise for USA by Prescott-Allen and Prescott-Allen, 1986). Sea fishing.

.natural medicinal resources: Pharmaceuticals and bioactives from marine sources (Judson, 1996).

Table II-4 Valuating the environment in CBA

Country	Goods, services	Method
Netherlands	water quality: * recreation . swimming: . fishing: * navigation: * water supply: * agriculture:	market price of entry to commercial pools TCM & market p. savings in sludge removal less costs productivity gains
Norway	freshw. fish, user/non-user benefits:	5x TC, 4x CVM

Table IV-0a From several indicators to one single index  
in the Mainstreams of indicator development

	(1) Indicator mouvement	(2) Greener accounts	(3) Functions of nature	(4) CBA EIA
<u>a Single aspect</u>				
a1 social	HDI			
a2 economic	GNP	SNA		
a3 environmental	UN-ECE, OECD CORE, IUCN, WRI	SEEA	xxx	xxx
<u>b Valuation</u>				
b1 social into mon.	IBRD's WDR			
b2 envir. into mon.	FAO fishery	SEEA	xxx	xxx
<u>c From indicators to one index</u>				
c1 aggregation of .1 monetary terms	IBRD's WDR	satel- lites	xxx	xxx
.2 phys. terms	eg biomes	satel- lites		
c2 multiaspect amalgamation				
.1 relat. dist. from target	CSD: sustain.; HDI: countries' min/max			
.2 weighting	small islands vulner. index			xxx
d <u>linkage</u>	if systematic "core"	xxx		

Table IV-2 Methods used in ocean related greening examples

Country	Renewable nonrenew. resources	Goods services	Method
*a Neglect of depletion of natural resources Stock			
SEEA	b, c, d		
??			
costa rica	r	fisheries	market values
indonesia	nonr	petrol	net-price (mp - extr.costs)
malaysia	nonr	marketable	net-price
cacln		italy nonr	minerals net-price
canada	?	natural R	?
france	r	f&f	hamilt: in phys. terms ??
	non		il mexico
		nonr	oil
			user-cost (El Serafy)
netherlands			cf norway
	nonr	metals	in phys. terms
norway	nonr	petroleum, minoil,	minerals in phys. terms
"	r	fish	in physical terms
Papua N.G.	nonr	mineral R	net-price, user-cost
portugal	r	fish	?
philippines	r	coastal fish.	?
Spain	?	marine R, f&f	?
oecd			
UK	nonr	oil	user-cost
USA	nonr	petroleum, metals	combination of meth.
"	r	later	
	nonr	?	?
*b Inadequate treatment of "defensive" expenditures LATER			
*c Failure to account for the degradation of environmental quality LATER			

Table IV-3 Galapagos National Park: Socio-economic value of the functions, land use and employment (\*)

\* From De Groot, 1992

(based on maximum sustainable use levels)

(values are expressed qualitatively (++) or in US\$/ha/year) except column 7  
Total surface area of the study area: 1,150,000 ha

Types of values (based on Table 3.0-1, for explanation, see text)

Environmental Functions	1 Conser- vation value	2 Existence value	3 + 4 Social values <sup>1</sup>	5 Consump- tive use value	6 Productive use value	7 Value to employment ( <sup>1</sup> people)
<b>Regulation Functions</b>	<b>&gt; 63.00</b>	<b>++</b>	<b>++</b>		<b>++</b>	
Watercatchm./erosion prev.	0.30		+		*	
Bio-energy fixation	(1,200.00) <sup>4</sup>	+			*	
Storage/rec. human waste	58.00 <sup>2</sup>		+		*	
Biological control	++	+	+		*	
Nursery f./migration hab.	7 <sup>2</sup>	++	++		*	
Maintenance of biol.div.	4.90	++	++		*	
<b>Carrier Functions</b>	<b>0.50</b>	<b>++</b>	<b>+</b>		<b>&gt; 45.00</b>	<b>&gt; 833</b>
Aquaculture					0.02 <sup>2</sup>	+
Recreation		+	+		45.00	772
Nature protection	0.55	++	++		*	61
<b>Production Functions</b>						
Food/nutrition			++	+	<b>&gt; 8.00</b>	<b>&gt; 160</b>
Genetic resources			++	+	0.70	156
Raw materials for constr.					+	+
Biochemicals					5.20	4
Energy resources					++	+
Ornamental resources					1.50 <sup>1</sup>	+
					0.40	+
<b>Information Functions</b>	<b>0.50</b>		<b>++</b>	<b>++</b>	<b>&gt; 3.00</b>	<b>&gt; 67</b>
Aesthetic information			+	++	+	
Spiritual information	0.52		++	++	*	
Historic information			+	++	*	
Cultural/artistic insp.			+	+	0.20	
Educ. & scientific inf.				+	2.70	67
<b>TOTAL ANNUAL RETURN</b>	<b>&gt; 64.00</b>	<b>++</b>	<b>++</b>	<b>++</b>	<b>&gt; 56.00</b>	<b>(1,060)</b>

This function applies to the terrestrial area only (720,000 ha).

This function applies to the marine area only (430,000 ha of which 4,100 intertidal zone)

Social values consist of the importance of environmental functions to human health and the option value placed on a safe future.

If a figure is given between brackets it was not used in calculating the total value because the calculation is too speculative.

These functions do contribute to economic productivity, either directly or indirectly, but no market or shadow price could be determined due to lack of information and/or shortcomings of the market mechanism.

	Land use (km <sup>2</sup> )	Annual retur (in million US\$)		Employment
		Actual	(potential)	
Cultivation	271	1.70	(4.40)	358
Fishery	-	0.30	(0.30)	156
Black coral harvest	-	0.10	(-)	?
Mining (sand, rock, gravel)	?	5.00	(6.00)	4
Energy conversion	?	?	(1.10)	?
Recreation and tourism (and related 'industries') <sup>1</sup>	?	26.80	(52.40)	772
Env. education	-	0.32	(0.60)	?
Env. research	-	1.25	(2.50)	67
Nature conservation	7,200	0.32	(0.60)	61
<b>TOTAL</b>		<b>28.75</b>	<b>48.29</b>	<b>1,418</b>

Public services, bars, restaurants, kiosks, handicraft, ship-construction, transportation, etc.

Table IV-all.a

## Taking Nature into account - Methodologies

Magnitudes	(1) Indicator mouvement	(2) Greener accounts	(3) Functions of Nature	(4) CBA, EIA
STOCK				
FLOW:				
1) over- exploitation				
2) exhaustion				
3) preventive anti-poll. expenditure				
4) damage elimination/ compensation				
5) loss of nature's functions				
6) immaterial costs				

Table A.II-1a UNEP Environmental data report 1993-94(\*)

#11

Ocean elements (EEZ and beyond)	Stock		Flow	Unit, valua t.
	quantity	quality		
1	2	3	4	5
1. Sea water	Sea le- vel 120 *	Litter 356	.Dumping 337,339* 354 .Spills/ accid. 365*	
2. Off-shore hydrocarbons and nonfuel minerals	309?			
4.3. coral reefs	150*	Reef dis- turbances 193, 150*	Reef uses 193; dis- turbances 193, 150*	
4.4. wetlands	196,150*			
4.5. parks, reserves	196			
5. Flora (renewable)	(186)			
6.2 mammals	146* 186;184 whales		146* catch 185	
6.3 reptiles	186			
6.4 fish	144*	concentr. 96, 97	catch 181 145* sust.144	
6.5 invertebrates		mussel 96		
6.6 aquaculture			prod.145	
7. Biodiversity	186			
* Interesting text, no data tables. Pages refer to UNEP's publication.				

Table A.II-1b Global Environment Outlook 1977 (Geo-1) (\*1 #12

Ocean elements (EEZ and beyond)  1	Stock		Flow  4	Unit, valu- ation  5
	quantity 2	quality 3		
1. Sea water		*2)	*2)	
4. Natural areas				
4.1. small islands	*2)	*2)	*2)	
4.2. coasts, estuaries	*2)	*2) 34, 43, 70, 88, 101; 167*1)	34, 43, 70, 88, 101; 167*1)	
4.3. coral reefs	*2)	*2) cf. 4.2	cf. 4.2	
4.5. parks, reserves	*2) 118			
5. Flora (renewable)				
5.2. mangroves	*2)			
6. Fauna (renewable)				
6.2 mammals	49, 83			
6.3 reptiles	49, 83			
6.4 fish	49, 83 *2)		22*2) 24*2) 70, 125	
6.5 invertebrates			70	
7. Biodiversity	*2)	7		
<p>*1 Interesting information; no systematic data on indicators. Pages refer to GEO-1, except for *2 below. Incl. UNEP/DEIA/MR.96-3; UNEP/DEIA/TR.97-1; UNEP/DEIA/Tr.97-3</p> <p>2* Significant environmental issues of SPREP island member coun- tries (South Pacific Regional Environment Programme). UNEP/DEIA/TR.97-3 p. 58-59.</p>				



Table A.II-1c

UNEP Island Directory (+

#23

Ocean elements (EEZ and beyond)	Stock		Flow	5
	quantity	quality		
1	2	3	4	5
0. All			6*, 553* vuln.spill; 7*, 538*, 549* 557* human impact	
1. Sea water	5* level			
4.1. small islands	XX	XX	XX	
4.2. coasts, estuaries	5 length			
4.3. coral reefs	isl. as raised c. 511; 7* sp.richn.			
4.5. parks, reserves	prot.sea areas 8, 534			
6. Fauna (renewable)	7* spec. richness			
7. Biodiversity	7* spec. richness; 10*, 553*, 557* mar. conserv.			

- +) Pages refer to UNEP Island Directory, 1991.  
Annotated list of nearly 2.000 of the significant islands of the world, between 50 and 200 selected for detailed treatment.
- \*) Vulnerability: High risk of oil spills and natural catastrophies.  
Human impact: A function of demographic pressure, active population, GDP, urbanisation, tourism.  
Sea level rise risk : The risk to the island from sea level rise due to climate change, evaluated as the % of the land area less than 5 metres above sea level.  
Marine species richness: Number of species of the few categories of organisms with data such as fish, corals or molluscs.  
Marine conservation importance: A function of ecosystem richness (marine ecosystems in the coastal zone to 100 m depths), species richness, vulnerability and natural protection.

Table A.II-1d

EU The Dobris assessment +)

#18

Ocean elements (EEZ and beyond)	Stock		Flow	5
	quantity 2	quality 3		
1				
0. All *1)			*2 tourism	*2
6.4 fish		contaminants 142 *3	overfishing 142	
6.5 invertebrates		contaminants 142 *3		

+ Pages refer to EU-EEA. Europe's environment - The Dobris Assessment. 1996. Cf. the accompanying, separate statistical compendium for statistical data on these and other elements. The text stresses sustainability.

1 European Seas: Medit., Black/Azov, Caspian, White, Barents, Norwegian, Baltic, North Sea, North Atlantic Ocean

2 It has been estimated that, in 1990, the algal plague in the Adriatic Sea cost an estimated ECU 1.5 billion in lost revenue from tourism and fishing; p. 489.

3 OSPARCOM. Supplementary baseline study of contaminants in fish and shellfish. 1992

DB/Börlin

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10 September 1997

Prof. E. Mann Borgese  
IOI Dalhousie University  
1226 LeMarchant Street  
HALIFAX; Nova Scotia  
Canada B3H 3P7

Dear Elisabeth,

Thank you again for the kind hospitality in Halifax.

Now you receive my final report (without späters)

- \* on disk, file Wordperfect 5.1 DOS
- \* " " Word
- \* printed, recto/verso
- \* " " recto only.

My first paper in English was on multidimensionality in econometric models, written in Berkeley 30 years ago; my last comes again to multidimensionality, and it is a privilege and pleasure to present it to you.

When in India, C. G. Jung refrained to meet Ramana Maharshi; it is remarkable that you give such a space to Indian spirituality, at such a forum. Revolutionary, you said? Please add syncretist! This is not captatio benevolentiae, it is the expression of my gratitude for your clear standpoint.

Here my replies to your 87-105 and 127 ff.:

- 94 sea-board trade: A. Behnam confirms by phone that your figure is total output and not value added (which is 20 times less); see \* & 14n22 Annex A and p. 18\* of my report. And I add: a contrario one could argue that without all the terrestrial activities upstream of loading, ships would navigate empty, and hence the 5196 are allocated to terrestrial; Leontief sorted this out, and got the Nobel Prize.
- 103 fn 16: my bibliography p. 21
- 104: please avoid THEORY
- 105: social and economic indicators are for both, terrestrial and simultaneously marine; my report p. 4 f.
- 127: unquantifiable? But then, why indicators; how co-management?

Your Gotfried Hauptmann reminded me of a Chinese story; you find it on Annex B. Also, I mentioned to you Dahl expressing similar revolutionary ideas; e.g. on p. 91, 92 of Annex C.

I hope my note is useful to you and wish you success with your Report.

Kind, cordial regards.

A

Estimates of total freight costs in world trade a/ by groups  
(Millions of US dollars)

Year	Country group	Estimate of total freight costs of imports	Value of imports (cif)	Freight costs as percentage of import value
1980	1. World total	123 264	1 856 834	6.64
	2. Developed market-economy countries	78 286	1 425 979	5.49
	3. Developing countries - total	44 978	430 855	10.44
	<u>of which in:</u>			
	Africa	10 432	77 757	13.42
	America	10 929	123 495	8.85
	Asia	21 979	211 089	10.41
	Europe	1 320	16 037	8.23
Oceania	318	2 477	12.84	
1985	1. World total	103 638	1 792 285	5.78
	2. Developed market-economy countries	68 499	1 424 420	4.81
	3. Developing countries - total	35 139	367 865	9.55
	<u>of which in:</u>			
	Africa	5 813	51 576	11.27
	America	6 825	81 259	8.40
	Asia	21 162	219 956	9.62
	Europe	1 074	12 919	8.31
Oceania	265	2 155	12.30	
1994	1. World total	219 317	4 063 338	5.40
	2. Developed market-economy countries	125 252	2 922 810	4.29
	3. Developing countries - total	94 065	1 140 528	8.25
	<u>of which in:</u>			
	Africa	10 660	96 453	11.05
	America	17 438	219 350	7.95
	Asia	64 156	805 203	7.97
	Europe	1 331	15 600	8.53
Oceania	480	3 922	12.24	
1995	1. World total	247 325	4 688 637	5.27
	2. Developed market-economy countries	145 040	3 457 009	4.20
	3. Developing countries - total	102 285	1 231 628	8.30
	<u>of which in:</u>			
	Africa	11 598	101 369	11.44
	America	20 305	257 505	7.89
	Asia	68 003	847 054	8.03
	Europe	1 728	20 445	8.45
Oceania	651	5 255	12.39	

X

Source: Derived from IMF cif/fob factors and IMF import data.

a/ The estimate for the world total is not complete, since data for (1) countries that are not members of the IMF, (2) countries of Central and Eastern Europe and republics of the former Soviet Union, (3) socialist countries of Asia are not included for reasons of lack of data and others.

**THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA,  
ITS IMPLEMENTATION AND AGENDA 21**

\* \* \* \* \*

International Ocean Institute  
Dalhousie University  
9 June - 15 August 1997 - HALIFAX

**SHIPPING AND PORTS IN DEVELOPING COUNTRIES: PERSPECTIVES**

Dr. A. Behnam

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The views expressed in this paper are those of the author and do not necessarily reflect the views of the UNCTAD secretariat.

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Borlin, Max, "Indicators for sustainable development: UNEP's role in a collaborative effort," *UNEP Industry and Environment*, September 1995, 21-24.

Lyon Dahl, Arthur, *The Eco Principle*, London, Zed Books, 1996, 90-93.

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## 60. LAUGHTER

*Laughter is such a transforming force that nothing else is needed. If you change your sadness to celebration, then you will also be capable of changing your death into resurrection.*

I have heard about three Chinese mystics. Nobody knows their names. They were known only as the Three Laughing Saints, because they never did anything else—they simply laughed. They would move from one town to another, stand in the marketplace and have a good belly laugh.

These three people were really beautiful, laughing, and their bellies waving. It would become an infection—the whole marketplace would laugh . . . For a few seconds a new world opened.

They moved all over China just helping people to laugh. Sad people, angry people, greedy people, jealous people: they all started laughing with them. And many people felt the key—you can transform.

Then in one village it happened that one of the three died. The villagers said, "Now there will be trouble. Their friend has died—they must weep." But the two were dancing, laughing and celebrating the death.

The village people said, "Now this is too much. This is unmannerly. When a man is dead it is profane to laugh and dance."

They said, "You don't know what has happened! All three of us were always thinking of who was going to die first. This man has won, we are defeated. The whole life we laughed with him. How can we give him the last send-off with anything else? We have to laugh, we have to enjoy, we have to celebrate.

"This is the only farewell that is possible for the man who has laughed his whole life. And if we don't laugh, he will laugh at us and he will think, 'You fools! So you have fallen again into the trap? We don't see that he is dead. How can laughter die, how can life die?'"

Then the body was to be burned, and the village people said, "We will give him a bath as the ritual prescribes." But

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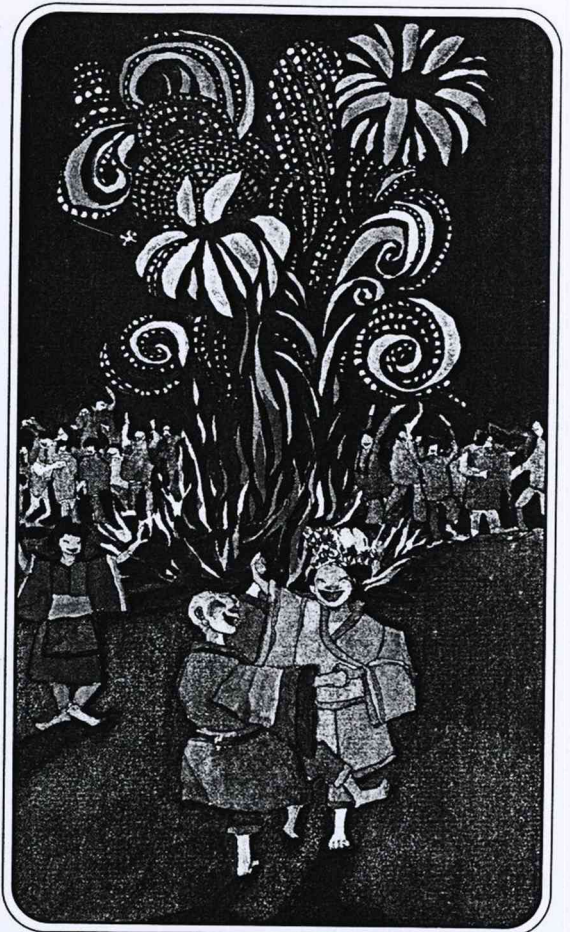
those two friends said, "No, our friend has said, 'Don't perform any ritual and don't change my clothes and don't give me a bath. Just put me on as I am on the burning pyre.' So we have to follow his instructions."

And then, suddenly, there was a great happening. When the body was put on the fire, that old man had played the last trick. He had hidden many fireworks under his clothes, and suddenly there was *Diwali!* Then the whole village started laughing. These two mad friends were dancing, then the whole village started dancing. It was not a death, it was a new life, a resurrection. Every death opens a new door.

If you change your sadness to celebration, then you will also be capable of changing your death into resurrection. So learn the art while there is still time.

YOGA: THE ALPHA AND THE OMEGA,  
Vol. 4, pp. 252-254

60



LAUGHTER



Max Börlin  
Founex, Switzerland  
September 1997

## ***OCEAN RELATED INDICATORS***

*A contribution to ch. 3 section 2 of*

OCEAN PERSPECTIVES  
A REPORT TO THE CoR

Prepared for: Prof. Elisabeth Mann Borgese  
International Ocean Institute  
Dalhousie University  
Halifax, Canada

### *CONTENT*

- *Abbreviations and acronyms*
- *1 Ongoing initiatives about ocean related indicators: descriptive indicators, indicators for sustainable development, relevant initiatives elsewhere*
- *2 Gaps in ocean related indicators: in general, in specific sectors*
- *3 Inconsistencies with Common Heritage Economics: requirements, inadequacies*
- *4 Round-up*
- *Bibliography*

**ABBREVIATIONS AND ACRONYMS**

CBA/EIA	Cost-Benefit Analysis / Environmental Impact Assessment
EDP	Environmentally adjusted Domestic Product
FAO	Food and Agriculture Organization of the UN
GDP/GNP	Gross domestic/national product
GEO-1	UNEP's First Global Environment Outlook
GESAMP	IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Group of Experts on Scientific Aspects of Marine Pollution
HDI	UNDP's Human Development Index
ISD	Indicator for Sustainable Development
ISEW	Index of Sustainable Economic Welfare
IUCN	The World Conservation Union
OECD	Organization for Economic Cooperation and Development
SCOPE	Scientific Committee on Problems of the Environment
SEEA	UN Satellite System for Integrated Economic and Environmental Accounting
SIDS	Small Island Developing States
SNA	UN System of National Accounts
UN-CSD	Commission for Sustainable Development
UNDP	UN Development Programme
UN-DPCSD	Department of Policy Coordination and Sustainable Development
UNEP	UN Environment Programme
UNEP/DEIA	Department for Environmental Information and Assessment
UNESCO	UN Educational, Scientific and Cultural Organization
UNSTAT	UN Statistical Office
WCWC	World Conservation Monitoring Centre (UNEP, IUCN, WWF)
WRI	World Resources Institute
WWF	World Wide Fund for Nature

## OCEAN RELATED INDICATORS

The purpose of this analysis is to help explicitly introducing the subject of indicators into the Report of E. Mann Borgese to the Club of Rome about ocean development. Indicators in fact are needed in a more comprehensive theory of wealth and welfare rooted in the concept of Common Heritage of Mankind of UNCLOS to perform measurements of monetarized and non-monetarized resources.

Traditionally, indicators are defined as a piece of information which (a) is a part of a specific management process and can be compared with its results; and (b) has been assigned a significance beyond its face value. They are developed (and distinct) from general-purpose statistics that have important applications in their own right; and they are used for (and again distinct from) problem-solving of given issues.

This note presents in the first part ongoing initiatives relevant to ocean related indicators, discusses in the second part gaps in ocean related indicators and explores in the third part the validity of ocean related indicators in the light of the new economics of Common Heritage of Mankind. Conclusions round up the analysis.

### 1 ONGOING INITIATIVES ABOUT OCEAN RELATED INDICATORS

We call the explicit development of indicators "Indicator movement"; it generates descriptive indicators reflecting actual developments (taking a picture) as well as indicators for sustainable development (ISDs). Other initiatives strongly support it. Thus, greener national accounts are being developed in a variety of shape and form and deserve attention as consumers and producers of indicators. Similarly, attempts to identify functions of nature and the institutionalized use of cost-benefit analysis and environmental impact assessment (CBA/EIA) brought about a development of methodologies and applications useful to the indicator movement.

### **1.1 Descriptive indicators**

In his Report to the Club of Rome, Giarini<sup>1</sup> introduces Dowry and Patrimony as being a combination of natural or physical, biological, man made (cultural) and monetarized (capital) phenomena. Similarly, the UN-CSD distinguishes social, economic, environmental and institutional aspects of sustainable development<sup>2</sup>. One more aspect is uncertainty. In shorthand, we call these parameters "the S.E.E.U. dimensions" and use them in the following discussion about descriptive indicators.

#### **Social indicators**

Social indicators for large series of countries are elaborated and presented by UNDP in its Human Development Report and by the World Bank in its World Development Report<sup>3</sup>. The following remarks about the Human Development Report illustrate the role of social indicators for ocean development.

UNDP's Human Development Report described in Box 1 presents Human Development indicators and the Human Development Index. They are meant to measure the social and economic situation in the some 175 covered countries. Human Development Indicators possibly relevant to oceans are GDP and GNP; employment, unemployment; land and income distribution; urban population in coastal cities; annual marine fish catch; major protected areas. The relevance of fish catch and marine protected areas is straightforward. For other variables like e.g. GDP or life expectancy, the linkage with ocean development is less direct. In small island developing states SIDSS, the social and economic situation is a result of ocean development (or non-development); for them, nation-wide social and economic indicators are "ocean related". Large coastal countries like Argentina or Canada on the other hand owe their social and economic situation to marine and to terrestrial activities, and the resulting nation-wide indicators like GDP and life expectancy are not only "ocean related". For such situations

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<sup>1</sup>Giarini 1988.

<sup>2</sup>UN, 1996.

<sup>3</sup>UNDP, 1997. World Bank, 1997.

ongoing efforts to develop methods for disaggregating the human development\_indicators according to subnational regions are important; this is not to say that the benefits of ocean development necessarily go to the coastal sub-region. At any rate, here and for large coastal countries, social and economic indicators are the necessary input into statistical analyses of the ocean dependency of their socio-economic situation, rather than the reflection of such a linkage. This is also true for the Human Development Index HDI.

### **Economic indicators**

Ocean related goods and services in the categories:

- offshore oil, gas and non-fuel minerals
- man-made capital: built infrastructure (ports and harbors, fleet, touristic installations)
- sea-born trade
- coastal and marine tourism

were already referred to in the previous section reporting production (i.e. flow) estimates. We now turn to considerations about stocks as well as supported and generated impact. Global data on energy and mineral reserves are regularly compiled by specialized institutions including the World Energy Council, the International Energy Agency, the US Bureau of Mines and the World Bureau of Metal Statistics; offshore reserves however are not identifiable in the major data reports (and neither in the two sustainability indicators about fossil fuel energy and mineral reserves proposed by UN-CSD; see below). Stock of built infrastructure should in principle be found in national accounts (amortisations, Leontief input-output and flow investment matrix) and in some specialized publications (e.g. OECD Maritime transport for the world fleet and FAO yearbooks for the fishery fleet).

The ocean related activities generate and support external costs (Giarini's "deducted values"), where [internalized market costs] + [external costs] = [social costs] ). Maritime transport e.g. is likely to have significant impacts on coastal resources for port and channel construction and maintenance, and for navigation routes; operational impacts include risks from transport of hazardous wastes or oil spills. Such forms of pollution generated by them are addressed at below in the context of

environmental indicators. The effects of supported impacts on the other hand can be studied comparing environmental indicators of the state of marine natural resources and economic indicators of ocean related activities, both with cross-section (one year, many countries) and time-series (one country, many years) analysis.

### **Environmental indicators**

Environmental indicators reflect stock and/or flow realities of marine resources, with man-made and natural additions and deductions (flows) modifying the initial into a final stock. Stock has a quantity and a quality aspect: such as size of species population and contaminants in fish. Flows result from "usus", e.g. sustainable harvesting, and "abusus" of natural resources, i.e. over-exploitation of renewable and depletion of non-renewable resources; pollution resulting in environmental expenditures and non-compensated economic costs; as well as loss of ecological functions and immaterial welfare (e.g. damage to landscape and cultural patrimony).

What ocean related indicator work is ongoing for these natural resources and their different phenomena? Given the vastness of the documentation and the impressive number of teams at work, the reply of a one-man-show must remain very humble and general. Over-all, the UNDP/CSD indicator menu lists approximately 130 indicators used in the UN-CSD proposal for sustainability indicators, and the Core Data sets Matrix some 170 parameters/datasets used for the first UNEP Global Environmental Outlook GEO-1<sup>4</sup>. Of the latter,

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<sup>4</sup>UNEP/DEIA/MR.96-3. A core data working group (1996), six regional consultations held in 1996 and a model-based analysis supporting GEO-1 were preparatory initiatives of DEIA, UNEP's Division of Environmental Information and Assessment. Our following review is also based on: UNEP/UN System-wide Earthwatch Coordination, 1995; *UN system-wide Earthwatch Programme Document*. The mission of Earthwatch is to coordinate, harmonize and integrate observing, assessment and reporting activities across the UN system in order to provide environmental and appropriate socio-economic information for decision-making on sustainable development, including information on the pressures on, status of and trends in key global resources, variables and processes in both natural and human systems and on the response to problems in these areas.

about 30 can be considered social and 40 economic indicators; this leaves about 100 environmental indicators; of these we consider up to one fourth being ocean related, more than half terrestrial and the remaining quarter general (climate, institutional support).

As recalled in the previous section, sea water is used for desalination and for producing renewable energy from the ocean (including tidal for electricity). Indicators of bathing quality, metal content and coastal marine water quality, litter in marine environment (quality of stock) reflect pollution through dumping, discharges and, as proposed by UNDP/CSD, releases of N and Ph and oil discharges; GESAMP offers an overview over the respective and more general indicators<sup>5</sup>.

Within our category of natural areas, small islands indicators are reported i.a. in UNEP's Island Directory<sup>6</sup> and in UNDP's Small Island Developing States Network. Interesting in the present context is also UNEP's Barbados Programme of Action for Small Island Developing States SIDS, to be fully reviewed in 1999. Besides the length of coasts (stock quantity), GEO-1<sup>7</sup> gives estimates about pollution suffered and the resulting stock quality. The Barbados International Coral Reef Initiative for small islands may complement existing data about reef disturbances and reef uses. As for protected parks and reserves, the standard inventories (IUCN, WCMC) identify marine sites and are the basis of a proposed sustainability indicator (stock quantity)<sup>8</sup>.

About flora, mangroves loss reported in GEO-1 and an algae index proposed as sustainability index concern stock quantity. Algae catch (WRI; flow) recall the uses as pharma/food mentioned in the previous section. A

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<sup>5</sup>GESAMP, *State of the Marine Environment*, 1990, 1996.

<sup>6</sup>UNEP, 1991.

<sup>7</sup>UNEP, 1997.

<sup>8</sup>For a detailed table from national and international systems for protection of natural areas, including separate data for marine and coastal protected areas, see the bi-annual "World Resources" of World Resources Institute.

sustainability indicator for threatened species as a % of total native species is proposed for vascular plants and vertebrate species; however, no distinction between marine and terrestrial is mentioned (IUCN, WCMC).

Other sources for fauna include the UNEP/FAO Marine Mammal Action Plan and the International Whaling Commission. Available for fish and other marine animals are in principle estimates for stock quantity, stock quality (contaminants), catch and accidental kills (mainly FAO, incl. mariculture). The UN-CSD list includes an indicator for maximum sustained yield for fisheries.

Some indicators exist already for taxonomic, genetic, ecosystem and environmental function diversity including threatened and endemic species, protected areas, % of developed coast. Impetus for a systematic treatment is expected from the Global Biodiversity Forum's Dialogue on Biodiversity Indicators and Implementation Targets, within the implementation of the Biodiversity Convention. UNEP's Biodiversity Programme and Implementation Strategy gives priority to marine biodiversity, including in SIDS<sup>9</sup>.

### Uncertainty

*"Owing to the complexity of the mechanisms that affect biological capacity and fish populations, estimates of commercial fish stocks are uncertain at the present time"*<sup>10</sup>.

This statement in UNEP's latest Environmental Data Report recalls the "limits to certainty" inherent in every indicator or index, be it descriptive of the present state or an outlook into the future.

Uncertainties come in all kinds: about the measurements and resulting statistical data, about the causal relations and the models used to represent reality; and no probabilities can be calculated and assigned to outcomes. Therefore a vulnerability index may be developed and merged

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<sup>9</sup>See also UNEP, 1995a; *The UNEP Biodiversity Programme and Implementation Strategy* - As well as UNEP, 1995; *Global Biodiversity Assessment*, an over 1100 pages report about the present state of knowledge, gaps in understanding and areas where further research is needed.

<sup>10</sup>UNEP, 1993, *Environmental Data Report 1993-94*. See also Giarini/Stahel, 1993.



with the more traditional social, economic and environmental indicators. Thus, UNEP collaborates in the development of a Vulnerability Index in support of the Programme of action for the sustainable development of small island developing States SIDS. Already in its Island Directory<sup>11</sup> an index was estimated for important islands at risk based on marine conservation importance, human impact and data reliability. More recently, Briguglio<sup>12</sup> addressed the issue of SIDS quantifying forces behind their economic vulnerability (exposure to foreign economic conditions, remoteness and insularity, disaster proneness), and attempted to construct a composite index of vulnerability. For one out of three analyzed SIDS, the switch from the present GDP-based ranking to the ranking based on the vulnerability adjusted development index would have immediate conditionality effects. In another example, vulnerability to anthropogenic change of tropical coastal ecosystems was calculated as a function of GNP per capita and population density, and the resulting normalized vulnerability index was plotted against a normalized resource abundance index for mangroves, sea grasses and coral reefs<sup>13</sup>.

## 1.2 Indicators for sustainable development

At the UN Conference on Environment and Development in Rio in 1992, the International Community committed itself to achieving sustainable development, and Agenda 21 comments specifically on the need for indicators in Chapter 40 asking the United Nations system to create with other relevant organizations a set of indicators reflecting developments towards sustainability. Subsequently, the UN Commission on Sustainable Development has adopted a Work Programme on Indicators of Sustainable Development whose primary purpose is to make internationally consistent ISDs accessible to decision-makers at the national level. On an international level, it is especially the Department for policy coordination and sustainable development (DPCSD) of the UN Division for Sustainable Development which is dealing with

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<sup>11</sup>UNEP, 1991.

<sup>12</sup>Briguglio, 1995.

<sup>13</sup>World Resources Institute, 1986.

this issue. A provisional core set of ISDs was published in 1996 with the approval of the Commission on Sustainable Development under the title *Indicators of Sustainable Development - Framework and Methodologies*<sup>14</sup>. Preparatory activities of UNEP/EAP Environment Assessment Programme in this ISD process were an overview of environmental indicators (1994), a SCOPE-Belgian-Costa Rican Workshop held in January 1995 in Ghent and the SCOPE scientific workshop on ISDs in Wuppertal, Germany, of November 1995.

In the published core set of ISDs the dimensions are social, economic, environmental and institutional; although holistic, the approach does not include moral/ethical/spiritual sustainability, i.e. the state of the set of shared values defining acceptable behavior and motivating people to act in the common interest. Descriptive methodology sheets for every ISD (with no estimates for the time being) are presented according to the dimensions, the chapters of Agenda 21 and the indicator type (driving force, state or response indicator).

In principle, an ISD results from the national descriptive indicator discussed earlier in this section, from the corresponding international sustainability target (e.g. the critical stock or level of a coastal resource) and from the comparison of the two. Environmental targets or limits may have an objective, scientific basis; social and economic targets/limits are much more value loaded and hence subject to each society's concepts, goals and values. This may explain why for most of the indicators international targets are not yet available.

A dozen ISDs can concern ocean development, such as indicators about income inequality, the environmentally adjusted Net Domestic Product EDP, mineral reserves, fossil fuel reserves, lifetime of proven energy reserves, population growth in coastal areas, discharge of oil, N and Ph into coastal waters, maximum sustained yield for fisheries, existence of algae, threatened species and protected area. Within this dozen ocean related indicators, one is expressed in monetary terms, namely EDP. For only three targets are defined: for sustained yield for fisheries, for threatened species and for the protected area. Finally, one third of the ocean related SDIs are

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<sup>14</sup>UN, 1996.

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"under development" altogether. This reminds us of the fact that the CSD core set of ISDs still is in development.

### 1.3 Relevant initiatives elsewhere

Greener national accounts, functions of Nature and Cost-benefit analysis support the indicator movement in several ways.

#### Greener national accounts

At a conference at the European Parliament, the Club of Rome and WWF-International called for a modification of SNA<sup>15</sup> framework and boundaries leading to a new, Nature-adjusted single measure incorporating the value of Nature's resources and services<sup>16</sup>. Satellite accounts offer a mid-way solution in that without modifying the SNA they complement it with estimates of stocks of natural resources, environmental non market services and damages due to economic activity. In its Satellite system for integrated Environmental and Economic Accounting (SEEA), UNSTAT<sup>17</sup> defines a menu of five alternative versions, with Version IV being concerned with satellite accounts; pilot country applications of parts of SEEA exist e.g. for Colombia, Mexico, Papua New Guinea, Thailand.

Ocean related explorations of greener accounts include:

- accounting for the depletion of natural resources : e.g. World Bank's Genuine Saving (output minus net depletion of natural resources)
- estimates in several developing and industrial countries for off-shore minerals and oil; for the recreational value of marine resources; for wetlands, mangroves and marine wilderness areas; for fishery and national patrimony;
- more adequate treatment of "defensive" expenditures: in Germany in general and in Mexico for environmental protection services; in half a dozen industrial countries development of ISEW, the Index of Sustainable Economic

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<sup>15</sup>UN Statistical Office, 1994.

<sup>16</sup>Sheng, 1995. Van Dieren (ed.), 1995.

<sup>17</sup>UN Statistical Office, 1993.

Welfare covering i.a. costs of pollution and non-renewable natural resource depletion;

- accounting for the degradation of environmental quality: e.g. of the Yellow Sea off Korea with oil spills and hazardous substances, of the Chesapeake Bay due to herbicide pollution.

The SEEA accounts can also be used to calculate linkage environmental indicators. In a pilot study for 11-13 developing and industrial countries, WRI e.g. calculated a macro-economic Index of Resource Depletion measuring the value of the decline in natural resource stocks relative to the value of gross investment in man-made capital during the given year. WRI produced also a disaggregated Resource Depletion Index for the agriculture-forestry-fisheries sector measuring the ratio of the SEEA environmentally adjusted domestic product combined to the standard GDP for these resource sectors<sup>18</sup>.

Green accounting supports the indicator movement generating relevant quantitative data and methodologies, representing the linkage between economy and environment on which to base macro-economic indicators, offering the input needed to develop environmental ISDs. It hence is not surprising that countries including Finland, France, the Netherlands and the United Kingdom are integrating, in one way or another, the efforts towards greener national accounts and the generation of indicators in practical applications.

### **Functions of Nature**

It is in line with the present context of Common Heritage of Mankind and modern service economy to consider the studies dealing with functions of Nature as further initiatives helpful to the indicator movement. Costanza's attempt to measure the "eco-system services" performed by the oceans has already been mentioned in the previous section. Here, attention is drawn to the system of some 50 functions of natural environment developed by de Groot<sup>19</sup>. They are grouped in regulation functions for essential

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<sup>18</sup>Hammond et al., 1995.

<sup>19</sup>De Groot, 1992.

ecological processes and life support systems, carrier functions providing space and a substrate or medium for human activities, production functions covering the provision of many resources and information functions offering opportunities for reflection, spiritual enrichment, cognitive development and aesthetic experience.

De Groot has applied this system to the Galapagos National Park (Table 1) and the Dutch Wadden Sea. Ponctual ocean related applications include for regulation functions e.g. waste treatment services provided by wetlands compared to restoring a wetland; nursery function of estuaries and wetlands; primary productivity of some coastal marshes supporting offshore commercial and recreational fishing industries; for carrier functions the value of wildlife-related recreational activities (in Canada they exceed by far the economic value of sport fishing or hunting); for production functions the contribution of wildlife to the US economy, including fisheries, biological diversity, ecological services, recreation; marine medicinal resources.

#### **Cost-benefit analysis, Environmental impact assessment**

Over the past decade, significant progress has been achieved in the development of techniques for the monetary valuation of environmental damage and benefit. In its CBA/EIA-Programme, OECD published a comprehensive survey of existing techniques and data as well as an analysis of some fifty case studies from six member countries<sup>20</sup>.

In the Netherlands for example, the value of water quality was estimated for recreation using the market price of entry to commercial pools for swimming and the total cost method for fishing; and for navigation based on savings in sludge removal. In a series of valuations of user and non-user benefits from Norway, the total cost and the contingent valuation method were applied.

This OECD Programme illustrates a last initiative supporting the indicator movement with new methodologies and applications recalled also later.

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<sup>20</sup>Barde/Pearce (eds.), 1991.

## 2 GAPS IN OCEAN RELATED INDICATORS

### 2.1 In general

Ethical/values/consciousness dimensions of human life, leading to efficiency, vitality and harmony are missing. With respect to Agenda 21 Earthwatch<sup>21</sup> mentions as gaps local population programmes (3C), oceans: establishment of global marine databases and better quality fishery data at the national level (17), consistent georeferencing of data. Also, a specific northern orientation of indicators should be avoided.

Downstreams of indicators, detailed statistical analysis of the ocean relevance of potentially pertinent variables like coastal population or regional income are needed. Concerning marine sector's contributions to GNP, the European Union's Environmental Assessment report<sup>22</sup> considers information for transport, tourism and fishing/aquaculture as weak, and UNEP prepared guidelines, with pilot applications in Gambia and Tanzania.

### 2.2 In specific sectors

*"Many highly aggregated economic and social indicators have been widely adopted, but there are virtually no comparable national environmental indicators to help decision-makers or the public evaluate environmental trends"*<sup>23</sup>. At the level of disaggregated environmental indicators, main data gaps concern marine renewable energy technology; fish stocks and aspects such as trends in fishing techniques, employment levels and productivity; biodiversity. A distinction between the terrestrial and the marine part of phenomena should be aimed at whenever appropriate, and lessons gained with like-minded initiatives (greener national accounts, functions of nature, CBA/EIA) in methodology, data generation and applications should systematically be exploited. Also, inter-dimension linkage

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<sup>21</sup>UNEP/Earthwatch Coordination, 1995.

<sup>22</sup>European Environment Agency, 1996.

<sup>23</sup>Hammond et al., 1995.

indicators are needed, as well as introducing some environmental aspects into the Human Development Index HDI.

The Brent Spar affair 1995 confirmed the general level of ignorance of matters oceanic: The oceans remain a realm of the still largely unknown. Indicators of vulnerability and indicators couched within frameworks of probability should systematically be developed.

Completeness and international acceptance of the methodology sheets for ISDs still need scientific input, efforts of the agencies involved and intercultural cooperation of all governments. In fact, the Work Programme sets out a number of activities including:

- further identification and assessment of linkages between economic, social, institutional and environmental aspects of sustainable development and the development of linkage-based, policy-relevant indicators;
- further work on highly aggregated indicators;
- completion of the national testing phase during which a few selected countries have volunteered to test and evaluate the use of ISDs.

### **3. INCONSISTENCY OF PRESENT INDICATORS WITH COMMON HERITAGE ECONOMICS. An exploration**

This paragraph explores the validity of present and projected ocean related indicators in the light of the new economics of Common Heritage.

#### **3.1 Requirements for consistent indicators**

Repeatedly, Orio Giarini<sup>24</sup> insists on the fact that a more comprehensive theory of wealth and welfare encourages utilization of the indicators; on this road to the new economics of Common Heritage of Mankind requirements relevant to the development of indicators are i.a.:

- i use of indicators is needed, especially with non-marketed goods and services;
- ii wealth and welfare is a combination of natural or physical, biological, man made (cultural tools) and monetarized (capital) phenomena; this holistic views

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<sup>24</sup>Giarini, 1980. Giarini/Börlin, 1988.

- reflects in our social, economic and environmental dimensions;
- iii stock rather than flow magnitudes must be addressed;
  - iv utilization instead of exchange value is relevant;
  - v non-remunerated work, i.e. work not exchanged and work exchanged, but not paid with money
  - vi deducted value, i.e. costs of man-made pollution and over-exploitation of ocean resources, and
  - vii uncertainty inherent in complex systems have to be taken into account.

Stock and flow magnitudes (cf. iii) relate: during a given period, man-made and natural additions and deductions modify the opening into a closing stock; hence methodologies for compiling stock and flow indicators have to be compatible. Moreover, national accounts considerations link (v) and (vi): today's GDP is too low since excluding non-remunerated work, and too high since including environmental costs. As for work unpaid, the value of non-SNA production in industrial countries is at least half of gross domestic product, and it accounts for more than half of private consumption; at world output basis, unvalued household and voluntary community work including the informal sector adds about 70 % to the officially estimated \$23 trillion of global output<sup>25</sup>.

### **3.2 Inadequacy of today's indicators**

Some scenarios will show how ocean related indicators do not fulfill all of these requirements.

#### **Multidimensional programmes**

The requirement (ii) of a holistic approach is being heard by the UNDPDSD core set of indicators for sustainable development and WRI's World resources report: they cover the social, the economic and the environmental dimension. Other sets of indicators concentrate on two dimensions, including SEEA, the UN system for integrated economic and environmental accounting, and the Human Development Index with social and economic indicators. Still other initiatives cover mainly one dimension, such as the UN

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<sup>25</sup>UNDP, 1995.



System of national accounts the economic or UNEP's GEO-1 and the Environmental Data Report the environmental; or they deal in depth with one sector, such as FAO for fishery. This readiness of bringing more disciplines together however does not satisfactorily extend to the marine environment.

### **Wealth from marketed and not-marketable natural resources**

The value of marketed marine natural resources such as fish or off-shore oil results from the estimated quantity and the valuation method. The quantity estimation rests on the choice between stock (e.g. stock of fish; man-made capital) or flow (e.g. fish catch; GNP) and hence concerns requirement (iii). The stock approach is already traditional in some areas, e.g. for IUCN's threatened species reports, and only a new proposal in some others, especially in national accounts with SEEA and in UN-DPCSD's ocean related ISDs.

The valuation on the other hand rests on net prices, i.e. market prices minus external costs, or on user-costs (based on the value added element [true income] and the user-cost element [depletion costs] ). These valuation methods should respect the requirements (iv) utilization instead of exchange value, (v) include non-remunerated work and (vi) exclude deducted values or external costs. Acceptance of these requirements is growing<sup>26</sup>, their application however by no means generalized. It therefore is very important that the CSD core set of SIDS suggests an indicator "Environmentally adjusted net domestic product".

The estimation of the value of non-marketable marine resources like mangroves or wilderness areas asks for a delicate choice of valuation methods developed in the area of CBA/EIA. Relevant are the different motivations people have in valuing natural resources: for an actual use (use value), for preserving the option to use it (option value), for the environment's own sake or intrinsic value of species and ecosystems (existence value). The use value is estimated via surrogate markets like the method of travel costs to recreational sites, the option value via experimental markets with the contingent valuation method,

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<sup>26</sup>Think e.g. of SEEA for external environmental costs and of the Human Development Report for wealth not covered by SNA.

i.e. asking people what they would be willing to pay for the conservation of a certain asset, the existence value with the replacement, avoidance, and maintenance cost approach. Total economic value of natural resources then corresponds to actual use + option + existence value. The recognition of these different forms of contributions to wealth and welfare will help developing the new Common Heritage economics.

A systematic treatment of uncertainty (requirement vii) is still lacking.

Turning rapidly to like-minded initiatives, we are reminded of SEEA in National Accounts and of the functions of nature approach. SEEA Version IV deals with valuation methods, however without giving clear-cut guidelines for the valuation of depletion and degradation. Table 1 about the socio-economic value of the functions of Galapagos National Park on the other hand gives estimates for the types of values mentioned above for the regulation, carrier, production and information functions. This remarkable application is instructive; a detailed analysis however would show where the requirements from Common Heritage economics are not satisfied.

#### **Relative importance of the marine and the terrestrial resources; contributions to GNP/GDP**

Sometimes the wealth of the marine environment is described in relation to the wealth of both the ocean and the terrestrial environment, i.e. to GNP/GDP. This approach infringes requirement (iii) asking for stock instead of flow measures and hence for a marine/terrestrial comparison at the natural capital level instead of the present value added or final demand level. Moreover, sometimes a sector's contribution to GNP/GDP is estimated taking the sector's total output instead of its value added or final demand; this confusion is erroneous, given that (intermediate goods and services) + (value added or final demand, i.e. GNP/GDP) = (total output). Finally, this approach hearts requirements (iv), (v) and (vi) in ways mentioned above. ?

#### **Quantitative and aggregated indicators?**

Requirement (i) asks for indicators; do they have to be quantitative and aggregated? Indicators do not have to be

numbers; the Global environment outlook<sup>27</sup> for instance represents the relative importance given to seven environmental issues (including biodiversity as well as marine and coastal zones) in seven world regions with 7x7 little rectangles in four different colors according to intensity of concern; regional environmental trends are represented in an analogous way, and both summaries are concise and informative. Numerical indicators on the other hand appear in physical terms, in monetary terms or dimensionless. If in physical terms, they are expressed in their own dimension (e.g. 'people' for human and social capital, 'monetary' for economic capital, and 'physical' for environmental capital) or in a common measure like primary productivity (e.g. grams of carbon/m<sup>2</sup>/year) and biomass. If in monetary terms, directly so or, as the World Bank's monetarization of all forms of capital, indirectly after valuation of the physical measure. If dimensionless, e.g. as relative gap between present state and target like in the HDI or the ISDs.

Indicators may have many components, but the final indices must be few in number; otherwise decision-makers and the public will not readily absorb them<sup>28</sup>. This requires aggregation within each of the three dimensions social, economic and environmental applying e.g. natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen. The resulting three partial indices may remain disaggregated (e.g. SIDs, the GEO-1 or the HD Report indicators) or else be aggregated if expressed in common or in dimensionless terms (like e.g. in the case of the HDI and the island vulnerability index).

Hence, indicators exist in physical and in monetary terms, and also aggregated to an index, and this is consistent with requirement (i).

#### 4 ROUND-UP

Much work is going on in the indicator movement in general. Lessons gained with like-minded initiatives

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<sup>27</sup>UNEP, 1997: GEO-1 p. 6-7.

<sup>28</sup>Same opinion as Hammond et al., 1995.

(greener national accounts, functions of nature, CBA/EIA) in methodology, data generation and applications however should more systematically be exploited.

Gaps in ocean related indicators exist in general, specifically for descriptive social, economic and environmental indicators, in coping with uncertainty and concerning indicators for sustainable development.

*of the* Much of what exists has to be thought through in the light of the new economics for Common Heritage.

Concerning the holistic, multidisciplinary approach required, there is a readiness of bringing more disciplines together; however, it does not satisfactorily extend to the marine environment.

As far as valuation methods for marketed marine resources are concerned, acceptance of requirements from the new economics (utilization value, deducted value, non-remunerated work) is growing, their application however by no means generalized. It therefore is very important that the CSD core set of indicators for sustainable development suggests an indicator "Environmentally adjusted net domestic product".

Benefit-cost analysis has revealed different forms of benefits from non-marketable marine resources; the recognition of this contribution will help developing the new Common Heritage economics.

A systematic treatment of uncertainty is still lacking.

The estimation of the contribution of marine resources to GNP/GDP is not yet satisfactory.

Indicators exist in physical and in monetary terms, and also aggregated to an index, and this is consistent with new economics.

*of the* To promote the development of ocean related indicators, consistent efforts should be undertaken at the nevralgic points, including with the task forces for sustainability indicators and for biodiversity indicators, in view of greener national accounts and with the development of a new economics for Common Heritage.

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BOX 1

**UNDP's HUMAN DEVELOPMENT REPORT WITH THE HUMAN DEVELOPMENT INDEX HDI**

UNDP's Human Development Report, annually published since 1990, presents Human Development Indicators and the Human Development Index for each of 175 countries, for some aggregates (regional, developing and industrial countries, North-South, rural-urban) and for the world as a whole; also, efforts towards further subnational disaggregations are ongoing.

The set of over 200 Human Development indicators concerns the human development/deprivation profile, wealth, and economic performance.

The Human Development Index reflects achievements towards a long and healthy life, knowledge, and a decent standard of living. In the first, descriptive step are produced the country's estimates for life expectancy, educational attainment (depending on adult literacy and school enrollment), and GDP per capita (adjusted for the local cost of living and for the diminishing utility of higher levels of income). In the following normative step, minima and maxima identical for every country are stipulated in each of the three components; each country's descriptive indicators are then compared to the corresponding minima; finally, the obtained measures of the way gone are put into relation with the full way, i.e. with the corresponding difference between the two extremes. The resulting dimensionless relative values then indicate how far that country already went in the attainment of certain defined goals: the closer its indicators are to 1, the less is the remaining distance that country has to travel. At last, a simple average combines the three dimensionless indicators into the one single HDI.

The HDI accounts for the social and the economic dimension. Proposals to include material intensity of economies, to adjust existing components of the HDI, or to construct an all-new Green Index to stand alongside the HDI tend to introduce the environmental dimension.

*Source: UNDP, 1997.*

TABLE 1

### SOCIO-ECONOMIC VALUE OF THE FUNCTIONS OF THE GALAPAGOS NATIONAL PARK

(based on maximum sustainable use levels)

(values are expressed qualitatively (++) or in US\$/ha/year) except column 7  
Total surface area of the study area: 1,150,000 ha

Types of values (based on the following explanation, see p. 10)

Environmental Functions	1 Conservation value	2 Existence value	3 + 4 Social values <sup>1</sup>	5 Consumptive use value	6 Productive use value	7 Value to employment ( <sup>1</sup> people)
<b>Regulation Functions</b>	> 63.00	++	++		++	
Watercatchm./erosion prev.	0.30		+		*	
Bio-energy fixation	(1,200.00) <sup>4</sup>	+			*	
Storage/rec. human waste	58.00 <sup>2</sup>		+		*	
Biological control	++	+	+		*	
Nursery f./migration hab.	7 <sup>2</sup>	++	++		*	
Maintenance of biol.div.	4.90	++	++		*	
<b>Carrier Functions</b>	0.50	++	+		> 45.00	> 833
Aquaculture					0.02 <sup>2</sup>	+
Recreation		+	+		45.00	772
Nature protection	0.55	++	++		*	61
<b>Production Functions</b>			++	+	> 8.00	> 160
Food/nutrition			++	+	0.70	156
Genetic resources					+	+
Raw materials for constr.					5.20	4
Biochemicals					++	+
Energy resources					1.50 <sup>1</sup>	-
Ornamental resources					0.40	+
<b>Information Functions</b>	0.50		++	++	> 3.00	> 67
Aesthetic information			+	++	+	
Spiritual information	0.52		++	+	*	
Historic information			+	++	*	
Cultural/artistic insp.			+	+	0.20	-
Educ. & scientific inf.				+	2.70	67
<b>TOTAL ANNUAL RETURN</b>	> 64.00	++	++	++	> 56.00	(1,060)

<sup>1</sup> This function applies to the terrestrial area only (720,000 ha).  
<sup>2</sup> This function applies to the marine area only (430,000 ha of which 4,100 intertidal zone)  
<sup>3</sup> Social values consist of the importance of environmental functions to human health and the option value placed on a safe future.  
<sup>4</sup> If a figure is given between brackets it was not used in calculating the total value because the calculation is too speculative.  
<sup>5</sup> These functions do contribute to economic productivity, either directly or indirectly, but no market or shadow price could be determined due to lack of information and/or shortcomings of the market mechanism.

Source: De Groot, 1992, p. 235.





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Institute

COPY



September 23, 1997

+ Chapter 3

Dr. Max Boerlin  
Chemin des Bosquets 1  
CH-1297 Founex/VD  
Switzerland

Dear Max,

My god, I think I got it altogether now, and here is this new draft.

I had to do quite a bit of editing on your text -- and I may have edited some nonsense into it.

Could you please *read the whole chapter very carefully* and catch any nonsense. And get back to me as soon as possible. I am also giving it to Ian McAllister and to Orio to read. It is one of the two most important chapters in the book, and I need to get it right.

When this is done, I'll send the other half of your check.

Thanks for the material you sent. The Dahl piece is excellent, and really quite in line with what we are trying to do. And I enjoyed the laughing saints. What a good idea to smuggle fireworks into your funeral pyre!

All the best,

Yours as ever,

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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CH-1297 Founex/VD  
Téléphone (022) 776 25 09  
Fax (022) 776 09 37

Founex, October 6, 1997

RECEIVED OCT 08 1997

Prof. E. Mann Borgese  
International Ocean Institute  
1226 LeMarchant Street  
HALIFAX, Nova Scotia,  
Canada, B3H 3P7

Dear Elisabeth,

You surprised me with your new draft: I thought you might pick up here and there from my report, and now I find the whole of it in sect. 2! Thank you for the patience you had with it. Now you receive my remarks from reading the draft, and I am afraid you still need some more patience.

Also, it is surprising what you wrote in your first Ocean report, 6 years before Rio and its pushing the development of indicators.

It would be good if the impact of the report in some way parallels the energy you put into its writing.

All the best, Love,

*Max*

encl.: pages with comments

Sent today by 'speed express', and the letter only to  
fax 001 902 868 2455

*Dra viertel 6 T-online. DE*

Oil & Gas		Oil&Gas	138,137	119,510	
Natural gas	20,960 <sup>1</sup>				
Crude oil	117,170 <sup>2</sup>				
Tourism	423,000	Worldwide Annual arrivals	423,000 <sup>5</sup>	296,100	
Shipping		Opeations Shipbuilding	5,196,000 <sup>6</sup>	247,000	
Defence	180,000	Navies Defence sales			
Insurance		Shipping ins. Disaster ins.	15,322	7,661 <sup>7</sup>	
Fish	42,000	Capture + Culture	42,000 <sup>8</sup>	23,100	25,000,000
		Processing	60,624	12,731	
		Seaweeds	4,000	840	
Submarine telecoms <sup>3</sup> .					
Ports&harbours <sup>4</sup>					
Marine Equipment					

<sup>1</sup>Production data are for 1995; value is based on June 1997 average world price of US\$ 1.60 per 1000 cu ft. Source: American Petroleum Institute and US Department of Energy, Energy Information Administration.

<sup>2</sup>Production data are for 1995. Value is based on June 1997 average world price of US\$ 16.72 per barrel Source: Ibid.

3

<sup>4</sup>According to the Tokyo-based International Association of Ports and Harbours, there exists no system for valuing the economic impact of ports and harbours globally. The following figures may be indicative of orders of magnitude. The American Association of Port Authorities gives the following figures for 1994: 15.9 million jobs; a contribution of US\$ 783.3 billion to GDP; personal incomes of US\$ 515.1 billion; tax revenues at all levels, of US\$ 210 billion; business sales of US\$ 1.623 trillion. 95 percent by weight of all US foreign trade moves through US ports. Rotterdam estimates that the port creates 70,000 jobs directly and 295,000 indirectly. For small countries like the Netherlands, Singapore and formerly Nong Kong, their wealth is directly dependent on their port activities..

The Canadian Ports Corporation gives the following summary of Canada's port system for 1990: Direct jobs: 36,872; induced jobs: 28,876; total jobs: 65,748. Revenue impact: CA\$ 5.7 billion; personal income impact CA\$ 3.2 billion; tax impact: CA\$ 1.2 billion.

According to the Associated British Ports Annual Report (1994) U.K. Port revenues amounted to US\$1,800,000,000; value added (70%) was \$1,276,800,000, and the number of persons employed was above 11,000.

<sup>5</sup>Source: World Tourism Organisation

<sup>6</sup>Source: UNCTAD

7

<sup>8</sup>1995 Total annual marine production: Capture and Aquaculture. Source: FAO

Max Börlin

heritage, therefore, are bound to affect the global economic system at the macro- as well as at the micro-level.

re sea-born trade p. 95:

- value of imports	p.95 5196	instead of: 247 , freight costs
- monetarized marine	6,5 trillion	1,5 trillion
- ocean contr. to global GDP	thirty %	seven %

because:

- the 23 trillion contain value added (247) and not total output (5196) of maritime transport (intermediate + value added = total output); cf. p. 121
- a contrario, most of the activities in primary, secondary and tertiary sectors up to shipping are terrestrial; without them, ships would navigate empty; hence one would be tempted to allocate the whole of 5196/247 to terrestrial

The confusion is current; cf. p. 116 f. The present text does not eliminate the suspicion of 'pro domo bias'.

Also in the "futuristic" & "life support" parts, figures are "sales", "market", hence rather "total output", than value added comparable to GNP/GDP.

$$5,196,000,000 \cdot 2\% = 259,200,000$$

Sea-born Trade <sup>9</sup>	4,758,000,000 tonnes	<del>5,196,000,000,000</del>	Increasing
Ports & Harbours <sup>10</sup>	?	?	Increasing
Tourism <sup>11</sup>	1996 worldwide arrivals 592,000,000	1996 worldwide receipts 423,000,000,000	

H 247. 325.000.0  
 } PTO K  
 } page 96

The total monetarized value of these traditional marine-related goods and services, and excluding the commercial value of ports and harbours, which is another major factor, thus adds up to something of the order of \$~~6.5~~ trillion. This is a conservative estimate. More could be added, for instance, investments in ship construction, including tankers. The Global GDP today is of the order of 23 trillion, 18 of which are contributed by the OECD countries. Roughly, one might say that the contribution of ocean-related goods and services is about ~~thirty~~ percent off the present global GDP: not a negligible proportion! Innovation in the economics of the common

H 1,5  
 | PTO |  
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<sup>9</sup>Source: Awni Behnam, UNCTAD, personal communication

<sup>10</sup>According to the Tokyo-based International Association of Ports and Harbours, there exists no system for valuing the economic impact of ports and harbours globally. The following figures may be indicative of orders of magnitude. The American Association of Port Authorities gives the following figures for 1994: 15.9 million jobs; a contribution of US\$ 783.3 billion to GDP; personal incomes of US\$ 515.1 billion; tax revenues at all levels, of US\$ 210 billion; business sales of US\$ 1.623 trillion. 95 percent by weight of all US foreign trade moves through US ports. Rotterdam estimates that the port creates 70,000 jobs directly and 295,000 indirectly. For small countries like the Netherlands, Singapore and formerly Nong Kong, their wealth is directly dependent on their port activities..

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<sup>11</sup>Source: World Tourism Organisation



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Med Gen 'SD  
~~Helix~~ Sophia Antipolis

Env-med, Resour, Level  
Actn Plan - Funding

Group	US\$'000,000	Activity	Economic impact	vallue added	jobs
Oil & Gas	138,137	Naut. Gas	20,960		
		Crude oil	117,170		
		Total	138,137	119,510	
Tourism	423,000	Worldwide annual arrivals	423,000	296,100	
Defence	180,000	Navies			
		Defense sales			
Insurance		Shipping	15,322	7,661	
		<i>disaster</i>			
Fish	42,000	Capture + Culture	42,000	23,100	25,000,000
		Processing			
		Seaweeds	4,000	840	
<i>Seaborne Trade</i>	<i>5,196</i>	<i>Seaborne Trade</i>	<i>5,196</i>	<i>247</i>	
Submarine telecoms					
Ports and Harbours					
Marine Equipment					
Coastal		Construction	25,920	5,443	
		Crossings	6,480	4,017	
Environmental	16,418	Wasste disposal	14,978	5,391	
		Survey	1,440	720	
Safety & Salvaga	9,888	Salvage	1,440	720	
		lighthouses	3,216	1,769	
		Lifeboats	2,736	684	
		Coastguards	2,496	624	
Education & training	7,392		7,392	4,879	
Marie Research	2,400	Marine Research	2,400	1,584	
Aggregates, placers, etc	756,000	Nonfuel minerals	756,000	196,560	
Fresh water.	11,965	submarine springs	365		
		Desalination	11,600		
Tidal Energy	10,100	annual estimated global potential	10,100		

196,560,000,000

196 billion

7,66

1,459,810,000,000

1,460 trillion

1460 Trillion

14.5 trillion

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kaum möglich!

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X

## I. INTRODUCTION

### A. Purpose, outline

The purpose of this analysis is to help explicitly introducing the subject of indicators into the Report of E. Mann Borgese to the Club of Rome about ocean development. Indicators in fact are needed in a more comprehensive theory of wealth and welfare rooted in the concept of Common Heritage of Mankind of UNCLOS and in the concept of Dowry and Patrimony of Giarini to perform measurements of monetarized and non-monetarized resources. *→ first Report to the CoR*

To this end, this note presents the ongoing initiatives relevant to ocean related indicators, discusses gaps in ocean related indicators and finally explores the validity of the existing and the projected ocean related indicators in the light of the new economics of Common Heritage of Mankind and Dowry and Patrimony. Conclusions round up the analysis.

### B. Issues and role of indicators

Traditionally, indicators are defined as a piece of information which (a) is a part of a specific management process and can be compared with the objectives of that management process; and (b) has been assigned a significance beyond its face value.

General-purpose statistics produce results that have important applications in their own right; one of the applications may be to serve as input for the production of indicators/indices. After data collection and analysis (and distinct from it) comes the development of indicators/indices. Finally, follow their uses.

At the macro level, indicators of the wealth and welfare of a nation are taken into account for instance by international lending institutions in their funding decisions, or for the participation in certain international boards (e.g. the G8), or for joining later the euro-club. At the micro level, any development project should be judged against its effects on the wealth and welfare of the nation or region. In general, it is necessary to ensure that the social, economic and environmental aspects of development are, as far as possible, brought into account at policy decisions. One way of doing this is to use indicators to summarize the findings. And between these two levels, indicators are used in national performance reviews.

In its indicator programme, OECD developed the Pressure-State-Response PSR framework. The PSR framework is based on a concept of causality: human activities exert pressures on the environment and change its quality and the quantity of natural resources (their "state"). Society responds to these changes through environmental, general economic and sectoral policies (the "societal response") (cf. OECD 1994). Today, an example of a response are the arrangements under way for implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities. Meanwhile, it was suggested that the PSR framework could be improved by distinguishing between "Driving forces" and "Pressures", by adding "Impacts", "Effects", and/or "Exposures" to the "State" component, and by changing "Response" to "Activities" (cf. SCOPE). Finally, the working list of indicators of the UN-CSD (UN-CSD 1996) is organized in the so-

called Driving Force-State-Response framework. Driving forces indicate human activities, processes and patterns that have impact on sustainable development, state indicators indicating the state of sustainable development and response indicators indicating policy options and other responses to changes in the state of sustainable development. The indicators are grouped by chapters of Agenda 21 covering social, economic, environmental and institutional aspects of sustainable development (SCOPE p.29). Example for the issue "marine resources", mentioned by World Bank: A. Pressure: contaminants, demand for fish as food; B. State: stock of marine species; C. Response: coverage of international protocols/conventions.

C. Descriptive and normative indicators; indicators for sustainability

At the 1992 UNCED Conference, a redefinition of progress was proposed by introducing the concept of Sustainable Development. Since then, most governments have committed themselves to using the concept of sustainable development as a compass for policy issues. However, "commonly used indicators of sustainable development do not provide adequate indications of sustainability. Indicators of sustainable development need to be developed to provide solid bases for decision making at all levels ..." (Agenda 21). At the international level, the UN-DPCSD is developing a provisional core set of indicators for sustainable development for the CSD (See UN CSD 1996. Also, Van Dieren 1995 p. 152 f., 260 ff.). Thus, a distinction has to be made between descriptive indicators, reflecting actual developments (taking a picture), and normative indicators, reflecting developments towards sustainability (comparing the picture of today's society with an imaginary economically, socially and environmentally sustainable society).

It was recognized that there are fundamental and culturally-bound value judgments inherent to sustainability indicators which naturally would vary from country to country. The danger was also recognized of producing an indicator system which could become a developed country-biased evaluation system which would be inappropriate and unusable for developing countries and countries in economic transition.

D Ocean related wealth and welfare and its dynamics

a. Dimensions, including uncertainty

In his Report to the Club of Rome, Giarini (Giarini, 1980) introduces Dowry and Patrimony as being a combination of natural or physical, biological, man made (cultural) and monetarized (capital) phenomena (cf. Table I-1). Serageldin of World Bank develops a somewhat similar trilogy of social, economic and environmental objectives asking for social, economic and environmental sustainability (cf. Table I-2, from Serageldin 1993). Finally, the UN-CSD distinguishes social, economic, environmental and institutional aspects of sustainable development (UN CSD, 1996). Examples of social issues are education and literacy, work and unemployment, consumption, distribution of income and wealth, and health. Economic aspects include over-all income, wealth, efficiency. Water and biodiversity are relevant parameters of the environmental dimension. And "International legal instruments and

mechanisms" is a chapter dealing with indicators for institutional aspects of sustainable development.

In his comments on the "sustainability trilogy", Serageldin recalls that environmental sustainability seeks to improve human welfare by protecting the source of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans. We are thus reminded that, besides being rooted in philosophy, the preservation of the environment in the long run is a prerequisite for social and economic well-being. In some countries in West Asia e.g. coastal areas and marine environments have come under increasing pressure, and the degradation of the ecosystem has adversely affected both fisheries and tourism, one of the largest sources of foreign exchange revenue for several countries. Similarly, many beaches in the Caribbean now have average tar levels 10 times higher than that estimated to adversely affect the use of beaches by tourists - levels at which beaches become virtually unusable for recreation. Declining fish stocks have resulted in the collapse of the East Coast fisheries, with a devastating impact in eastern Canada. A last example comes from Europe: Contaminants originate from a wide range of land-based sources and activities, as well as from shipping and other offshore activities. Depending on type, the contaminant can harm marine organisms through physical damage or toxicity, turn bathing water and seafood into a human health hazard, and decrease the amenity value of beaches, thereby damaging local tourist industries (Examples from GEO-1, 1997, p. 68, 85, 100, 110).

The development and use of indicators happens in a world of uncertainty: about the statistical data, the causal relations, the models to represent reality. One way to deal with uncertainty, is to develop a vulnerability index and to merge it with the more traditional social, economic and environmental indicators. Examples of a vulnerability index are the vulnerability index for small islands developing States (Briguglio 1995), or the reef vulnerability index of WRI (??).

#### b. Dynamics

In a dynamic context, at the beginning of a period quantity and quality of ocean resources start with an opening stock, during the period man-made and natural flows result in additions and deductions, and at the end of the period the ocean resources exhibit a new closing stock. This relation between stock and net flow explains also why methodologies for compiling stock and flow indicators have to be compatible.

In the economy-environment interface, flows result from losses of natural resources (input from environment to economy) (1) through over-exploitation of renewable resources beyond sustainability and (2) through depletion of non-renewable resources; from pollution (output of the economy to the environment) resulting in environmental expenditures (i.e. actual financial transfers) as (3) anti-pollution expenditures to avoid, reduce or transform pollution and as (4) expenditures following residual pollution for ex post damage elimination or impact compensation; as well as resulting in other environmental costs of residual pollution in the form of (5) non-compensated economic costs (in production, income, assets) and losses of ecological functions of

media, ecosystems, and species and in the form of (6) immaterial welfare losses to individuals and society at large, such as damage to landscape and cultural patrimony or long-run ecological risks (Table I-3).

Also wealth and welfare from oceans have a quantity and a quality aspect. Threatened marine plants and animals or sea level rise are quantitative phenomena, levels of organochlorine compounds in fish flesh and standards of bathing water are qualitative phenomena.

c Ocean elements

In the present ocean related context, the natural environment performing environmental functions is formed by sea water, minerals, flora, fauna and natural areas of the coastal and marine zones, from deep sea beyond exclusive economic zones EEZ up to coastal watersheds under national jurisdiction, as listed in Table I-4.

## II. ONGOING OCEAN RELATED INDICATOR WORK

### A. Preliminaries: Over-view

In 1994, OECD published its core set of environmental indicators. Other institutions had already developed or followed with global and sectoral indicators. Generally, they are descriptive measures reflecting actual developments (taking a picture). At the UN Conference on Environment and Development in Rio in 1992, the International Community committed itself to achieving sustainable development, and indicators of sustainable development are being developed to operationalize the concept. These are normative indicators, reflecting developments towards sustainability.

We call these and similar efforts "(1) Indicator movement"; other initiatives strongly support it. Thus, to ensure that the economic and environmental aspects of development are, as far as possible, brought into account at policy decisions, greener national accounts are being developed in a variety of shape and form. These "(2) greener national accounts" deserve attention as consumers and producers of indicators.

In the present context of Common Heritage of Mankind and modern service economy, one will ask for the environmental functions performed by the physical elements of the environment. This central question arises in greener national accounts as well as in other contexts including in integrated management of coastal and marine areas, in investment planning, in environmental policy. We shall deal with "(3) functions of nature" as being one element of the system of positive and negative interactions between man and the environment identifying regulation, carrier, production and information functions.

Finally, at the micro level, regulative and executive requirements for benefit analysis have promoted the institutional use of cost-benefit-analysis and environmental impact assessment (CBA/EIA) asking i.a. that development projects should be judged against their effects on the wealth and welfare of the community. This incentive brought about a development of methodologies and applications usefull to the indicator movement and for greening national accounts, to be dealt with as "(4) CBA/EIA".

These four mainstreams of action will now be considered more in detail. They are recalled in Table II-0 about the main programmes and activities.

B.  
action

← B. Four mainstreams of

- (1) The indicator movement: Major programmes and activities

In the indicator movement, the major programmes and activities as listed in Table II-0 above, result in single indicators, or in a system of core indicators, or, if merged, in an index. Their tabular standard presentation lists in the vertical the ocean elements/functions introduced earlier and in the horizontal the indicator type. The latter is identified by dychotomies discussed

earlier, namely descriptive or normative/sustainable, quantity or quality of ocean resources, their stock or man-made vs natural and positive vs negative flow, and the uncertainty of the information. Moreover, for the indicator as a whole is indicated the geographic coverage (worldwide or regional) and the type of the result (indicator or index): overview by ocean element and by indicator in standard presentation Table II-1 incl. UNDP's HDR with HDI Box II-1

... .

(2) Greener national accounts

The relation between the efforts for greener national accounts and the indicator movement are twofold: Indicators can be an input into greener accounts, and greener accounts generate indicators; we are interested in this latter relation.

i Drawbacks of the present national accounts and solutions of interest to the indicator movement

With respect to the environment, national accounts aggregates such as Gross Domestic Product GDP have three major drawbacks:

- \*a the neglect of the depletion of natural resources
- \*b the inadequate treatment of "defensive expenditure"
- \*c the failure to account for the degradation of environmental quality and its effects on human health and welfare.

Accordingly, three approaches are devised for solving these drawbacks as recalled in Table II-2a.



\*a) The adjustment of national accounts to arrive at a 'green' national product has for the time being been rejected. The Club of Rome and WWF-International on the other hand are strongly in favour of it. A conference "Taking Nature into Account" was held from May 31 to June 1 1995 in the European Parliament; it was jointly organized by the European Commission, the European Parliament, WWF-International and the Club of Rome. On this occasion, WWF-International and the Club of Rome presented an Action Plan whose Preface reads: "Macroeconomic indicators such as Gross Domestic Product (GDP) and National Income calculated under the United Nations System of National Accounts (SNA) do not accurately reflect economic activity's impact on Nature, despite the 1993 revision of the SNA. . . . This Plan calls for global actions to develop and implement a new, Nature-adjusted SNA by incorporating, to the extent possible, the value of Nature's resources and services as key economic factors into the core accounts and indicators of the SNA" (see Sheng, 1995; van Dieren (ed.), 1995). Moreover, efforts towards such an over-all aggregated figure are pursued with the elaboration of ISEW, the Index for sustainable economic welfare ??? presented later

\*b) three principal functions of satellite accounts:

- . disaggregation of SNA with regard to environmental aspects;
- valuation of stocks of natural resources and of nonmarket services of the environment;
- . valuation of environmental damage due to economic activity.

A very broad, systematic approach has been developed by UNSTAT in the form of a Satellite system for integrated Environmental and Economic

Accounting (SEEA). The SEEA Handbook (UN 1994?) offers a menu of five alternative versions, with Version IV being concerned with satellite accounts.

Several methods of valuation of environmental resources have been developed and applied; they will be discussed in Part IV below. The Statistical Office of the European Communities, EUROSTAT, has launched the European System for the Collection of Economic Information on the Environment (SERIEE, from the French Systeme integre de recolte d'information economique et environnementale)

\*c) Natural resource and environment accounts concern the two main categories:

- . environmental resource accounts for natural resources whose value is typically defined through multiple-use: as an input to economic activities, as a key factor in ecosystems and as a source of non-market utility such as recreation. Ocean related ex:wild life resource aac (F, Esp). Quantity: measuring pollution flows from economic activities to n.r.;

- . material resource accounts for natural resources whose value is typically defined through their single-use as an input to economic activities, like mineral and fossil fuel resources (e.g. energy accounts).

SEEA Version III offers a methodology.

ii The greening of national accounts and ocean related indicators

Green accounting represents a linkage between economy and environment; a necessary precondition for indicators which make environmental-economic interlinkages at a macroscopic level is an underlying ("green") accounting system. Indicators derived from green accounting represent linkages between economy and environment. Flow relations from natural resource accounts form the input needed to calculate indicators of sustainable use of natural resource quantities. These ideas were presented at a SCOPE Scientific workshop on indicators of sustainable development (see SCOPE 1995), as well as at an OECD Seminar on environmental accounting for decision-making (see OECD 1994a and Hamilton/OECD 1994b).

It hence is not surprising that countries including Finland, France, the Netherlands and the United Kingdom are integrating, in one way or another, the efforts towards greener national accounts and the generation of indicators in practical applications. Also, other ocean related results from efforts towards greener accounts exist, including those presented in Table II-2b.

Source: Antille/Boerlin, 1997; de Groot, 1992; Lutz/Munasinghe, 1991; OECD and OECD/Hamilton 1994; Sheng, 1995; Van Dieren (ed.), 1995

(3) Functions of nature  
i The concept

In the present context of Common Heritage of Mankind and modern service economy, one will ask for the environmental functions performed by the physical elements of the environment and rooted in the "Weltanschauungs-dimensions" recalled above. Similarly, de Groot (De Groot, 1992) looks at environmental functions as being one element of the following system of positive and negative interactions between man and the environment:

- . natural processes and components
- . environmental goods and services, environmental hazards and risks
- . human needs and activities
- . environmental impact and environmental management;

and identifies around 50 functions of natural environment

grouped in regulation, carrier, production and information functions, where

- . regulation functions relate to the capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life support systems which, in turn, contribute to the maintenance of a healthy environment by providing clean air, water and soil;
- . carrier functions relate to ecosystems' providing space and a suitable substrate or medium for many human activities such as habitation, cultivation and recreation;
- . production functions cover the provision of many resources, ranging from food and raw materials for industrial use to energy resources and genetic material; and
- . information functions result from the natural ecosystems' contribution to the maintenance of human mental health by providing opportunities for reflection, spiritual enrichment, cognitive development and aesthetic experience.

The set of some 50 functions of natural environment is presented in Table II-3 and has been applied by de Groot to the Dutch Wadden Sea and to the Galapagos National Park.

ii Ocean related applications

Table II-3b

in the present ocean related context, the natural environment performing environmental functions is formed by sea water, minerals flora, fauna and natural areas of the coastal and marine zones, from deep sea beyond exclusive economic zones EEZ up to coastal watersheds

(4) Cost-benefit analysis and environmental impact assessment CBA/EIA Table II-4

(5) Conclusions

III. OCEAN RELATED GAPS: Requirements for minimum coverage

- A. By type of indicator (isolated vs in a system)
- B. By element of ocean resources
- C. Spacewise: national/regional/planetary

III. OCEAN RELATED GAPS

A. Requirements for minimum coverage

- a. By types of indicator (isolated vs in a system)
- b. Spacewise

C

1. national/regional/planetary

deep

2. biome: coastal zone, continental margins, sea-bed of the open ocean

c. By element of ocean resources and functions

d. By **xyz** quantity and quality (empty cells of II.B.b. above)

#### IV. INCONSISTENCY OF PRESENT INDICATORS WITH D&P/CHM ECONOMICS; an exploration

This paragraph explores the validity of the present and the projected ocean related indicators in the light of the new economics of Common Heritage of Mankind and Dowry and Patrimony.

##### A. Requirements for adjustment

Repeatedly, Orio Giarini insists on the fact that a more comprehensive theory of wealth and welfare of the kind proposed elsewhere in this Report, tries to provide a basis for a more consistent approach and actually encourages utilization of the indicators. The needed steps are:

- (a) define first a new theory of value (utilization value)
- (b) devise then the most appropriate methods and possibilities of measurement and the judgement (selection of indicators)
- (c) open in this way the possibility of defining new operational economic policies (for instance in the fiscal and monetary field as well as in the preservation and development of non-monetarized resources).

On this road to the new economics of Common Heritage of Mankind and Dowry and Patrimony, Giarini has already identified several requirements; relevant to the development of indicators are i.a.:

- i wealth and welfare is a combination of natural or physical, biological, man made (cultural tools) and monetarized (capital) phenomena (cf. Table I-1)
- ii uncertainty is inherent in complex systems, i.e. parameter uncertainty, model structure uncertainty, and uncertainty due to variable data quality
- iii utilization instead of exchange value is relevant
- iv non-remunerated work has to be included
- v deducted value, i.e. external costs of man-made pollution and over-exploitation of ocean resources has to be taken into account
- vi address stock rather than flow magnitudes must be addressed.

How far do present-day ocean related indicators fulfill these requirements? The next paragraph offers some pieces of a reply.

B. Screening of ocean related indicators in the light of the requirements for adjustment

a. *the present situation*

For each single component of the mainstream (1) to (4), we compare the present practice with the CHM requirements. Before doing so however, we take a look at the distinction between indicator and index and at how it is dealt with (Table IV-0).

In order to add indicators of various aspects of the environment together, we need some sort of weighting. There are three ways of doing this: natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen. At the level of the three overall social, economic and environmental indicators, they can be expressed in their own units (e.g. 'people' for human and social capital, 'monetary' for economic capital, and 'physical' for environmental capital) and not aggregated at all; or they can remain expressed in a common unit at the outset, in which case aggregation is not needed (e.g. the World Bank's monetarization of all forms of capital; or UNDP's Human Development Index HDI, where valuation of the partial index is obtained through cross-section-wise comparison with an average over the whole set of countries); or, again, assigning weights by experts or by citizen groups. HDI, other ex.??

In a measurement situation, one possibility is to select from the multitude of variables a representative single-parameter indicator. At the other extreme, single-valued indices are developed combining various variables into one; the Human Development Index devised by UNDP e.g. incorporates both social and economic factors. Between indices and single-parameter indicators are sets of indicators; they consist of a limited number of harmonized single-parameter indicators, together representing a larger issue.

In order to add indicators of various aspects of the environment together, we need some sort of weighting. There are three ways of doing this: natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen. At the level of the three overall social, economic and environmental indicators, they can be expressed in their own units (e.g. 'people' for human and social capital, 'monetary' for economic capital, and 'physical' for environmental capital) and not aggregated at all; or they can remain expressed in a common unit at the outset, in which case aggregation is not needed (e.g. the World Bank's monetarization of all forms of capital; or UNDP's Human Development Index HDI, where valuation of the partial index is obtained through cross-section-wise comparison with an average over the whole set of countries); or, again, assigning weights by experts or by citizen groups.

This spectrum of solutions will be taken into account in the following analysis where needed.

(1) Indicator movement

Table IV-1

(2) Greener national accounts

(3) *Functions of Nature*

(4) *CBA/EIA*

b. Comparing the present situation with the requirements of D&P/CHM economics (B.a. : A.)

(1) Indicator mouvement

(2) Greener national accounts

(3) Functions of Nature

(4) CBA/EIA

(5) Summing up

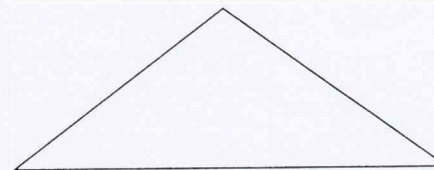
C. Non-numerical Essay: the Galapagos National Park study revisited

V. CONCLUSIONS AND FOLLOW-UP

*B. P. H. G. J. 1987*

# Table I-2

- Growth
- Equity
- Efficiency



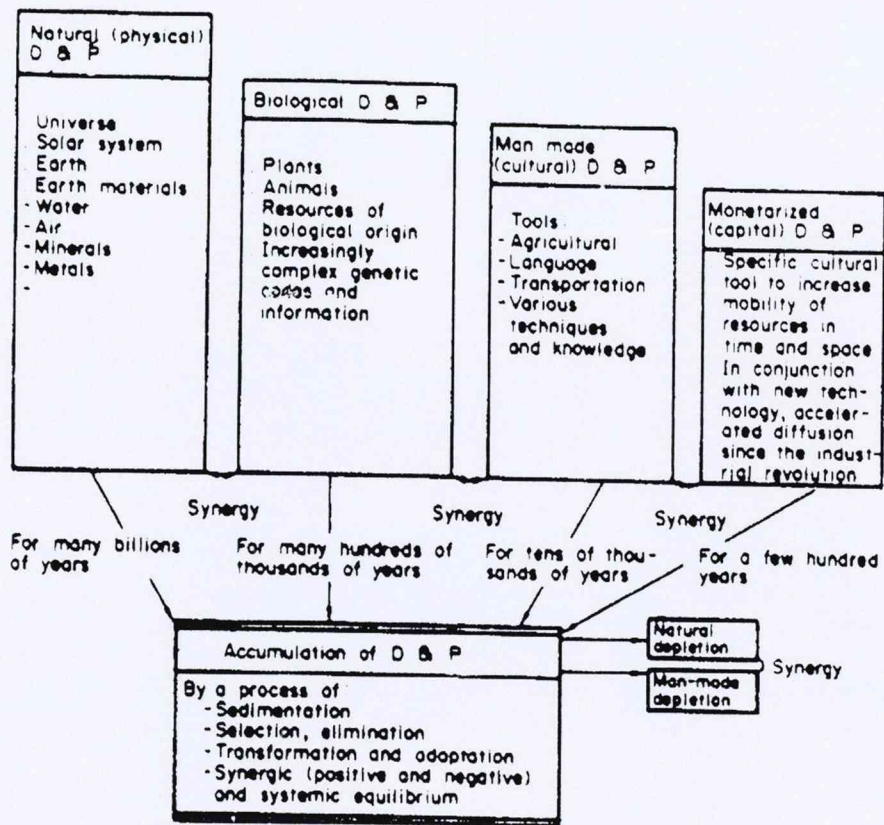
Social objectives:

- Empowerment
- Participation
- Social mobility
- Social cohesion
- Cultural identity
- Institutional development

Ecological objectives:

- Ecosystem integrity
- Carrying capacity
- Biodiversity
- Global issues

# Table I-1



## Social Sustainability ("SS")

ES needs SS—the social scaffolding of organizations that empower self-control and self-policing in peoples' management of natural resources (see Cernea, 1993). Resources should be used in ways which increase equity and social justice, while reducing social disruptions. SS will emphasize quality improvement over quantitative growth, and cradle-to-grave pricing to cover full costs, especially social. SS will be achieved only by strong and systematic community participation or civil society (Putnam, 1993 a, b). Social cohesion, cultural identity, institutions, love, commonly accepted standards of honesty, laws, discipline, etc., constitute the part of social capital that is least subject to measurement, but probably most important for SS. This "moral capital," as some have called it, requires maintenance and replenishment by the religious and cultural life of the community. Without this care it will depreciate as surely as will physical capital.

## Economic Sustainability ("ES")

The widely accepted definition of economic sustainability is "maintenance of capital," or keeping capital intact, and has been used by accountants since the Middle Ages to enable merchant traders to know how much of their sales receipts they and their families could consume. Thus the modern definition of income (Hicks, 1946) is already sustainable. But of the four forms of capital (human-made, natural, social, and human) economists have scarcely at all been concerned with natural capital (e.g., intact forests, healthy air) because until relatively recently it had not been scarce. Also, economists prefer to value things in money terms, so we are having major problems valuing natural capital, intangible, intergenerational, and especially common access resources, such as air etc. In addition, environmental costs used to be "externalized," but are now starting to be internalized through sound environmental policies and valuation techniques. Because people and irreversibles are at stake, economics has to use anticipation and the precautionary principle routinely, and should err on the side of caution in the face of uncertainty and risk. Human capital (investments in education, health, and nutrition of individuals) is now accepted in the economic lifestyle (WDR, 1990, 1991, 1995), but social capital, as used in SS, is not adequately addressed.

## Environmental Sustainability ("ES")

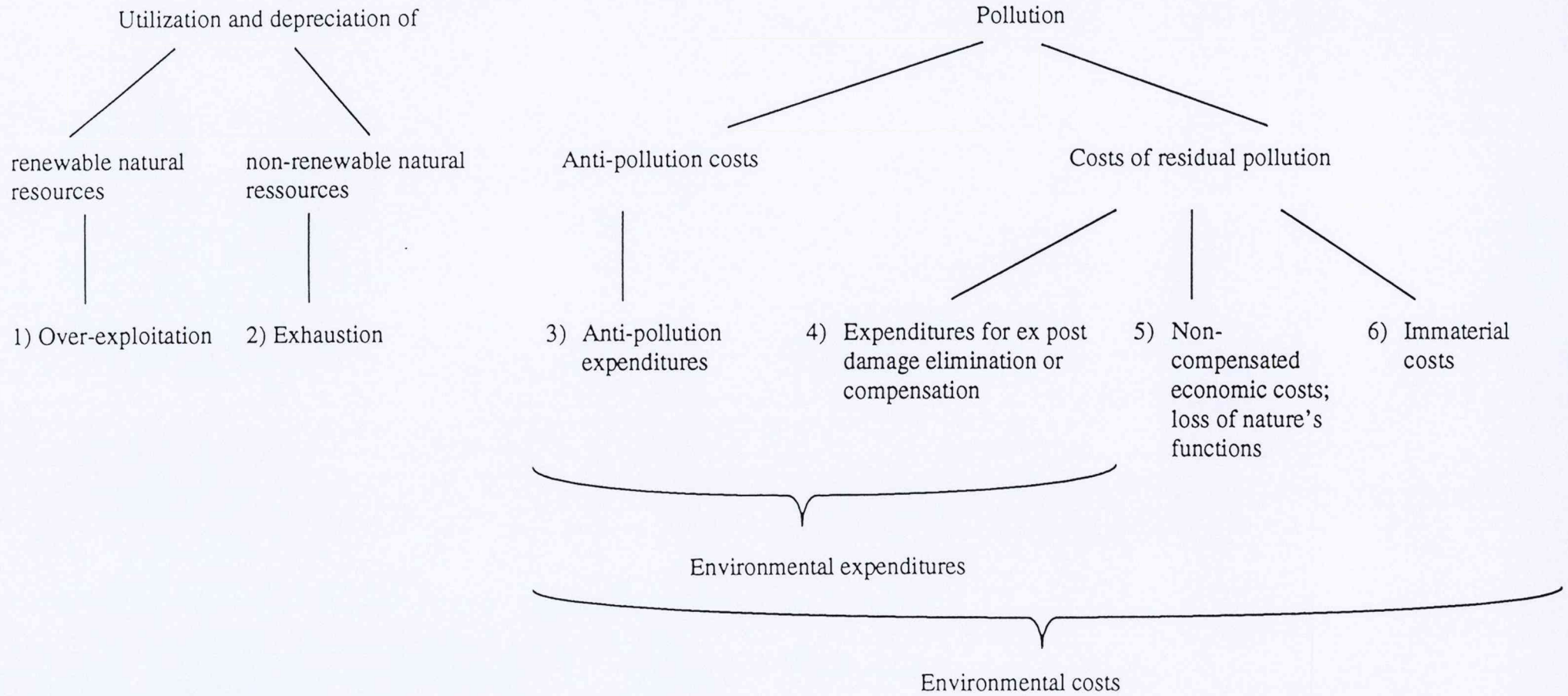
Although environmental sustainability is needed by humans and originated because of social concerns, ES itself seeks to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans. Humanity must learn to live within the limitations of the physical environment, both as a provider of inputs ("sources") and as a "sink" for wastes (Serageldin, 1993a). This translates into holding waste emissions within the assimilative capacity of the environment without impairing it and by keeping harvest rates of renewables within regeneration rates. Quasi-ES can be approached for non-renewables by holding depletion rates equal to the rate at which renewable substitutes can be created (El Serafy, 1991).

Figure 7.1 Comparison of social, economic, and environmental sustainability (from: Serageldin 1993a, b)

Van Dieren (ed.) 264

# Table I-3

Table 1. Economy-Environment Interface: Environment related costs



(Amelle - Robin 1997)



Table I-4 Ocean elements (EEZ and beyond)

1. Sea water
2. Off-shore hydrocarbons and nonfuel minerals (reserves and operative deposits)
3. Built infrastructure (shipping, ports & harbours, touristic)
4. Natural areas
  - 4.1. smalll islands
  - 4.2. coasts, estuaries
  - 4.3. coral reefs
  - 4.4. wetlands
  - 4.5. parks, reserves
5. Flora (renewable)
  - 5.1.
  - 5.2. mangroves
  - 5.3. seagrass, algae
  - 5.4. aquaculture
6. Fauna (renewable)
  - 6.1.
  - 6.2 mammals
  - 6.3 reptiles
  - 6.4 fish
  - 6.5 invertebrates
  - 6.6 aquaculture
7. Biodiversity

Table II-0

Tentative!

Programmes, Reports	So- cial	Econ- omic	Envi- ronm.	Uncer- tainty	Ins- tit.	Aggregatio n
<u>(1) Indicator mouv.</u>						
1 CSD	xx	xx	xx		xx	(via sust. target)
2 WRI: WRR	xx	xx	xx	vulne- rabil.		
3 UNDP: HDI, HDR	xx	xx				interstate
4 IBRD: WDR	xx	xx	xx			monetariz.
5 UN: Soc.Ind.	xx					
11 UNEP: EnvDataRep	xx	xx	xx			
18 EU-EEA: Europe's envir. - Dobris Ass.	(x)	xx	xx		xx	
19 OECD: Env. ind.		xx	xx			
19b Briguglio: Small island st. SIDS		xx		vulne- rabil.		interstate ; weighting
23 UNEP: Island directory			xx	vulne- rabil.		
24 UNEP, BIONET, IUCN, GESAMP:Bio- diversity						
27 FAO, OECD:Fishery						
<u>(2) Greener accounts</u>						
6a UN SNA/SEEA		xx	xx			monetariz.
6b EUROSTAT SERIEE, Greening		xx	xx			monetariz.
6c OECD Natural resource accounts		xx	xx			monetariz.

Programmes, Reports	So- cial	Econ- omic	Envi- ronm.	Uncer- tainty	Ins- tit.	Aggregatio n
<u>(3) Envir. functions</u>						
27a Functions of Nature		xx	xx			monetariz.
27b Hueting - Dutch Stat. Office						
<u>(4) CBA/EIA</u>						
19a OECD CBA/EIA Programme		xx	xx			monetariz.

Table II-0, (1) Indicator mouvement, end (perhaps needed)

Programmes, Reports	Social	Econ.	Envir.	Inst.	Link.
10 UN: Earthwatch					
12 UNEP: GEO-1					
14 GESAMP: State of MarEnvRep					
15 IOC: GOOS					
21 ITO: Tourism					
22 IMO, OECD: Mar. Transport					
29 UNEP/FAO:Mar.mam.					
31 UNESCO:B.sph.Res.					
33 IUCN, CMC: Nat. parks,prot.areas					
34 Council E.: Bio- genetic reserves					

BOX II-1

UNDP'S HUMAN DEVELOPMENT REPORT HDR WITH THE HUMAN DEVELOPMENT INDEX  
HDI

UNDP's Human Development Report, published first in 1990 and then annually, presents a number of Human Development Indicators and the Human Development Index. The indicators concern the human development/deprivation profile, wealth, and economic performance, whereas the Human Development Index reflects achievements in three dimensions of basic human capabilities: a long and healthy life, knowledge, and a decent standard of living. Both appear for the whole world, for all developing and all industrial countries together, for each of 10 regions (8 developing regions, Eastern Europe and CIS, all industrial countries together), for each of 174 countries, and finally within countries for rural and urban population; efforts to develop methods of disaggregation according to subnational regions are ongoing (HDR 1996, p. 31 f.).

In the 1996 Report, the Human Development Indicators possibly relevant to oceans are (a) total and per capita GDP and GNP (for developing and industrialized countries respectively Table 24, 25, 26 and Table 45, 46), (b) employment, unemployment (Table 16, Table 32, 33), and (c) income distribution (Table 17, Table 36).

The Human Development Index has three key components: (a) life expectancy at birth; (b) knowledge or educational attainment, comprising an adult literacy ratio with two third weight and a schooling enrolment ratio with one third weight; and (c) income represented by an adjusted value of real GDP per capita.

The HDI is constructed by (1) defining a country's measure of relative achievement in each of the three basic variables and (2) taking a simple average of the three indicators. In (1), the straightforward descriptive step ends with life expectancy in years, the two education ratios in %, and real GDP per capita accounting for the local cost of living and hence in PPP\$. Moreover, real income is adjusted for the diminishing utility of higher levels of income to human development, the premise being that people do not need an infinite income for a decent standard of living; so the HDI defines a threshold for income regarded as adequate for a reasonable standard of living, and proposes an "adjusted real GDP per capita", again expressed in PPP\$. Still in (1), follows the normative valuation step, in that minimum and maximum values are established for each of the three components of the HDI. The HDI value for each country then indicates how far that country has to go to attain certain defined goals. Also, this procedure reduces all three basic partial indicators to a common rod by measuring achievement in each indicator as the relative distance from a desired goal: the closer a country's HDI is to 1, the less the remaining distance that country has to travel.

END OF BOX II-1

In (2), the three partial indicators are combined into the one single HDI. Since they are already expressed in a common measure, straightforward aggregation is possible, and a simple average of the three partial indices is taken.

The HDI accounts for the social and the economic dimension. Proposals to include material intensity of economies, to adjust existing components of the HDI, or to construct an all-new Green Index to stand alongside the HDI tend to introduce the environmental dimension. In the later respect, the Green HDI by Meghnad Desai and being published by the New Economics Foundation is a measure of the intensity of environmental exploitation, taking a limited number of readily available components (e.g. energy consumption, water, CO2 emissions). Calculated according to several methods, the basic finding is that the green index moves some countries which rank high on HDI down toward the bottom of the list and promotes some countries ranked low on HDI (SCOPE p. 42).

Table II-2a

Approaches	Environmental categories to be taken into account	Characteristics of accounting
*a adjustment of natural accounts	valuation of natural capital stock and env. expenditure, damages and services	modification of SNA framework and boundaries
*b satellite accounts	as above; corresponding phys. flows and stocks	complements SNA without modifying it; general coherence with SNA
*c natural resource and env. accounts	phys. flows and stocks of nat. res.; phys. and mon. flows from exploitation of nat. res.	independent from and complementary to SNA

Table II-2b

Conceptual solutions	Ocean relevant applications include
*a Neglect of depletion of	natural resources
<ul style="list-style-type: none"> <li>. World Bank's Genuine Saving</li> <li>. eco-domestic product EDP</li> <li>. net national welfare NNW: France, Japan</li> <li>. SERIEE ???</li> </ul>	<ul style="list-style-type: none"> <li>. off-shore minerals, oil; coast; recreational value of marine res.;</li> <li>wetlands, marine wilderness areas;</li> <li>mangroves, fishery, other flora/fauna; national patrimony</li> <li>. Costa Rica, Indonesia, Malaysia, Mexico, Nigeria, Papua N.G., Philippines;</li> <li>. Italy, Norway, Portugal, Spain, United Kingdom, USA</li> </ul>
*b Inadequate treatment of	"defensive" expenditures
<ul style="list-style-type: none"> <li>. ISEW: Denmark, France, Germany, Netherlands, UK, USA</li> <li>. SEEA Versions I, II</li> <li>. SERIEE</li> </ul>	<ul style="list-style-type: none"> <li>. Mexico: environmental protection services</li> <li>. Germany: defensive expenditures</li> </ul>
*c Failure to account for quality	the degradation of environmental
<ul style="list-style-type: none"> <li>. GIOM: UN-DESIPA's global i-o model which integrates poll. and poll. abatement activities and ren. and non-ren. resource use with prod./cons. patterns for 16 world regions</li> <li>. SEEA Version IV</li> </ul>	<ul style="list-style-type: none"> <li>. Mexico: pollution, degradation</li> <li>. Yellow Sea off Korea: oil and hazardous substances spills</li> <li>. Chesapeake Bay: herbicide pollutio</li> </ul>
<p>Genuine saving</p> <p>EDP</p> <p>ISEW</p>	<p>Output minus net depletion of natural resources.</p> <p>Environmentally adjusted measure of net domestic product NDP.</p> <p>Index of Sustainable Economic Welfare; considers i.a. costs of pollution and non-renewable natural resource depletion</p>

## Table II - 3a

### Functions of natural environment

#### Regulation functions

1. Protection against harmful cosmic influences
2. Regulation of the local and global energy balance
3. Regulation of the chemical composition of the atmosphere
4. Regulation of the chemical composition of the oceans
5. Regulation of the local and global climate (incl. the hydrological cycle)
6. Regulation of runoff and flood-prevention (watershed protection)
7. Watercatchment and groundwater-recharge
8. Prevention of soil erosion and sediment control
9. Formation of topsoil and maintenance of soil-fertility
10. Fixation of solar energy and biomass production
11. Storage and recycling of organic matter
12. Storage and recycling of nutrients
13. Storage and recycling of human waste
14. Regulation of biological control mechanisms
15. Maintenance of migration and nursery habitats
16. Maintenance of biological (and genetic) diversity

#### Carrier functions

*providing space and a suitable substrate for*

1. Human habitation and (indigenous) settlements
2. Cultivation (crop growing, animal husbandry, aquaculture)
3. Energy conversion
4. Recreation and tourism
5. Nature protection

#### Production functions

1. Oxygen
2. Water (for drinking, irrigation, industry, etc.)
3. Food and nutritious drinks
4. Genetic resources
5. Medicinal resources
6. Raw materials for clothing and household fabrics
7. Raw materials for building, construction and industrial use
8. Biochemicals (other than fuel and medicins)
9. Fuel and energy
10. Fodder and fertilizer
11. Ornamental resources

#### Information functions

1. Aesthetic information
2. Spiritual and religious information
3. Historic information (heritage value)
4. Cultural and artistic inspiration
5. Scientific and educational information

(De Groot 1992)



Table II-36

Examples of numerical applications of ocean-relevant functions of nature

All functions

Functions and values of the Dutch Wadden Sea (a tidal wetland) & Functions and values of the Galapagos National Park; for the latter see Part V below.

Regulation functions

. Waste treatment services provided by wetlands compared to restoring a wetland. Recycling of phosphorus by a wetland versus by an artificial

purification plant (USA).

. Nursery function of estuaries and wetlands, usually not explicitly included in the market price of the harvested species, such as fish and shellfish, but shadow prices can be calculated: Primary productivity of some coastal marshes, which supports offshore commercial and recreational fishing industries (USA). Revenues lost from commercial and sport fisheries due to the destruction of coastal estuaries (USA). Dutch Wadden Sea, commercial North Sea catch of plaice, sole, shrimp, dab and herring.

Carrier functions; value of natural ecosystems:

.to indigenous cultures: Quite difficult; possibly as "Gross Tribal Product".

.to (sustainable) cultivation: Wildlife farming, exotic fish raised on Florida fish farms. Harvest from aquaculture.

.to recreation and tourism: The value of wildlife-related recreational activities exceeds by far the economic value of sport fishing or hunting (Canada).

Production functions

.'wild' food and nutritious drinks: wild plants and animals, including fish, game mammals, algae/plankton (USA). Contribution of wildlife to the US economy, including fisheries, biological diversity, ecological services, recreation (from the full-scale numerical exercise for USA by Prescott-Allen and Prescott-Allen, 1986). Sea fishing.

.natural medicinal resources: Pharmaceuticals and bioactives from marine sources (Judson, 1996).

Information functions

- .value of aesthetic information
- .value of spiritual and religious information
- .value of historic information (heritage value)
- .value of cultural and artistic inspiration
- .value of educational and scientific information,

Table II-4

*Very incomplete*

Country	Goods, services	Method
Netherlands	water quality: * recreation . swimming: . fishing: * navigation: * water supply: * agriculture:	market price of entry to commercial pools TCM & market p. savings in sludge removal less costs productivity gains
Norway	freshw. fish, user/non-user benefits:	5x TC, 4x CVM

Table IV-0

	(1) Indicator mouvement	(2) Greener accounts	(3) Functionso f nature	(4) CBA EIA
a <u>Single aspect</u>				
a1 social	HDI			
a2 economic	GNP	SNA		
a3 environmental	UN-ECE, OECD CORE, IUCN, WRI	SEEA	XXX	XXX
b <u>Valuation</u>				
b1 social into mon.	IBRD's WDR			
b2 envir. into mon.	FAO fishery	SEEA	xxx	xxx
c <u>Translation of more indicators into one index</u>				
c1 aggregation of				
c1.1 monetary terms	IBRD's WDR	satellites	xxx	xxx
c1.2 phys. terms	eg biomes	satellites		
c2 multiaspect amalgamation				
c2.1 relat. dist. from target	CSD sustain- ability; HDI countries' min/max			
c2.2 weighting	small islands vulner. index			xx
d <u>linkage</u>	if systematic 'core'	XXX		

Table IV-2

i complete

Country	Renewable nonrenew. resources	Goods services	Method
*a Neglect of depletion of natural resources Stock			
SEEA			b, c, d
??			
costa rica	r	fisheries	market values
indonesia	nonr	petrol	net-price (mp -
extr.costs)			
malaysia	nonr	marketable	net-price
cacln	nononr	minerals	net-price
italy			
canada	?	natural R	?
france	r	f&f	hamilt: in phys. terms
			??
	non		il
		nonr	oil
			mexico
			user-cost (El Serafy)
netherlands			cf norway
	nonr	metals	in phys. terms
norway	nonr	petroleum, minoil,	minerals in phys.
terms			
"	r	fish	in physical terms
Papua N.G.	nonr	mineral R	net-price, user-cost
portugal	r	fish	?
philippines	r	coastal fish.	?
Spain			?
oecd	?	marine R, f&f	?
UK	nonr	oil	user-cost
USA	nonr	petroleum, metals	combination of meth.
"	r	later	
	nonr	?	?
*b Inadequate treatment of "defensive" expenditures LATER			
*c Failure to account for the degradation of environmental quality LATER			

Table Bve

Table IV-all

Magnitudes	(1) Indicator mouvement	(2) Greener SEEA	accounts exempl.	(3) Functions of Nature	(4) CBA, EIA
STOCK					
FLOW:					
1) over- exploitation					
2) exhaustion					
3) preventive anti-poll. expenditure					
4) damage elimination/ compensation					
5) loss of nature's functions					
6) immaterial costs					

Tidal Energy		112,128 Gwh/yr <sup>8</sup>	10,100,000,000 <sup>9</sup>	increasing
Fresh water		2 million		
Submarine		cu.m/day <sup>10</sup>	365,000,000	
springs	20.3 million		11,600,000,000	
Desalination	cu.m/day		Total:	
			11,965,000,000 <sup>11</sup>	

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<sup>8</sup>64 Gw capacity x 8,760 h/yr x 20% efficiency

<sup>9</sup> 1Gw/h = \$90,000, at 1997 price.. The site at La Rance, France, is a 240 Mw facility. The Annapolis Royal 20 Mw facility generates 2.5 Gwh/month (30 Gwh/yr) with a revenue of CA\$2.7 million.

<sup>10</sup> 1997 Estimated Global Potential

<sup>11</sup>Assumes average cost of \$0,50/cu.m. Figures provided by Dr. James D. Birkett, West Neck Strategies.

Max Börlin  
 Founex, Switzerland  
 September 1997

## **OCEAN RELATED INDICATORS**

*A contribution to ch. 3 section 2 of*

OCEAN PERSPECTIVES

A REPORT TO THE CoR

Prepared for: Prof. Elisabeth Mann Borgese  
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- *2 Gaps in ocean related indicators: in general, in specific sectors*
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## ABBREVIATIONS AND ACRONYMS

CBA/EIA	Cost-Benefit Analysis / Environmental Impact Assessment
EDP	Environmentally adjusted Domestic Product
FAO	Food and Agriculture Organization of the UN
GDP/GNP	Gross domestic/national product
GEO-1	UNEP's First Global Environment Outlook
GESAMP	IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Group of Experts on Scientific Aspects of Marine Pollution
HDI	UNDP's Human Development Index
ISD	Indicator for Sustainable Development
ISEW	Index of Sustainable Economic Welfare
IUCN	The World Conservation Union
OECD	Organization for Economic Cooperation and Development
SCOPE	Scientific Committee on Problems of the Environment
SEEA	UN Satellite System for Integrated Economic and Environmental Accounting
SIDS	Small Island Developing States
SNA	UN System of National Accounts
UN-CSD	Commission for Sustainable Development
UNDP	UN Development Programme
UN-DPCSD	Department of Policy Coordination and Sustainable Development
UNEP	UN Environment Programme
UNEP/DEIA	Department for Environmental Information and Assessment
UNESCO	UN Educational, Scientific and Cultural Organization
UNSTAT	UN Statistical Office
WCWC	World Conservation Monitoring Centre (UNEP, IUCN, WWF)
WRI	World Resources Institute
WWF	World Wide Fund for Nature



## OCEAN RELATED INDICATORS

The purpose of this analysis is to help explicitly introducing the subject of indicators into the Report of E. Mann Borgese to the Club of Rome about ocean development. Indicators in fact are needed in a more comprehensive theory of wealth and welfare rooted in the concept of Common Heritage of Mankind of UNCLOS to perform measurements of monetarized and non-monetarized resources.

Traditionally, indicators are defined as a piece of information which (a) is a part of a specific management process and can be compared with its results; and (b) has been assigned a significance beyond its face value. They are developed (and distinct) from general-purpose statistics that have important applications in their own right; and they are used for (and again distinct from) problem-solving of given issues.

This note presents in the first part ongoing initiatives relevant to ocean related indicators, discusses in the second part gaps in ocean related indicators and explores in the third part the validity of ocean related indicators in the light of the new economics of Common Heritage of Mankind. Conclusions round up the analysis.

### 1 ONGOING INITIATIVES ABOUT OCEAN RELATED INDICATORS

We call the explicit development of indicators "Indicator movement"; it generates descriptive indicators reflecting actual developments (taking a picture) as well as indicators for sustainable development (ISDs). Other initiatives strongly support it. Thus, greener national accounts are being developed in a variety of shape and form and deserve attention as consumers and producers of indicators. Similarly, attempts to identify functions of nature and the institutionalized use of cost-benefit analysis and environmental impact assessment (CBA/EIA) brought about a development of methodologies and applications useful to the indicator movement.

### 1.1 Descriptive indicators

In his Report to the Club of Rome, Giarini<sup>1</sup> introduces Dowry and Patrimony as being a combination of natural or physical, biological, man made (cultural) and monetarized (capital) phenomena. Similarly, the UN-CSD distinguishes social, economic, environmental and institutional aspects of sustainable development<sup>2</sup>. One more aspect is uncertainty. In shorthand, we call these parameters "the S.E.E.U. dimensions" and use them in the following discussion about descriptive indicators.

#### Social indicators

Social indicators for large series of countries are elaborated and presented by UNDP in its Human Development Report and by the World Bank in its World Development Report<sup>3</sup>. The following remarks about the Human Development Report illustrate the role of social indicators for ocean development.

UNDP's Human Development Report described in Box 1 presents Human Development indicators and the Human Development Index. They are meant to measure the social and economic situation in the some 175 covered countries. Human Development Indicators possibly relevant to oceans are GDP and GNP; employment, unemployment; land and income distribution; urban population in coastal cities; annual marine fish catch; major protected areas. The relevance of fish catch and marine protected areas is straightforward. For other variables like e.g. GDP or life expectancy, the linkage with ocean development is less direct. In small island developing states SIDSS, the social and economic situation is a result of ocean development (or non-development); for them, nation-wide social and economic indicators are "ocean related". Large coastal countries like Argentina or Canada on the other hand owe their social and economic situation to marine and to terrestrial activities, and the resulting nation-wide indicators like GDP and life expectancy are not only "ocean related". For such situations

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<sup>1</sup>Giarini 1988.

<sup>2</sup>UN, 1996.

<sup>3</sup>UNDP, 1997. World Bank, 1997.

ongoing efforts to develop methods for disaggregating the human development\_indicators according to subnational regions are important; this is not to say that the benefits of ocean development necessarily go to the coastal sub-region. At any rate, here and for large coastal countries, social and economic indicators are the necessary input into statistical analyses of the ocean dependency of their socio-economic situation, rather than the reflection of such a linkage. This is also true for the Human Development Index HDI.

### **Economic indicators**

- Ocean related goods and services in the categories:
- offshore oil, gas and non-fuel minerals
  - man-made capital: built infrastructure (ports and harbors, fleet, touristic installations)
  - sea-born trade
  - coastal and marine tourism

were already referred to in the previous section reporting production (i.e. flow) estimates. We now turn to considerations about stocks as well as supported and generated impact. Global data on energy and mineral reserves are regularly compiled by specialized institutions including the World Energy Council, the International Energy Agency, the US Bureau of Mines and the World Bureau of Metal Statistics; offshore reserves however are not identifiable in the major data reports (and neither in the two sustainability indicators about fossil fuel energy and mineral reserves proposed by UN-CSD; see below). Stock of built infrastructure should in principle be found in national accounts (amortisations, Leontief input-output and flow investment matrix) and in some specialized publications (e.g. OECD Maritime transport for the world fleet and FAO yearbooks for the fishery fleet).

The ocean related activities generate and support external costs (Giarini's "deducted values"), where [internalized market costs] + [external costs] = [social costs] ). Maritime transport e.g. is likely to have significant impacts on coastal resources for port and channel construction and maintenance, and for navigation routes; operational impacts include risks from transport of hazardous wastes or oil spills. Such forms of pollution generated by them are addressed at below in the context of

environmental indicators. The effects of supported impacts on the other hand can be studied comparing environmental indicators of the state of marine natural resources and economic indicators of ocean related activities, both with cross-section (one year, many countries) and time-series (one country, many years) analysis.

### **Environmental indicators**

Environmental indicators reflect stock and/or flow realities of marine resources, with man-made and natural additions and deductions (flows) modifying the initial into a final stock. Stock has a quantity and a quality aspect: such as size of species population and contaminants in fish. Flows result from "usus", e.g. sustainable harvesting, and "abusus" of natural resources, i.e. over-exploitation of renewable and depletion of non-renewable resources; pollution resulting in environmental expenditures and non-compensated economic costs; as well as loss of ecological functions and immaterial welfare (e.g. damage to landscape and cultural patrimony).

What ocean related indicator work is ongoing for these natural resources and their different phenomena? Given the vastness of the documentation and the impressive number of teams at work, the reply of a one-man-show must remain very humble and general. Over-all, the UNDP/CSD indicator menu lists approximately 130 indicators used in the UN-CSD proposal for sustainability indicators, and the Core Data sets Matrix some 170 parameters/datasets used for the first UNEP Global Environmental Outlook GEO-1<sup>4</sup>. Of the latter,

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<sup>4</sup>UNEP/DEIA/MR.96-3. A core data working group (1996), six regional consultations held in 1996 and a model-based analysis supporting GEO-1 were preparatory initiatives of DEIA, UNEP's Division of Environmental Information and Assessment. Our following review is also based on: UNEP/UN System-wide Earthwatch Coordination, 1995; *UN system-wide Earthwatch Programme Document*. The mission of Earthwatch is to coordinate, harmonize and integrate observing, assessment and reporting activities across the UN system in order to provide environmental and appropriate socio-economic information for decision-making on sustainable development, including information on the pressures on, status of and trends in key global resources, variables and processes in both natural and human systems and on the response to problems in these areas.

about 30 can be considered social and 40 economic indicators; this leaves about 100 environmental indicators; of these we consider up to one fourth being ocean related, more than half terrestrial and the remaining quarter general (climate, institutional support).

As recalled in the previous section, sea water is used for desalination and for producing renewable energy from the ocean (including tidal for electricity). Indicators of bathing quality, metal content and coastal marine water quality, litter in marine environment (quality of stock) reflect pollution through dumping, discharges and, as proposed by UNDP/CSD, releases of N and Ph and oil discharges; GESAMP offers an overview over the respective and more general indicators<sup>5</sup>.

Within our category of natural areas, small islands indicators are reported i.a. in UNEP's Island Directory<sup>6</sup> and in UNDP's Small Island Developing States Network. Interesting in the present context is also UNEP's Barbados Programme of Action for Small Island Developing States SIDS, to be fully reviewed in 1999. Besides the length of coasts (stock quantity), GEO-1<sup>7</sup> gives estimates about pollution suffered and the resulting stock quality. The Barbados International Coral Reef Initiative for small islands may complement existing data about reef disturbances and reef uses. As for protected parks and reserves, the standard inventories (IUCN, WCMC) identify marine sites and are the basis of a proposed sustainability indicator (stock quantity)<sup>8</sup>.

About flora, mangroves loss reported in GEO-1 and an algae index proposed as sustainability index concern stock quantity. Algae catch (WRI; flow) recall the uses as pharma/food mentioned in the previous section. A

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<sup>5</sup>GESAMP, *State of the Marine Environment*, 1990, 1996.

<sup>6</sup>UNEP, 1991.

<sup>7</sup>UNEP, 1997.

<sup>8</sup>For a detailed table from national and international systems for protection of natural areas, including separate data for marine and coastal protected areas, see the bi-annual "World Resources" of World Resources Institute.

sustainability indicator for threatened species as a % of total native species is proposed for vascular plants and vertebrate species; however, no distinction between marine and terrestrial is mentioned (IUCN, WCMC).

Other sources for fauna include the UNEP/FAO Marine Mammal Action Plan and the International Whaling Commission. Available for fish and other marine animals are in principle estimates for stock quantity, stock quality (contaminants), catch and accidental kills (mainly FAO, incl. mariculture). The UN-CSD list includes an indicator for maximum sustained yield for fisheries.

Some indicators exist already for taxonomic, genetic, ecosystem and environmental function diversity including threatened and endemic species, protected areas, % of developed coast. Impetus for a systematic treatment is expected from the Global Biodiversity Forum's Dialogue on Biodiversity Indicators and Implementation Targets, within the implementation of the Biodiversity Convention. UNEP's Biodiversity Programme and Implementation Strategy gives priority to marine biodiversity, including in SIDS<sup>9</sup>.

### Uncertainty

*"Owing to the complexity of the mechanisms that affect biological capacity and fish populations, estimates of commercial fish stocks are uncertain at the present time"*<sup>10</sup>.

This statement in UNEP's latest Environmental Data Report recalls the "limits to certainty" inherent in every indicator or index, be it descriptive of the present state or an outlook into the future.

Uncertainties come in all kinds: about the measurements and resulting statistical data, about the causal relations and the models used to represent reality; and no probabilities can be calculated and assigned to outcomes. Therefore a vulnerability index may be developed and merged

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<sup>9</sup>See also UNEP, 1995a; *The UNEP Biodiversity Programme and Implementation Strategy* - As well as UNEP, 1995; *Global Biodiversity Assessment*, an over 1100 pages report about the present state of knowledge, gaps in understanding and areas where further research is needed.

<sup>10</sup>UNEP, 1993, *Environmental Data Report 1993-94*. See also Giarini/Stahel, 1993.

with the more traditional social, economic and environmental indicators. Thus, UNEP collaborates in the development of a Vulnerability Index in support of the Programme of action for the sustainable development of small island developing States SIDS. Already in its Island Directory<sup>11</sup> an index was estimated for important islands at risk based on marine conservation importance, human impact and data reliability. More recently, Briguglio<sup>12</sup> addressed the issue of SIDS quantifying forces behind their economic vulnerability (exposure to foreign economic conditions, remoteness and insularity, disaster proneness), and attempted to construct a composite index of vulnerability. For one out of three analyzed SIDS, the switch from the present GDP-based ranking to the ranking based on the vulnerability adjusted development index would have immediate conditionality effects. In another example, vulnerability to anthropogenic change of tropical coastal ecosystems was calculated as a function of GNP per capita and population density, and the resulting normalized vulnerability index was plotted against a normalized resource abundance index for mangroves, sea grasses and coral reefs<sup>13</sup>.

## 1.2 Indicators for sustainable development

At the UN Conference on Environment and Development in Rio in 1992, the International Community committed itself to achieving sustainable development, and Agenda 21 comments specifically on the need for indicators in Chapter 40 asking the United Nations system to create with other relevant organizations a set of indicators reflecting developments towards sustainability. Subsequently, the UN Commission on Sustainable Development has adopted a Work Programme on Indicators of Sustainable Development whose primary purpose is to make internationally consistent ISDs accessible to decision-makers at the national level. On an international level, it is especially the Department for policy coordination and sustainable development (DPCSD) of the UN Division for Sustainable Development which is dealing with

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<sup>11</sup>UNEP, 1991.

<sup>12</sup>Briguglio, 1995.

<sup>13</sup>World Resources Institute, 1986.

this issue. A provisional core set of ISDs was published in 1996 with the approval of the Commission on Sustainable Development under the title *Indicators of Sustainable Development - Framework and Methodologies*<sup>14</sup>. Preparatory activities of UNEP/EAP Environment Assessment Programme in this ISD process were an overview of environmental indicators (1994), a SCOPE-Belgian-Costa Rican Workshop held in January 1995 in Ghent and the SCOPE scientific workshop on ISDs in Wuppertal, Germany, of November 1995.

In the published core set of ISDs the dimensions are social, economic, environmental and institutional; although holistic, the approach does not include moral/ethical/spiritual sustainability, i.e. the state of the set of shared values defining acceptable behavior and motivating people to act in the common interest. Descriptive methodology sheets for every ISD (with no estimates for the time being) are presented according to the dimensions, the chapters of Agenda 21 and the indicator type (driving force, state or response indicator).

In principle, an ISD results from the national descriptive indicator discussed earlier in this section, from the corresponding international sustainability target (e.g. the critical stock or level of a coastal resource) and from the comparison of the two. Environmental targets or limits may have an objective, scientific basis; social and economic targets/limits are much more value loaded and hence subject to each society's concepts, goals and values. This may explain why for most of the indicators international targets are not yet available.

A dozen ISDs can concern ocean development, such as indicators about income inequality, the environmentally adjusted Net Domestic Product EDP, mineral reserves, fossil fuel reserves, lifetime of proven energy reserves, population growth in coastal areas, discharge of oil, N and Ph into coastal waters, maximum sustained yield for fisheries, existence of algae, threatened species and protected area. Within this dozen ocean related indicators, one is expressed in monetary terms, namely EDP. For only three targets are defined: for sustained yield for fisheries, for threatened species and for the protected area. Finally, one third of the ocean related SDIs are

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<sup>14</sup>UN, 1996.



"under development" altogether. This reminds us of the fact that the CSD core set of ISDs still is in development.

### 1.3 Relevant initiatives elsewhere

Greener national accounts, functions of Nature and Cost-benefit analysis support the indicator movement in several ways.

#### Greener national accounts

At a conference at the European Parliament, the Club of Rome and WWF-International called for a modification of SNA<sup>15</sup> framework and boundaries leading to a new, Nature-adjusted single measure incorporating the value of Nature's resources and services<sup>16</sup>. Satellite accounts offer a mid-way solution in that without modifying the SNA they complement it with estimates of stocks of natural resources, environmental non market services and damages due to economic activity. In its Satellite system for integrated Environmental and Economic Accounting (SEEA), UNSTAT<sup>17</sup> defines a menu of five alternative versions, with Version IV being concerned with satellite accounts; pilot country applications of parts of SEEA exist e.g. for Colombia, Mexico, Papua New Guinea, Thailand.

Ocean related explorations of greener accounts include:

- accounting for the depletion of natural resources : e.g. World Bank's Genuine Saving (output minus net depletion of natural resources)
- estimates in several developing and industrial countries for off-shore minerals and oil; for the recreational value of marine resources; for wetlands, mangroves and marine wilderness areas; for fishery and national patrimony;
- more adequate treatment of "defensive" expenditures: in Germany in general and in Mexico for environmental protection services; in half a dozen industrial countries development of ISEW, the Index of Sustainable Economic

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<sup>15</sup>UN Statistical Office, 1994.

<sup>16</sup>Sheng, 1995. Van Dieren (ed.), 1995.

<sup>17</sup>UN Statistical Office, 1993.

Welfare covering i.a. costs of pollution and non-renewable natural resource depletion;

- accounting for the degradation of environmental quality: e.g. of the Yellow Sea off Korea with oil spills and hazardous substances, of the Chesapeake Bay due to herbicide pollution.

The SEEA accounts can also be used to calculate linkage environmental indicators. In a pilot study for 11-13 developing and industrial countries, WRI e.g. calculated a macro-economic Index of Resource Depletion measuring the value of the decline in natural resource stocks relative to the value of gross investment in man-made capital during the given year. WRI produced also a disaggregated Resource Depletion Index for the agriculture-forestry-fisheries sector measuring the ratio of the SEEA environmentally adjusted domestic product combined to the standard GDP for these resource sectors<sup>18</sup>.

Green accounting supports the indicator movement generating relevant quantitative data and methodologies, representing the linkage between economy and environment on which to base macro-economic indicators, offering the input needed to develop environmental ISDs. It hence is not surprising that countries including Finland, France, the Netherlands and the United Kingdom are integrating, in one way or another, the efforts towards greener national accounts and the generation of indicators in practical applications.

### **Functions of Nature**

It is in line with the present context of Common Heritage of Mankind and modern service economy to consider the studies dealing with functions of Nature as further initiatives helpful to the indicator movement. Costanza's attempt to measure the "eco-system services" performed by the oceans has already been mentioned in the previous section. Here, attention is drawn to the system of some 50 functions of natural environment developed by de Groot<sup>19</sup>. They are grouped in regulation functions for essential

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<sup>18</sup>Hammond et al., 1995.

<sup>19</sup>De Groot, 1992.

ecological processes and life support systems, carrier functions providing space and a substrate or medium for human activities, production functions covering the provision of many resources and information functions offering opportunities for reflection, spiritual enrichment, cognitive development and aesthetic experience.

De Groot has applied this system to the Galapagos National Park (Table 1) and the Dutch Wadden Sea. Punctual ocean related applications include for regulation functions e.g. waste treatment services provided by wetlands compared to restoring a wetland; nursery function of estuaries and wetlands; primary productivity of some coastal marshes supporting offshore commercial and recreational fishing industries; for carrier functions the value of wildlife-related recreational activities (in Canada they exceed by far the economic value of sport fishing or hunting); for production functions the contribution of wildlife to the US economy, including fisheries, biological diversity, ecological services, recreation; marine medicinal resources.

#### **Cost-benefit analysis, Environmental impact assessment**

Over the past decade, significant progress has been achieved in the development of techniques for the monetary valuation of environmental damage and benefit. In its CBA/EIA-Programme, OECD published a comprehensive survey of existing techniques and data as well as an analysis of some fifty case studies from six member countries<sup>20</sup>.

In the Netherlands for example, the value of water quality was estimated for recreation using the market price of entry to commercial pools for swimming and the total cost method for fishing; and for navigation based on savings in sludge removal. In a series of valuations of user and non-user benefits from Norway, the total cost and the contingent valuation method were applied.

This OECD Programme illustrates a last initiative supporting the indicator movement with new methodologies and applications recalled also later.

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<sup>20</sup>Barde/Pearce (eds.), 1991.

## 2 GAPS IN OCEAN RELATED INDICATORS

### 2.1 In general

Ethical/values/consciousness dimensions of human life, leading to efficiency, vitality and harmony are missing. With respect to Agenda 21 Earthwatch<sup>21</sup> mentions as gaps local population programmes (3C), oceans: establishment of global marine databases and better quality fishery data at the national level (17), consistent georeferencing of data. Also, a specific northern orientation of indicators should be avoided.

Downstreams of indicators, detailed statistical analysis of the ocean relevance of potentially pertinent variables like coastal population or regional income are needed. Concerning marine sector's contributions to GNP, the European Union's Environmental Assessment report<sup>22</sup> considers information for transport, tourism and fishing/aquaculture as weak, and UNEP prepared guidelines, with pilot applications in Gambia and Tanzania.

### 2.2 In specific sectors

*"Many highly aggregated economic and social indicators have been widely adopted, but there are virtually no comparable national environmental indicators to help decision-makers or the public evaluate environmental trends"*<sup>23</sup>. At the level of disaggregated environmental indicators, main data gaps concern marine renewable energy technology; fish stocks and aspects such as trends in fishing techniques, employment levels and productivity; biodiversity. A distinction between the terrestrial and the marine part of phenomena should be aimed at whenever appropriate, and lessons gained with like-minded initiatives (greener national accounts, functions of nature, CBA/EIA) in methodology, data generation and applications should systematically be exploited. Also, inter-dimension linkage

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<sup>21</sup>UNEP/Earthwatch Coordination, 1995.

<sup>22</sup>European Environment Agency, 1996.

<sup>23</sup>Hammond et al., 1995.

indicators are needed, as well as introducing some environmental aspects into the Human Development Index HDI.

The Brent Spar affair 1995 confirmed the general level of ignorance of matters oceanic: The oceans remain a realm of the still largely unknown. Indicators of vulnerability and indicators couched within frameworks of probability should systematically be developed.

Completeness and international acceptance of the methodology sheets for ISDs still need scientific input, efforts of the agencies involved and intercultural cooperation of all governments. In fact, the Work Programme sets out a number of activities including:

- further identification and assessment of linkages between economic, social, institutional and environmental aspects of sustainable development and the development of linkage-based, policy-relevant indicators;
- further work on highly aggregated indicators;
- completion of the national testing phase during which a few selected countries have volunteered to test and evaluate the use of ISDs.

### **3. INCONSISTENCY OF PRESENT INDICATORS WITH COMMON HERITAGE ECONOMICS. An exploration**

This paragraph explores the validity of present and projected ocean related indicators in the light of the new economics of Common Heritage.

#### **3.1 Requirements for consistent indicators**

Repeatedly, Orio Giarini<sup>24</sup> insists on the fact that a more comprehensive theory of wealth and welfare encourages utilization of the indicators; on this road to the new economics of Common Heritage of Mankind requirements relevant to the development of indicators are i.a.:

- i use of indicators is needed, especially with non-marketed goods and services;
- ii wealth and welfare is a combination of natural or physical, biological, man made (cultural tools) and monetarized (capital) phenomena; this holistic views

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<sup>24</sup>Giarini, 1980. Giarini/Börlin, 1988.

- reflects in our social, economic and environmental dimensions;
- iii stock rather than flow magnitudes must be addressed;
  - iv utilization instead of exchange value is relevant;
  - v non-remunerated work, i.e. work not exchanged and work exchanged, but not paid with money
  - vi deducted value, i.e. costs of man-made pollution and over-exploitation of ocean resources, and
  - vii uncertainty inherent in complex systems have to be taken into account.

Stock and flow magnitudes (cf. iii) relate: during a given period, man-made and natural additions and deductions modify the opening into a closing stock; hence methodologies for compiling stock and flow indicators have to be compatible. Moreover, national accounts considerations link (v) and (vi): today's GDP is too low since excluding non-remunerated work, and too high since including environmental costs. As for work unpaid, the value of non-SNA production in industrial countries is at least half of gross domestic product, and it accounts for more than half of private consumption; at world output basis, unvalued household and voluntary community work including the informal sector adds about 70 % to the officially estimated \$23 trillion of global output<sup>25</sup>.

### 3.2 Inadequacy of today's indicators

Some scenarios will show how ocean related indicators do not fulfill all of these requirements.

#### Multidimensional programmes

The requirement (ii) of a holistic approach is being heard by the UNDP/CSD core set of indicators for sustainable development and WRI's World resources report: they cover the social, the economic and the environmental dimension. Other sets of indicators concentrate on two dimensions, including SEEA, the UN system for integrated economic and environmental accounting, and the Human Development Index with social and economic indicators. Still other initiatives cover mainly one dimension, such as the UN

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<sup>25</sup>UNDP, 1995.

System of national accounts the economic or UNEP's GEO-1 and the Environmental Data Report the environmental; or they deal in depth with one sector, such as FAO for fishery. This readiness of bringing more disciplines together however does not satisfactorily extend to the marine environment.

### **Wealth from marketed and not-marketable natural resources**

The value of marketed marine natural resources such as fish or off-shore oil results from the estimated quantity and the valuation method. The quantity estimation rests on the choice between stock (e.g. stock of fish; man-made capital) or flow (e.g. fish catch; GNP) and hence concerns requirement (iii). The stock approach is already traditional in some areas, e.g. for IUCN's threatened species reports, and only a new proposal in some others, especially in national accounts with SEEA and in UN-DPCSD's ocean related ISDs.

The valuation on the other hand rests on net prices, i.e. market prices minus external costs, or on user-costs (based on the value added element [true income] and the user-cost element [depletion costs]). These valuation methods should respect the requirements (iv) utilization instead of exchange value, (v) include non-remunerated work and (vi) exclude deducted values or external costs. Acceptance of these requirements is growing<sup>26</sup>, their application however by no means generalized. It therefore is very important that the CSD core set of SIDS suggests an indicator "Environmentally adjusted net domestic product".

The estimation of the value of non-marketable marine resources like mangroves or wilderness areas asks for a delicate choice of valuation methods developed in the area of CBA/EIA. Relevant are the different motivations people have in valuing natural resources: for an actual use (use value), for preserving the option to use it (option value), for the environment's own sake or intrinsic value of species and ecosystems (existence value). The use value is estimated via surrogate markets like the method of travel costs to recreational sites, the option value via experimental markets with the contingent valuation method,

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<sup>26</sup>Think e.g. of SEEA for external environmental costs and of the Human Development Report for wealth not covered by SNA.

i.e. asking people what they would be willing to pay for the conservation of a certain asset, the existence value with the replacement, avoidance, and maintenance cost approach. Total economic value of natural resources then corresponds to actual use + option + existence value. The recognition of these different forms of contributions to wealth and welfare will help developing the new Common Heritage economics.

A systematic treatment of uncertainty (requirement vii) is still lacking.

Turning rapidly to like-minded initiatives, we are reminded of SEEA in National Accounts and of the functions of nature approach. SEEA Version IV deals with valuation methods, however without giving clear-cut guidelines for the valuation of depletion and degradation. Table 1 about the socio-economic value of the functions of Galapagos National Park on the other hand gives estimates for the types of values mentioned above for the regulation, carrier, production and information functions. This remarkable application is instructive; a detailed analysis however would show where the requirements from Common Heritage economics are not satisfied.

#### **Relative importance of the marine and the terrestrial resources; contributions to GNP/GDP**

Sometimes the wealth of the marine environment is described in relation to the wealth of both the ocean and the terrestrial environment, i.e. to GNP/GDP. This approach infringes requirement (iii) asking for stock instead of flow measures and hence for a marine/terrestrial comparison at the natural capital level instead of the present value added or final demand level. Moreover, sometimes a sector's contribution to GNP/GDP is estimated taking the sector's total output instead of its value added or final demand; this confusion is erroneous, given that (intermediate goods and services) + (value added or final demand, i.e. GNP/GDP) = (total output). Finally, this approach hearts requirements (iv), (v) and (vi) in ways mentioned above.

#### **Quantitative and aggregated indicators?**

Requirement (i) asks for indicators; do they have to be quantitative and aggregated? Indicators do not have to be



numbers; the Global environment outlook<sup>27</sup> for instance represents the relative importance given to seven environmental issues (including biodiversity as well as marine and coastal zones) in seven world regions with 7x7 little rectangles in four different colors according to intensity of concern; regional environmental trends are represented in an analogous way, and both summaries are concise and informative. Numerical indicators on the other hand appear in physical terms, in monetary terms or dimensionless. If in physical terms, they are expressed in their own dimension (e.g. 'people' for human and social capital, 'monetary' for economic capital, and 'physical' for environmental capital) or in a common measure like primary productivity (e.g. grams of carbon/m<sup>2</sup>/year) and biomass. If in monetary terms, directly so or, as the World Bank's monetarization of all forms of capital, indirectly after valuation of the physical measure. If dimensionless, e.g. as relative gap between present state and target like in the HDI or the ISDs.

Indicators may have many components, but the final indices must be few in number; otherwise decision-makers and the public will not readily absorb them<sup>28</sup>. This requires aggregation within each of the three dimensions social, economic and environmental applying e.g. natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen. The resulting three partial indices may remain disaggregated (e.g. SIDs, the GEO-1 or the HD Report indicators) or else be aggregated if expressed in common or in dimensionless terms (like e.g. in the case of the HDI and the island vulnerability index).

Hence, indicators exist in physical and in monetary terms, and also aggregated to an index, and this is consistent with requirement (i).

#### 4 ROUND-UP

Much work is going on in the indicator movement in general. Lessons gained with like-minded initiatives

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<sup>27</sup>UNEP, 1997: GEO-1 p. 6-7.

<sup>28</sup>Same opinion as Hammond et al., 1995.

(greener national accounts, functions of nature, CBA/EIA) in methodology, data generation and applications however should more systematically be exploited.

Gaps in ocean related indicators exist in general, specifically for descriptive social, economic and environmental indicators, in coping with uncertainty and concerning indicators for sustainable development.

Much of what exists has to be thought through in the light of the new economics for Common Heritage.

Concerning the holistic, multidisciplinary approach required, there is a readiness of bringing more disciplines together; however, it does not satisfactorily extend to the marine environment.

As far as valuation methods for marketed marine resources are concerned, acceptance of requirements from the new economics (utilization value, deducted value, non-remunerated work) is growing, their application however by no means generalized. It therefore is very important that the CSD core set of indicators for sustainable development suggests an indicator "Environmentally adjusted net domestic product".

Benefit-cost analysis has revealed different forms of benefits from non-marketable marine resources; the recognition of this contribution will help developing the new Common Heritage economics.

A systematic treatment of uncertainty is still lacking.

The estimation of the contribution of marine resources to GNP/GDP is not yet satisfactory.

Indicators exist in physical and in monetary terms, and also aggregated to an index, and this is consistent with new economics.

To promote the development of ocean related indicators, consistent efforts should be undertaken at the nevralgic points, including with the task forces for sustainability indicators and for biodiversity indicators, in view of greener national accounts and with the development of a new economics for Common Heritage.

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BOX 1

**UNDP'S HUMAN DEVELOPMENT REPORT WITH THE HUMAN DEVELOPMENT INDEX HDI**

UNDP's Human Development Report, annually published since 1990, presents Human Development Indicators and the Human Development Index for each of 175 countries, for some aggregates (regional, developing and industrial countries, North-South, rural-urban) and for the world as a whole; also, efforts towards further subnational disaggregations are ongoing.

The set of over 200 Human Development indicators concerns the human development/deprivation profile, wealth, and economic performance.

The Human Development Index reflects achievements towards a long and healthy life, knowledge, and a decent standard of living. In the first, descriptive step are produced the country's estimates for life expectancy, educational attainment (depending on adult literacy and school enrollment), and GDP per capita (adjusted for the local cost of living and for the diminishing utility of higher levels of income). In the following normative step, minima and maxima identical for every country are stipulated in each of the three components; each country's descriptive indicators are then compared to the corresponding minima; finally, the obtained measures of the way gone are put into relation with the full way, i.e. with the corresponding difference between the two extremes. The resulting dimensionless relative values then indicate how far that country already went in the attainment of certain defined goals: the closer its indicators are to 1, the less is the remaining distance that country has to travel. At last, a simple average combines the three dimensionless indicators into the one single HDI.

The HDI accounts for the social and the economic dimension. Proposals to include material intensity of economies, to adjust existing components of the HDI, or to construct an all-new Green Index to stand alongside the HDI tend to introduce the environmental dimension.

*Source: UNDP, 1997.*

TABLE 1

### SOCIO-ECONOMIC VALUE OF THE FUNCTIONS OF THE GALAPAGOS NATIONAL PARK

(based on maximum sustainable use levels)

(values are expressed qualitatively (++) or in US\$/ha/year) except column 7  
Total surface area of the study area: 1,150,000 ha

Environmental Functions	Types of values						7 Value to employment (' people)
	1 Conser- vation value	2 Existence value	3 + 4 Social values <sup>1</sup>	5 Consump- tive use value	6 Productive use value	7	
<b>Regulation Functions</b>	> 63.00	++	++		++		
Watercatchm./erosion prev.	0.30		+		*		
Bio-energy fixation	(1,200.00) <sup>4</sup>	+			*		
Storage/rec. human waste	58.00 <sup>2</sup>		+		*		
Biological control	++	+	+		*		
Nursery f./migration hab.	7 <sup>2</sup>	++	++		*		
Maintenance of biol.div.	4.90	++	++		*		
<b>Carrier Functions</b>	0.50	++	+		> 45.00	> 833	
Aquaculture					0.02 <sup>2</sup>	+	
Recreation		+	+		45.00	772	
Nature protection	0.55	++	++		*	61	
<b>Production Functions</b>			++	+	> 8.00	> 160	
Food/nutrition			++	+	0.70	156	
Genetic resources					+	+	
Raw materials for constr.					5.20	4	
Biochemicals					++	+	
Energy resources					1.50 <sup>1</sup>	.	
Ornamental resources					0.40	.	
<b>Information Functions</b>	0.50		++	++	> 3.00	> 67	
Aesthetic information			+	++	+		
Spiritual information	0.52		++	++			
Historic information			+	++			
Cultural/artistic insp.			+	+	0.20		
Educ. & scientific inf.				+	2.70	67	
<b>TOTAL ANNUAL RETURN</b>	> 64.00	++	++	++	> 56.00	(1,060)	

<sup>1</sup> This function applies to the terrestrial area only (720,000 ha).

<sup>2</sup> This function applies to the marine area only (430,000 ha of which 4,100 intertidal zone)

<sup>3</sup> Social values consist of the importance of environmental functions to human health and the option value placed on a safe future.

<sup>4</sup> If a figure is given between brackets it was not used in calculating the total value because the calculation is too speculative.

<sup>5</sup> These functions do contribute to economic productivity, either directly or indirectly, but no market or shadow price could be determined due to lack of information and/or shortcomings of the market mechanism.

Source: De Groot, 1992, p. 235.

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24 November 1997

Prof. E. Mann Borgese  
Fax +1 902 868 2455  
Halifax, Nova Scotia, Canada

COPY

fax of 4 pages

Dear Elisabeth,

thank you for the registered letter of November 1 with the chart/Table 2 and the second check.

After coming back from an extended "journey within" I turn to your question concerning Table 2; I refer to my letter of 11 September and enclose Dr. A Behman's chart including 1995.

- a) In Table 2, col. 2 corresponds to the line Total of the group in col. 4, so in Oil & Gas, Fish etc.. If for every group with more than one activity the group Total is indicated in col.4 (e.g. in Coastal etc.), col. 2 could be eliminated, thus avoiding present redundancies.
- b) Given the equation [intermediates] + [value added] = [total output] and the heading Value added of col. 5. I presume that Economic impact stands on col. 4 for Total output, or Production value, or Business sales, as endnotes 1 to 20 say. Moreover, the present heading "economic impact" suggests inter-group effects ("indirectly", "induced"; cf. endnote 11), whereas all figures are intra-group only. Hence "Total output" or "Production value" would be more appropriate than "Economic impact".
- c) There seems to be some double-counting in col. 4 and 5:  
(8,4): some Insurance is contained in Trade;  
(12 in 2, 6/7, 9-11, 15, 18): Techn.Equip. in other groups;  
(13a in 11): some Construction in Ports and Harbours.  
But even correcting it (how?), the main conclusion of Table 2 about the importance of the oceans remains.
- d) Some Value added factors in col. 6 are unexpected:  
. Oil & Gas so much higher than Non-fuel minerals?  
. Lifeboats and Coastguards even below non-fuel minerals?  
Probably the reader would find satisfactory details in the paper of Westwood and Young.
- e) Row (4) Sea-borne trade: Presently a mixture of 1996 and 1995; 1995 consistently would be:

1995, A. Behnam, UNCTAD (\* US\$ millions  
 production of goods up to loading 4,441,312  
 total freight costs 247,325  
 cif-value of imports 4,688,637  
 \*) Derived from IMF cif/fob factors and IMF import data

f) With the nice distinction between "Total output" and "Value added" of Table 2, Sea-borne trade would be accounted for with "Maritime Transport", as suggested in the table below (following also [a] and [b]):

Group	Activity	Total output US\$ millions	Value added US\$ millions	Value added factor
Maritime transport	Intermed. (+ Value added Total output	247,325 (4)	125,000	0.50 (4a)

+ Intermediates: Including energy, chemicals, appliances, insurance, taxes

(4) Total freight costs 1995, according to A. Behnam (UNCTAD), Shipping and Ports in Developing Countries: Perspectives. Delivered at International Ocean Institute, Halifax CND, 1997.

In 1995, these total freight costs were included in the cif-value of imports of Millions US\$ 4,688,637, a figure which reflects the importance of oceans.

(4a) Own estimate.

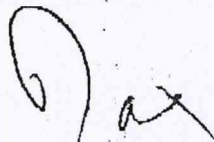
g) Last Row, according to [a], [b], and [f]:

Group	Activity	Total output US\$ millions	Value added US\$ millions	Value added factor
TOTAL		2,121,234	949,131	

This Table 2 is impressive, as well as the other themes of chapter 6 - I am wondering about the book in his final form. I remain at your disposal in case of changes of the indicator section.

Orio is unhappy about needing a third hipp intervention!

Best personal wishes,



encl. 2 pages of the Behnam paper



COPY

Monday, December 15, 1997

Dr. Max Borlin  
Consultant en Economie de l'environnement,  
des ressources et du developement  
1, chemin des Bosquets  
CH-1297 Founex/VD, Switzerland

Dear Dr. Borlin,

On behalf of the International Ocean Institute, I would like to thank you for taking time to lecture at the 1997 Training Programme on *The United Nations Convention on the Law of the Sea, its Implementation and Agenda 21*. Your contribution played an integral role in the success of this programme, and was much appreciated. Your stimulating and informative presentation provided the participants with greater awareness and understanding of your area of expertise, and it is hoped that they will each use their new knowledge and skills to make a significant and lasting impact on the management of the world's oceans.

I am pleased to enclose a copy of the 1997 Course Report. I hope you will find it of interest, and that it is useful in the Reference Library of your office.

Since the conclusion of the Training Programme in August, the IOI has continued to be very active. Amongst other things, Volume 13 of *Ocean Yearbook* is nearing publication, and IOI - Headquarters in Malta hosted Pacem in Maribus XXV from 15th-18th November. The conference examined the theme *Common Heritage and the 21st Century*, and was preceded by a workshop on the *Job Creating Potential of Integrated Coastal Management* held on 13th and 14th November. In 1998, the Year of the Oceans, Pacem in Maribus XXVI will be held in Halifax and will examine the theme *The Crisis of Knowledge*.

Once again, thank you for your interest in and contribution to the International Ocean Institute. I look forward to the opportunity of collaborating with you again in the future.

Yours sincerely,

Robert L. Race  
Director, IOI-Canada

Enclosure

Date sent: Tue, 16 Dec 1997 09:32:06 -0400 (AST)  
From: Scott Coffen-Smout <ar120@chebucto.ns.ca>  
To: IOI <ioi@kilcom1.ucis.dal.ca>  
Subject: Please forward to Max Boerlin. Thanks!

FAX TRANSMISSION

FAXED

TO: Dr. Max Boe"rlin, Geneva  
NO: +44 22 776 0937  
  
FROM: Scott Coffen-Smout, c/o IOI-Canada, Halifax  
NO: +1 902 494-2034  
  
DATE: 16 December, 1997  
RE: Global Monetarized Marine GDP

Dear Dr. Boe"rlin,

I recently assisted Elisabeth Mann Borgese with research on the economic impact of global marine industries for her Report to the Club of Rome. I think you were sent a copy of the table for comment. My reason for contacting you now is to determine the source of your figure for global monetarized marine GDP (i.e. US\$ 1.5 trillion), which Elisabeth gave to me for our calculations.

We have used your figure to globalize the value of five marine economy sectors by extrapolation from the UK marine economy revenues calculated by Westwood and Young, two British researchers. Since the \$1.5 trillion is approximately 30 times the UK marine GDP of US\$ 44 billion, it provided a reasonable (but rough!) approximation of the value each sector contributes to the global marine economy.

I would be grateful to receive the source, method of calculation, or published reference for this figure \$1.5 trillion global monetarized marine GDP. Many thanks for your assistance.

With greetings of the season,

Yours sincerely,

Scott Coffen-Smout

-----  
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F A X

to: Scott Coffen-Smout, IOI CND  
 #: +1 902 494-2034  
 date: 19 December 1997

Dear Mr. Coffen-Smout,

Your surprising fax dated 10 December reached me in a compact and later in a normal version; may I reply in four steps.

1 Chronology. Versions:

23. 9.	EMB	6,5 trillion	mix	Annex A
6.10.	Bo	1,5 "	"	Annex A
1.11.	EMB	1,071 "	GDP	
24.11.	Bo	0,949 "	GDP	Annex B.g)

The 1,5 trillion are obsolete.

2 The chicken or the egg? Fax and footnote 1 and 13 of Table 2 explain that the estimate for the '5 sectors' stems from an estimate for 18, i.e 13 + 5 sectors. This sounds like a circularity: 5 is done with 18, and 18 stems from 5.

3 Extrapolation via TO or via GDP=VA? I presume you do via VA:

$[VA-UK-5] \times \left[ \frac{VA-world-13}{VA-UK-13} \right] = [VA-world-5]$

In this direct way, Table 2 would have empty cells for TO and for Factor, at the five rows; they are not needed.

Via TO, one would have to proceede in two steps:

a.  $[TO-UK-5] \times [TO-converter-5] = [TO-world-5]$

b.  $[TO-world-5] \times [TO/VA \text{ factor-UK-5}] = [VA-world-5]$

Are the UK-revenue-figures really VA/GDP? If so, they permit the simpler 'via GDP=VA'.

4 In conclusion. Taking for (1) the last version, for (2) the converter-13 and not as presently an inexistent converter-18 and for (3) the 'via GDP=VA' one gets:

Sector groups	World	UK	UK-World-Converter: w/UK
OLD: 18	1,5 trill.	44 billion	30
NEW: 13 5	,949 - ,025 = ,925 ,025	[44 - x] x	,925/[44-x] = y
18			approx. 20

With greetings of the season, and kind regards,

encl. Annex A and B

→ copy to Prof. Borgese via home fax, without encl.

*Max Börlin*

inevitably have <sup>much</sup> relevance to the use and health of the

UNDP's Human Development Report (described in Box 1) <sup>welfare</sup> presents <sup>and compare</sup> Human Development indicators and the Human Development Index. They are meant to measure the social and economic situation in some 175 countries. <sup>These</sup>

Human Development Indicators possibly relevant to oceans are GDP and GNP; employment, unemployment; land and income distribution; urban population in coastal cities; annual marine fish catch; major protected areas. The relevance of fish catch and marine protected areas is straightforward. For other variables such as GDP or life expectancy, the linkage with ocean development is less direct. In small island developing states (SIDSs), the social and economic situation is a result of ocean development (or non-development); for them, nation-wide social and economic indicators are "ocean related". Large coastal countries like Argentina or Canada on the other hand depend for their social and economic development on <sup>interior land resource use</sup> terrestrial as well as on marine activities, and the resulting nation-wide indicators like GDP and life expectancy are not only "ocean related." Large countries thus must develop methods for disaggregating the human development indicators according to subnational regions; This is not to say, however, that the benefits of ocean development necessarily go to the coastal sub-region. At any rate, social and economic indicators are the necessary input into statistical analyses of the ocean dependency of their socio-economic situation, rather than the reflection of such a linkage. This is also true for the Human Development Index HDI.

aggregate levels of GDP/GNP give some proxy indications of the pollution that is likely to pour down rivers, the pressures on fishstocks, the volumes of international trade, and so on.

specifies a number of  
These are the best of  
indicators, use data denotes  
information volumes and so on, each provides clues to the degree of interest of just of the oceans and ocean resources

(c) Economic indicators

fall into many

Ocean related goods and services in the categories:

Thus, for examples:

- ◆ offshore oil, gas and non-fuel minerals;
- ◆ man-made capital, built infrastructure (ports and harbours, fleets, tourist installations, and so on);
- ◆ sea-born trade & services and institutions;
- ◆ coastal and marine tourism

shipping vessels, oil-

were already referred to in the previous section reporting production (i.e. flow) estimates. We now turn to considerations about stocks as well as supported and

Such factors

generated impact. Global data on energy and mineral reserves are regularly compiled by specialized institutions including the World Energy Council, the International Energy Agency, the US Bureau of Mines and the World Bureau of Metal Statistics; offshore reserves however are not identifiable in the major data reports (nor in the two sustainability indicators about fossil fuel energy and mineral reserves proposed by UN-CSD; see below). Stock of built infrastructure should in principle be found in national accounts (amortisations, Leontief input-output and flow investment matrix) and in some specialized publications (e.g. OECD Maritime transport for the world fleet and FAO yearbooks for the fishery fleet), and so on.

and their impacts

embedded in matrices over time such

capital depreciation

Ocean related activities generate "deducted values," where [internalized market costs] + [external costs] = [social costs]. Maritime transport e.g. is likely to have significant impacts on coastal resources for port and channel construction

accumulation, as well as be somewhat detectable through the analysis of

Elizabeth

Have rewritten pages 112, 113 -  
using - so far as I could -  
the existing material.

The hard-written pages are  
not identical to the jottings I've  
made to your text for pp. 112-113,  
since (as I wrote it out) a  
few more modifications were added!

Hope this is ~~not too much~~  
of some use. | c

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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RECEIVED JAN 06 1998 Founex, 6 January 1998

To Mr. Robert L. Race  
Director, IOI-Canada  
Halifax, CND

FAX +1 902 494 2034

COPY

*Robert*

Dear Mr. ~~Race~~,

As last but one step of the Training programme (the last will be the refund of the out-of-pocket expenses, the list of which I gave to you at the last lecture in "my" week), a copy of the 1997 Course Report reached me just before New Year. It recalled to me a pleasant lecturing week, hopefully useful to the participants. And was accompanied by your letter with the many news about IOI-worldwide, including the formal recognition of your nomination: Congratulations and best wishes!

Sincerely,

*Max*

Max Borlin



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Founex, 6 January 1998

Prof. E. Mann Borgese  
International Ocean Institute  
Halifax, Canada

Dear Elisabeth,

Grazie per gli auguri, che contraccambio di cuore!  
Your fax of 26 November brought me good news: Seminar of CoR and publishing in November of the Year of the Ocean!

Thank you for asking to participate to the Seminar in March. I understand "Rechte und Pflichten" as follows:

- . receiving here a copy of the Indicator section (second section of chapter 3) out of the Draft Report distributed to CoR
- . presentation, if any, of the Indicator section
- . discussion; protocol of the more important remarks about the Indicator section
- . travel, food, lodging, out of pocket expenses covered
- . a modest honorarium for the time given to CoR.

I am glad to read that you plan to rewrite the whole book; in fact, the Indicator section will gain rewritten by you, in terms of homogeneity of style with the rest of the book. At that time you may wish me to help content-wise, perhaps:

- . EU just published a Manual with some 40 Indicators similar to the one of the Commission on Sustainable Development; introduce this and other most important new developments into the Indicator section;
  - . with your permission, discuss the Indicator section with UN and IUCN experts (perhaps Mr. Dahl, Dr Kahnert UN-ECE, the IUCN ocean Coordinator), perhaps sending them beforehand a copy of the Indicator section as distributed to CoR; Giarini would of course be first priority, if he accepts;
  - . introduce the protocolled remarks into the Indicator section.
- Given former commitments, the whole of it would have to be done by mid-April. The three initiatives would of course have to be decided in detail. Presently I presume that they would stay within a maximum budget of US\$ 2000 or, at a special preferential rate, almost 80 hours.

So, perhaps, we meet soon again. With best personal regards,

Encl. . 2 pages of the Behnam paper  
. copy of my reply to Scott Coffen-Smout

*Lova, Max*

*4 pages to home fax*



Dalhousie University

*1 page*  
International Ocean  
Institute



FACSIMILE TRANSMISSION

To: Dr. Max Boerlin  
Fax: 022 776 0937

From: Elisabeth Mann Borgese  
Fax: 1 902 868 2455

Date: March 5, 1998

Subject: Romania Seminar

Dear Max,

I have not heard from you any more, but now the fact is that the seminar has ben postponed. Between the Black-Sea University and the Club of Rome they failed to come up in time with the funding for the international air fares. That aspect was not very well managed. I talked to the Black-Sea University yesterday, and they said they would set a new date as soon as possible.

That is it!

Regards

*Elm*



Dalhousie University

*1 page*  
International Ocean  
Institute



FACSIMILE TRANSMISSION

To: Dr. Max Boerlin  
Fax: 022 776 09 37

From: Elisabeth Mann Borgese  
Fax: 1 902 868 2455

Date: March 8, 1998

Subject: Your fax of March 7

Dear Max,

Thanks for your letter. I am very sorry if the last minute change has caused you some inconvenience -- it caused me a lot of inconvenience! I had already my ticket to Bucharest, and my whole March schedule organized accordingly! They just did not get their act together at all, between the Black Sea University and the Club of Rome. Moreover, they are very hard to get in touch with in Bucharest. It really has been a pain in the neck.

Also, I have a publication schedule with the UNU Press: They need the finalized copy by May 1, if the book is to appear in November -- and that now does not fit with the Club of Rome schedule -- and the whole thing is a mess.

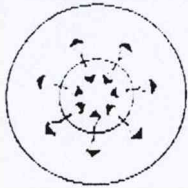
I think the next day for a sort of workshop that we can shoot at is a seminar of the Club of Rome in Budapest in June, but I don't know, when in June: and I have already several other dates in June.

Yes, I did ask Anthony Charles to send you his bibliography. I thought it would be useful to you. Of course, he deals only with fisheries. He frequently lectures in our training programmes and he is a very good man. I'll pass your suggestions on to him.

All the best and happy whirling!

Yours as ever,

*Elisabeth*

**PROGRES****TELEFAX**

Research Programme on the Service Economy

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TO : **Max Börlin**  
**Patricia Goldschmid**  
**Patrick Liedtke**  
**Geneviève Reday-Mulvey**  
**Walter Stahel**

FROM: **Orio Giarini**

DATE: **March 13, 1998**

No. of pages (inc. cover sheet): 1

**Developments and Follow-ups of the reports on the Service Economy for the Club of Rome**

This is just to inform all of you that:

- Max Börlin has contributed to a report that Elisabeth Mann Borgese has now prepared for the Club of Rome on the value of the oceans, using our ideas in general on the service economy, particularly concerning the notions of wealth and value.
- Doing this activity, Max Börlin has also found several initiatives concerning the setting up of values indicators of wealth. All these indicators are becoming more and more important in different ways. They all need a basic reference to be linked to a new economic theory of the type we are proposing.
- Concerning the indicators in particular, there is a large section on this issue in the report "Dialogue on Wealth and Welfare". Max Börlin will make photocopies of these pages with others he has written himself and use them to establish a network with the major interesting people setting up indicator systems.
- It should be clear that indicators of wealth have to be integrated in a global economic theory and not simply taken as something outside economics per se. This is what the idea of the service economy is trying to achieve and therefore arrive at the new definition of wealth indicators in which GNP is only one among others even if always of course relatively important. Even in this case, GNP has to be readapted by integrating the notion of value deducted.
- All this again has to do with a clear differentiation of the notion of flow on the one hand and stock on the other, as well as on the notion of monetarized and non-monetarized values.

Chemin des Bosquets 1  
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Téléphone (022) 7762509  
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Founex, 17 April 1998

Prof. E. Mann Borgese  
IOI Dalhousie University  
1226 LeMarchant Street  
HALIFAX, Nova Scotia  
Canada, B3H 3P7

Dear Elisabeth,

I was glad in February reading your "everything is in good order now", and sad at your last fax from St.Moritz! I hope you had at least a good time skying, like last year.

Meanwhile, I discovered with Orio a copy of your 'First draft' pp. 1-362. Earlier, you had sent me a former version of chapter 3; so I looked in the 'first draft' for the indicator section and your chart p. 93-95, made some remarks on photocopies of relevant pages [as e.g. p. 136a, a tentative pro memoria for a bridge between the indicator section and the institutional Ch.5/annex p. 257/305] and listed them on an 'overview'. Please have them by express mail.

Also, Orio asked me to send copies of some excerpts of his D&P-CHM-indicator writings to experts, as described in his enclosed fax. We would be happy to join to them the indicator section in my original version (Bö-paper to you, September 1997). I shall start with it as soon as my wife no longer needs a maggiordomo-chauffeur-secretary because of her broken right hand, and shall assume your permission unless you do not fax otherwise by beginning of the last April week (by 27 April); thank you on behalf of Orio for your cooperation.

All the very best.

Max

Encl.: - remarks p. 136a your 'first draft'  
- copy of fax from Orio Giarini  
Annex by Worldexpress: Remarks re your 'first draft':  
(1/2) 3 pages overview  
(3) some 20 annotated pages incl. p. 136a

Letter with encl. also to home fax  
Copy of letter with encl. to Prof. Orio Giarini, Geneva



Dalhousie University

International Ocean  
Institute



**FAXED**

FACSIMILE TRANSMISSION

To: Max Boerlin  
 Fax: 41 22 776 09 37

From: Elisabeth Mann Borgese  
 Fax: 1 902 868 2455

Date: April 19, 1998

Subject: Your fax of April 17

Dear Max

you most certainly have my permission to use whatever you think most useful, for the Orio initiative.

I have just finished the revision of the whole book -- and it is leaving for Tokyo tomorrow! It was a tremendous amount of work.

I am asking the Office to fax you the revised text as it now stands. I cut it a little, but not much, and I do think it reads well now. So if you want to use that in addition to your original, that is fine too.

On another, though related matter: Could you kindly send me a receipt for the US\$10,000 I paid you for the research. I need it for my income tax return.

All the very best,

Yours as ever,



Dalhousie University

FAXED

International Ocean  
Institute



## FAX TRANSMISSION

TEL: +1 902 494 6623  
FAX: +1 902 494 2034

**To:** Max Börlin  
**Date:** April 22, 1998  
**Fax #:** 41-22-776-0937  
**Pages:** 25  
**From:** Robert L. Race,  
Director  
IOI-Canada  
**Subject:** Elisabeth's Book

Dear Max,

We received your package by express mail today. Elisabeth left for New York, London, Frankfurt, Milan etc. on Monday. As she left, she asked us to fax you these pages. The attached material is therefore not in response to your package which arrived after she left.

I have sent her your covering letter and first two enclosures by fax. She may send back new correspondence as a result. Then again she may not. I just thought that you should be aware of the sequence of correspondence so that the attached is not misunderstood.

Yours truly,

## ***II. Ocean Related Indicators***

Our first Report to the Club of Rome<sup>10</sup> concluded its discussion on the “economics of the common heritage” with the following recommendations:

A great deal of research will be needed in this new field on, for example, the need for and the cost of subregional, national, regional, and global services. Research will also be needed on deducted values arising from negative synergisms of conflicting uses of ocean space and resources; from present technological gigantism, risk management, and pollution economics; and from conflicts between military and peaceful uses of the marine sector of the economy. In addition, investigators must examine the utilization value of services provided and production created (for example, by aquaculture facilities and technologies, mining ships and technologies and OTEC plants); the generation of secondary and subsidiary industries (e.g., canning, construction, pharmaceuticals, petrochemicals, land-based transportation); and above all, *how to define a set of usable social indicators that will properly assess and monitor the generation of real wealth*. The latter research would help point out inadequate economic policies and organize actions toward specific as well as general goals. It should be a feasible exercise to select the most adequate indicators, even considering the delicate political problems likely to be encountered in gaining their acceptance. A recognized institute could then issue periodic verifications of the changes brought about in the level of wealth, with reference to the indicators, and stimulate the appropriate actions.

A great deal of work on social and environmental indicators has been done since the writing of these recommendations. It is deplorable, however, and almost beyond belief, that most of this work has concentrated on -terrestrial systems and activities. The oceans have been sadly neglected.

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<sup>10</sup>Elisabeth Mann Borgese, *The Future of the Oceans: A Report to the Club of Rome*, Montreal: Harvest House, 1986



In considering ocean indicators, one might start by reflecting on indicators in general -- on how they are arrived at and on what is done with them. Four axioms might launch the discussion

1. **Indicators follow theories.** We do not count pebbles on a beach or sheep in a field without some rationale -- even if the rationale might be as flimsy as "it will help put one to sleep!"
2. **Indicators do not have to be numbers.** In a numerate world that might sound unorthodox. But it does serve to remind us that not everything can be tidily measured and turned into dollar signs, weights, or other quantifiable dimensions. Just as snow can have many names and characteristics to an Inuit, so the ocean has many colours and sends many signals to a Bajo fisherman in rural Sulawesi. The more mechanised we become, the more readily we lose sight of the messages of non-numerical indicators.
3. **Data awaits human insights to recognize their shapes and to interpret their meanings.** Data, of themselves, can signify much. To an animist, the sound of rain on a rock or the colour of a stream bed might evoke concepts of gods or demons, of spirits past or future. To a geologist, those same sounds and sights can suggest gold or copper, iron-ore or coal within the rock face.
4. **Indicators are, in a world of some uncertainty, frequently couched within frameworks of probability.** The likelihood of an individual having a disease, when particular measures of heat, blood contents or visual characteristics fall within such and such a range, might be 20%, or 50% or whatsoever....

Over time the importance of particular indicators has changed. The significance of the sighting of Haley's comet is considerably different today than was the case at its first recorded sighting. Knowledge can reduce uncertainties: but it can also limit a more holistic understanding of life. Who is to suggest that a modern composer can plumb the emotional or spiritual depths of a Beethoven or Mozart? Could a Leonardo da Vinci have ever emerged in Twentieth Century North America?

The oceans remain a realm of the still largely unknown.

One of the accomplishments of twentieth-century humanity has been the delineation of a number of land-based shapes, albeit very imperfectly and haphazardly. National accounts provide some shape to the size and broad past behaviour of nation states in the context of production and consumption -- at least when such activities fall within a market place that allots prices or weights. The Human Development Index, despite many limitations, parallels the GNP indicators in the context of "human welfare." The oceans are practically ignored. They rarely fall into nation states -- they fringe them; they rarely, indeed are treated "in their own rights" but almost always as adjuncts: as if their claims for recognition were directly dependent on land-oriented policies.

Ian McAllister

In this section we are trying to contribute to closing this lacuna.

Indicators in fact are needed to perform measurements of monetarized and non-monetarized resources. in a more comprehensive theory of wealth and welfare rooted in the concept of Common Heritage of Mankind.

Traditionally, indicators are defined as information which (a) is a part of a specific management process and can enable comparisons of results to be made over time and between

policies; and (b) has been assigned a significance beyond its face value. Indicators can be developed (and distinguished) from general-purpose statistics that have important applications in their own right; and then be used for problem-solving of given issues.

This section presents in the first part ongoing initiatives relevant to ocean-related indicators, discusses in the second part gaps in ocean related indicators and explores in the third part the validity of ocean related indicators in the light of the new economics of Common Heritage of Mankind. Conclusions round up the analysis.

### ***1. Ongoing Initiatives About Ocean Related Indicators***

We call the explicit development of indicators "Indicator movement."

Greener national accounts are being developed in a variety of shapes and forms and deserve attention by consumers and producers of indicators alike. They are being built upon the legacy of traditional national accounts, but are extending the framework to respond to the challenges of "sustainable development." Similarly, attempts to take into account social and environmental factors through cost-benefit analysis and environmental impact assessment (CBA/EIA) brought about a development of methodologies and applications useful to the indicator movement.

#### ***(a) Descriptive indicators***

In his Report to the Club of Rome, Giarini<sup>11</sup> introduces Dowry and Patrimony, that is, the global stock of wealth, as a combination of natural (e.g., physical and biological) and man-made (e.g., cultural, human skills and "man-enriched" capital.) Similarly, the United Nations Commission on Sustainable Development distinguishes *social, economic, environmental* and *institutional* aspects of sustainable development<sup>12</sup>. *Uncertainty* and changing values have to be

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<sup>11</sup> Giarini, 1988.

<sup>12</sup> UN, 1996.

factored into assessments of each component of sustainable development. In shorthand, we call these parameters "the S.E.E.I.U. (*Social, economic, environmental, institutional, uncertainty*) dimensions."

**(b) *Social indicators***

Social indicators for large series of countries are elaborated and routinely presented by the UNDP, e.g., in its Human Development Report and by the World Bank, e.g. in its World Development Report<sup>13</sup>.

UNDP's Human Development Report (described in Box 1) specifies a number of welfare indicators and brings them together into a Human Development Index. These are meant to measure the social and economic situations in some 175 countries and to enable country comparisons to be made.

Human Development Indicators inevitably must have some relevance to the use and health of the oceans. The same is true for indicators such as GDP/GNP. Thus the aggregate levels of a nation's output will often give some proxy indication of the pollution that is likely to pour down its rivers, the pressures on fish stocks, the volume of international trans-oceanic trade, and so on. Employment and unemployment "indicators" can give an indication of how seriously environmental factors, likely to impinge on the oceans, may be taken. (In times of high unemployment, environmental protection groups tend to be marginalized by growth and higher employment "at any cost" groups.) Land-use and income distribution data, urban population densities in coastal cities, annual marine fish catches and numbers and size of protected areas -- such indicators provide clues to the intensity of use and abuse of the oceans and ocean resources.

For other variables, such as life expectancy, the linkage with ocean development may be less direct -- but even in such numbers clues may be encountered. For small island developing

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<sup>13</sup> UNDP, 1997. World Bank, 1997.

states (SIDS), the social and economic situation can be centrally a result of ocean development (or nondevelopment); for them, almost all nation-wide social and economic indicators are “ocean related.” Large coastal countries like Argentina or Canada, on the other hand, depend for much of their social and economic development on interior land resources as well as on marine activities. For them, indicators such as GDP and life expectancy will impinge less heavily on the oceans, albeit many interior mined or manufactured products find their ways across the oceans through international trade arrangements. Large countries must develop meaningful ways for disaggregating economic and social indicators in a manner that will slow their impacts on the oceans.

*(c) Economic indicators*

Ocean related goods and services fall into many categories. Thus, for example:

- ◆ offshore oil, gas and non-fuel minerals
- ◆ man-made capital (built infrastructure such as ports and harbours, ships, oil-rig installations)
- ◆ sea-born trade, services and institutions;
- ◆ coastal and marine associated tourism

Such factors were referred to in the previous section reporting production (flow) estimates. We now turn to considerations about stocks and their impacts.

Global data on energy and mineral reserves are regularly compiled by specialized institutions including the World Energy Council, the International Energy Agency, the US Bureau of Mines and the World Bureau of Metal Statistics.

Offshore reserves and their depletion (or growth) are not, however, identified in the major data reports (nor in the two sustainability indicators about fossil fuel energy and mineral reserves proposed by UN-CSD; see below). Stock of built infrastructure should, in principle, be embedded (over time) in the national accounts and capital depreciation/accumulation processes should also be detectable (but far from readily). Input-output matrices provide indications of

inter-industry flows, and specialized publications (e.g. OECD Maritime transport, for the world fleet; and FAO yearbooks for the fishery fleet) provide further pieces of the complicated and far from fully understood picture..

**(d) *Environmental indicators***

Environmental indicators reflect stock and/or flow realities of marine resources, with man-made and natural additions and deductions (flows) modifying the initial into a final stock. As with economic indicators, stock has a quantity and a quality aspect: such as size of species population and contaminants in fish. Flows result from "*usus*", e.g. sustainable harvesting, and "*abusus*" of natural resources, i.e. over-exploitation of renewable and depletion of non-renewable resources; pollution resulting in environmental expenditures and non-compensated economic costs; as well as loss of ecological functions and immaterial welfare (e.g. damage to landscape and cultural patrimony).

Over-all, the UNDP/CSD indicator menu lists approximately 130 indicators used in the UN-CSD proposal for sustainability indicators, and the Core Data Sets Matrix, some 170 parameters/data-sets used for the first UNEP Global Environmental Outlook (GEO-1<sup>14</sup>) . Of the latter, about 30 can be considered social and 40 economic indicators; this leaves about 100 environmental indicators; of these we consider up to one fourth being ocean related, more than half terrestrial and the remaining quarter general (climate, institutional support).

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<sup>14</sup> UNEP/DEIA/MR.96-3. A core data working group (1996), six regional consultations held in 1996 and a model-based analysis supporting GEO-1 were preparatory initiatives of DEIA, UNEP's Division of Environmental Information and Assessment. Our following review is also based on: UNEP/UN System-wide Earthwatch Coordination, 1995; *UN system-wide Earthwatch Programme Document*. The mission of Earthwatch is to coordinate, harmonize and integrate observing, assessment and reporting activities across the UN system in order to provide environmental and appropriate socio-economic information for decision-making on sustainable development, including information on the pressures on, status of, and trends in key global resources, variables and processes in both natural and human systems and on the response to problems in these areas.

As recalled in the previous section, sea water is used for desalination and for producing renewable energy from the ocean (including tidal energy for the production of electricity). Indicators of bathing quality, metal content and coastal marine water quality, litter in marine environment (quality of stock) reflect pollution through dumping, discharges and, as proposed by UNDP/CSD, releases of Nitrates and Phosphates and oil discharges; GESAMP offers an overview over the respective and more general indicators<sup>15</sup>.

Within our category of natural areas, small islands indicators are reported i.a. in UNEP's Island Directory<sup>16</sup> and in UNDP's Small Island Developing States Network. Interesting in the present context is also UNEP's Barbados Programme of Action for Small Island Developing States (SIDS), to be fully reviewed in 1999. Besides the length of coasts (stock quantity), GEO-1<sup>17</sup> gives estimates about pollution and the resulting stock quality. The Barbados International Coral Reef Initiative for small islands may complement existing data about reef disturbances and reef uses. As for protected parks and reserves, the standard inventories (IUCN, WCMC) identify marine sites and are the basis of a proposed sustainability indicator (stock quantity)<sup>18</sup>.

GEO-1, reporting on flora including mangrove loss, and an algae index, proposed as sustainability index, concern stock quantity. Algae Catch (World Resources Institute; flow) relate to the uses for pharma/food mentioned in the previous section. A sustainability indicator

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<sup>15</sup> GESAMP, *State of the Marine Environment*, 1990, 1996.

<sup>16</sup> UNEP, 1991.

<sup>17</sup> UNEP, 1997.

<sup>18</sup> For a detailed table from national and international systems for protection of natural areas, including separate data for marine and coastal protected areas, see the bi-annual "World Resources" of World Resources Institute.

for threatened species as a percentage of total native species is proposed for vascular plants and vertebrate species; however, no distinction between marine and terrestrial is mentioned (IUCN, World Conservation Monitoring Centre).

Other sources for fauna include the UNEP/FAO Marine Mammal Action Plan and the International Whaling Commission. For fish and other marine animals, estimates for stock quantity, stock quality (contaminants), catch and accidental kills (mainly FAO, incl. mariculture) are available. The UN-CSD list includes an indicator for maximum sustainable yield for fisheries.

Some indicators exist already for taxonomic, genetic, ecosystem and environmental function diversity including threatened and endemic species, protected areas, and percentage of developed coast. The Global Biodiversity Forum's Dialogue on Biodiversity Indicators and Implementation Targets should provide impetus for a systematic treatment within the implementation of the Biodiversity Convention. UNEP's Biodiversity Programme and Implementation Strategy gives priority to marine biodiversity, including in SIDS<sup>19</sup>.

**(e) *Uncertainty***

"Owing to the complexity of the mechanisms that affect biological capacity and fish populations, estimates of commercial fish stocks are uncertain at the present time"<sup>20</sup>. This statement in UNEP's latest Environmental Data Report recalls the "limits to certainty" inherent in every indicator or index, be it descriptive of the present state or future-oriented.

Uncertainties exist: with regard to the measurements and resulting statistical data, the

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<sup>19</sup> See also UNEP, 1995; *The UNEP Biodiversity Programme and Implementation Strategy* - As well as UNEP, 1995; *Global Biodiversity Assessment*, an over 1100 pages report about the present state of knowledge, gaps in understanding and areas where further research is needed.

<sup>20</sup> UNEP, 1993, *Environmental Data Report 1993-94*. See also Giarini/Stahel, 1993.

causal relations and the models used to represent reality; and no probabilities can be calculated and assigned to outcomes. Therefore a vulnerability index may be developed and merged with the more traditional social, economic and environmental indicators. Thus the UN Department of Economic and Social Affairs (DESA) has initiated work on the development of a Vulnerability Index in support of the Programme of Action for the sustainable development of small island developing States (SIDS) and has suggested that an economic vulnerability index and an ecological vulnerability index be constructed.. Already in its Island Directory<sup>21</sup> UNEP has proposed an index for important islands at risk underlining the importance of marine conservation, human impact and data reliability. More recently, Briguglio<sup>22</sup> addressed the issue of SIDS, in an attempt to quantify factors enhancing their economic vulnerability (dependence on external economic conditions, remoteness and insularity, disaster proneness). On this basis he attempted to construct a composite index of vulnerability. For one out of three analysed SIDS, the switch from the present GDP-based ranking to the ranking based on the vulnerability adjusted development index would have immediate conditionality effects. In another example, vulnerability to anthropogenic change of tropical coastal ecosystems was calculated as a function of GNP per capita and population density, and the resulting normalized vulnerability index was plotted against a normalized resource abundance index for mangroves, sea grasses and coral reefs<sup>23</sup>.

***(f) Indicators for sustainable development***

Agenda 21 emphasizes the need for indicators in Chapter 40, requesting the United Nations system to create, with other relevant organizations, a set of indicators reflecting developments towards sustainability. Subsequently, the UN Commission on Sustainable Development adopted

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<sup>21</sup> UNEP, 1991.

<sup>22</sup> Briguglio, 1995.

<sup>23</sup> World Resources Institute, 1986.



a Work Programme on Indicators of Sustainable Development whose primary purpose is to make internationally consistent ISDs accessible to decision-makers at the national level. On an international level, it is especially the Department for Policy Coordination and Sustainable Development (DPCSD) of the UN Division for Sustainable Development which is dealing with this issue. A provisional core set of ISDs was published in 1996 with the approval of the Commission on Sustainable Development under the title *Indicators of Sustainable Development - Framework and Methodologies*<sup>24</sup>. Preparatory activities of UNEP/EAP Environment Assessment Programme in this ISD process included an overview of environmental indicators (1994), a SCOPE-Belgian-Costa Rican Workshop held in January 1995 in Ghent, and the SCOPE scientific workshop on ISDs in Wuppertal, Germany, of November 1995.

In the published core set of ISDs the dimensions are social, economic, environmental and institutional; although holistic, the approach does not include moral/ethical/spiritual sustainability, defining acceptable behaviour and motivating people to act in the common interest. Descriptive methodology sheets for every ISD (with no estimates for the time being) are presented according to the dimensions, the chapters of Agenda 21 and the indicator type (driving force, state or response indicator).

In principle, an ISD results from the national descriptive indicator discussed earlier in this section, from the corresponding international sustainability target (e.g. the critical stock or level of a coastal resource) and from the comparison between the two. Environmental targets or limits may have an objective, scientific basis; social and economic targets/limits are much more value loaded and hence subject to each society's concepts, goals and values. This may explain why, for most of the indicators, international targets are not yet available.

A dozen ISDs can concern ocean development, such as indicators about income inequality, the environmentally adjusted Net Domestic Product EDP, mineral reserves, fossil fuel reserves, lifetime of proven energy reserves, population growth in coastal areas, discharge of oil,

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<sup>24</sup> UN, 1996.

Nitrates and Phosphates into coastal waters, maximum sustainable yield for fisheries, existence of algae, threatened species and protected areas. Within this dozen ocean related indicators, one is expressed in monetary terms, namely EDP. Targets are defined for only three: for sustainable yield for fisheries, for threatened species and for the protected areas. Finally, one third of the ocean related SDIs are "under development" altogether. This reminds us of the fact that the CSD core set of ISDs still is in development.

***(g) Other relevant initiatives***

Greener national accounts, Functions of Nature (eco-system services) services and Cost-benefit analysis support the indicator movement in several ways.

***(I) Greener national accounts***

At a conference at the European Parliament, the Club of Rome and WWF-International called for a modification of the U.N. System of National Accounts (SNA)<sup>25</sup> framework and boundaries leading to a new, Nature-adjusted single measure incorporating the value of Nature's resources and services<sup>26</sup>. Satellite accounts offer a mid-way solution in that without modifying the SNA they complement it with estimates of stocks of natural resources, environmental non market services and damages due to economic activity. In its Satellite system for integrated Environmental and Economic Accounting (SEEA), UNSTAT<sup>27</sup> offers a menu of five alternative versions, Version IV being concerned with satellite accounts. Pilot country applications of parts

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<sup>25</sup> UN Statistical Office, 1994.

<sup>26</sup> Sheng, 1995. Van Dieren (ed.), 1995.

<sup>27</sup> UN Statistical Office, 1993.

of SEEA exist e.g. for Colombia, Mexico, Papua New Guinea, Thailand.

Ocean related explorations of greener accounts include:

- ◆ accounting for the depletion of natural resources : e.g. the World Bank's Genuine Saving (output minus net depletion of natural resources)
- ◆ estimates in several developing and industrial countries for off-shore minerals and oil; for the recreational value of marine resources; for wetlands, mangroves and marine wilderness areas; for fishery and national patrimony;
- ◆ more adequate treatment of "defensive" expenditures: in Germany in general and in Mexico for environmental protection services; in half a dozen industrial countries development of an Index of Sustainable Economic Welfare (ISEW) covering, i.a., costs of pollution and non-renewable natural resource depletion;
- ◆ accounting for the degradation of environmental quality: e.g. of the Yellow Sea off Korea with oil spills and hazardous substances, of the Chesapeake Bay due to herbicide pollution.

The UN Satellite System for Integrated Economic and Environmental Accounting can also be used to calculate linkage environmental indicators. In a pilot study for 11-13 developing and industrial countries, the World Resources Institute, e.g., formulated a macro-economic Index of Resource Depletion measuring the value of the decline in natural resource stocks relative to the value of gross investment in man-made capital during the given year. The Institute produced also a disaggregated Resource Depletion Index for the agriculture-forestry-fisheries sector measuring the ratio of the SEEA environmentally adjusted domestic product combined to the standard GDP for these resource sectors<sup>28</sup>.

Green accounting supports the indicator movement by generating relevant quantitative data and methodologies, representing the linkage between economy and environment on which to base macro-economic indicators, offering the

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<sup>28</sup> Hammond et al., 1995.

input needed to develop environmental ISDs. Hence it is not surprising that countries including Finland, France, the Netherlands and the United Kingdom are integrating, in one way or another, the efforts towards greener national accounts and the generation of indicators in practical applications.

*(ii) Functions of Nature*

It is in line with the present context of the Common Heritage of Mankind concept and the modern service economy to consider the studies dealing with functions of nature as further initiatives helpful to the indicator movement. Costanza's attempt to measure the "eco-system services" performed by the oceans has already been mentioned in the previous section. Here, attention is drawn to the system of some 50 functions of the natural environment developed by de Groot<sup>29</sup>. They are grouped in regulation functions for essential ecological processes and life support systems, carrier functions providing space and a substrate or medium for human activities, production functions covering the provision of many resources, and information functions offering opportunities for reflection, spiritual enrichment, cognitive development and aesthetic experience.

De Groot has applied this system to the Galapagos National Park (Table 4) and the Dutch Wadden Sea. Other ocean related applications include regulation functions (e.g. waste treatment services provided by wetlands compared to restoring a wetland); nursery function of estuaries and wetlands; primary productivity of some coastal marshes supporting offshore commercial and recreational fishing industries; carrier functions (the value of wildlife-related recreational activities; in Canada they exceed by far the economic value of sport fishing or hunting); production functions (the contribution of wildlife to the US economy, including fisheries, biological diversity, ecological services, recreation; marine medicinal resources).

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<sup>29</sup> De Groot, 1992.

### ***(iii) Cost-benefit analysis, Environmental impact assessment***

Over the past decade, significant progress has been achieved in the development of techniques for the monetary valuation of environmental damage and benefit. In its Cost-Benefit Analysis/Environmental Impact Assessment-Programme, OECD has published a comprehensive survey of existing techniques and data as well as an analysis of some fifty case studies from six member countries<sup>30</sup>.

In the Netherlands for example, the value of water quality for recreation was estimated using the market price of entry to commercial swimming pools and the value for navigation was calculated based on savings in sludge removal. In a series of valuations of user and non-user benefits from Norway, the total cost and the contingent valuation method were applied.

This OECD Programme illustrates an initiative supporting the indicator movement with new methodologies and applications recalled also later.

## ***2 Gaps in Ocean Related Indicators***

### ***(a) General***

Ethical/values/consciousness dimensions of human life, leading to efficiency, vitality and harmony are, missing. With respect to Agenda 21 Earthwatch<sup>31</sup> mentions as gaps local population programmes (3C), establishment of global marine databases and better quality fishery data at the national level (17), and consistent geo-referencing of data. Also, a specific northern orientation of indicators should be avoided.

Downstream of indicators, detailed statistical analysis of the ocean relevance of potentially pertinent variables like coastal population or regional income are needed. Concerning

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<sup>30</sup> Barde/Pearce (eds.), 1991.

<sup>38</sup> UNEP/Earthwatch Coordination, 1995.

the marine sector's contributions to GNP, the European Union's Environmental Assessment report<sup>32</sup> considers information for transport, tourism and fishing/aquaculture as weak, and UNEP has prepared guidelines, with pilot applications in Gambia and Tanzania.

***(b) In specific sectors***

*"Many highly aggregated economic and social indicators have been widely adopted, but there are virtually no comparable national environmental indicators to help decision-makers or the public evaluate environmental trends"*<sup>33</sup>. At the level of disaggregated environmental indicators, main data gaps concern marine renewable energy technology; fish stocks and aspects such as trends in fishing techniques, employment levels and productivity; biodiversity. A distinction between the terrestrial and the marine part of phenomena should be aimed at whenever appropriate, and lessons gained with like-minded initiatives (greener national accounts, functions of nature, CBA/EIA) in methodology, data generation and applications should systematically be exploited. Also, inter-dimension linkage indicators are needed, as well as introducing some environmental aspects into the Human Development Index HDI.

The Brent Spar affair 1995 confirmed the general level of ignorance of matters oceanic: The oceans remain a realm of the still largely unknown. Indicators of vulnerability and indicators couched within frameworks of probability should systematically be developed.

We have gone a long way since the publication of my first report on the oceans to the Club of Rome. We still have a long way to go -- and will, for ever.

Completeness and international acceptance of the methodology sheets for ISDs still need scientific input, efforts of the agencies involved and intercultural cooperation of all governments. In fact, the Work Programme sets out a number of activities including:

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<sup>32</sup> European Environment Agency, 1996.

<sup>33</sup> Hammond et al., 1995.

- ◆ further identification and assessment of linkages between economic, social, institutional and environmental aspects of sustainable development and the development of linkage-based, policy-relevant indicators;
- ◆ further work on highly aggregated indicators;
- ◆ completion of the national testing phase during which a few selected countries have volunteered to test and evaluate the use of ISDs.

### ***3. Inconsistency of Present Indicators with Common Heritage Economics***

The validity of present and projected ocean related indicators in the light of the new economics of Common Heritage must now be explored

#### ***(a) Requirements for consistent indicators***

Orio Giarini<sup>34</sup> repeatedly insists on the fact that a more comprehensive theory of wealth and welfare, in the context of the economics of the Common Heritage of Mankind, encourages utilization of indicators. They must address the following points:

- I indicators are needed especially for non-marketed and non-marketable goods and services;
- ii wealth and welfare is a combination of natural or physical and biological, of man made (cultural tools) and of monetarized (capital) phenomena; this holistic view reflects our social, economic and environmental dimensions;
- iii stock rather than flow magnitudes must be addressed; The value added accounting system is based *on flow*. *What is needed is the effect on stock*.
- iv utilization instead of exchange value is relevant; Exchange value, up to a certain point, is a sub-system and can be used as a part of utilisation value, provided that deducted value

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<sup>34</sup> Giarini, 1980. Giarini/Börlin, 1988.

is taken into account.

- v non-remunerated work, i.e. work not exchanged and work exchanged, but not paid with money, must be included;
- vi deducted value, i.e. costs of man-made pollution and over-exploitation of ocean resources, must be taken into consideration; and
- vii uncertainties inherent in complex systems have to be taken into account.

Stock and flow magnitudes (cf. iii) relate: during a given period, man-made and natural additions and deductions modify the opening into a closing stock; hence methodologies for compiling stock and flow indicators have to be compatible. Moreover, national accounts link (v) and (vi): today's GDP is too low since it excludes non-remunerated work, and too high since it includes environmental costs. As for unpaid work (v), the value of non-SNA production in industrial countries is at least half of gross domestic product, and in developing countries it is even higher. It accounts for more than half of private consumption; at world output basis, unaccounted household and voluntary community work including the informal sector adds about 70 % to the officially estimated \$23 trillion of global output<sup>35</sup>.

### **(b) *Inadequacy of today's indicators***

Some examples will show how ocean related indicators do not fulfill all of these requirements.

#### ***(I) Multidimensional programmes***

A holistic approach is attempted by the UNDP/WHO core set of indicators for sustainable development and WRI's World resources report. They both cover the social, the economic and the environmental dimension. Other sets of indicators concentrate on only two dimensions, as, e.g., SEEA, the UN system for integrated economic and environmental accounting, and the Human Development Index with social and economic indicators. Still other initiatives cover

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<sup>35</sup> UNDP, 1995.



mainly one dimension, such as the UN System of national accounts (the economic dimension) or UNEP's GEO-1 and the Environmental Data Report ( environmental dimension); or they deal in depth with one sector, such as FAO for fishery. In the marine sector, however, multidisciplinary is not applied adequately.

***(ii) Wealth from marketed and not-marketable natural resources***

The estimated value of marketed marine natural resources such as fish or off-shore oil depends on the estimated quantity and on the valuation method. The quantitative estimates depend on the choice between stock (e.g. stock of fish; man-made capital) or flow (e.g. fish catch; GNP) and hence concerns point (iii) above. The stock approach has already been fully adopted in some areas, e.g. for IUCN's threatened species reports, and is now being proposed in some others, especially in national accounts with SEEA and in UN-DPCSD's ocean related ISDs.

The valuation, moreover, is based on net prices, i.e. market prices minus external costs, or on user-costs (based on the value added element [true income] and the user-cost element [depletion costs] ). These valuation methods should respect the point (iv) above, i.e., utilization instead of exchange value, point (v), i.e., they should include non-remunerated work; and (vi) they should exclude deducted values or external costs. Acceptance of these requirements is growing<sup>36</sup>, but application has by no means been generalized. The suggestion, by the CSD core set of ISDs, of an indicator "environmentally adjusted net domestic product" (EDP), is therefore of great importance..

The valuation of non-marketable marine resources like mangroves or wilderness areas depends on a delicate choice between methods developed in the area of CBA/EIA. Relevant are the different motivations people have in valuing natural resources: for an actual use (use value), for preserving the option to use it (option value), for the environment's own sake or intrinsic value of species and ecosystems (existence value). The use value is estimated via surrogate

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<sup>36</sup>Think e.g. of SEEA for external environmental costs and of the Human Development Report for wealth not covered by SNA.

markets like travel costs to recreational sites, the option value via experimental markets with the contingent valuation method, i.e. asking people what they would be willing to pay for the conservation of a certain asset, the existence value with the replacement, avoidance, and maintenance cost approach. Total economic value of natural resources then corresponds to actual use + option + existence value. The recognition of these different forms of values is a contributions to developing the concept of utilization value in wealth and welfare will help developing the new Common Heritage economics..

A systematic treatment of uncertainty (point vii) is still lacking.

Turning rapidly to like-minded initiatives, we are reminded of SEEA in National Accounts and of the functions of nature approach. SEEA Version IV deals with valuation methods, however without giving clear-cut guidelines for the valuation of depletion and degradation. Table 1 about the socio-economic value of the functions of Galapagos National Park on the other hand gives estimates for the types of values mentioned above for the regulation, carrier, production and information functions. This remarkable application is instructive; a detailed analysis however would show where the requirements from Common Heritage economics are not satisfied.

*(c) Quantitative and aggregated indicators?*

Point (I) calls for indicators; but do they have to be quantitative and aggregated? Indicators do not have to be numbers. In the Global Environment Outlook,<sup>37</sup> for instance, we find a graphical representation of seven environmental issues (including biodiversity as well as marine and coastal zones) in seven world regions in four different colours according to intensity of concern. Regional environmental trends are represented in an analogous way, and both summaries are concise and informative.

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<sup>37</sup> UNEP, 1997: GEO-1 p. 6-7.

Indicators may have many components, but the final indices must be few in number; otherwise decision-makers and the public will not readily absorb them<sup>38</sup>. This requires aggregation within each of the three dimensions social, economic and environmental, applying e.g. natural weighting based upon physical and chemical properties, weighting proportionally to economic consequences or assigning weights by experts or by citizen. The resulting three partial indices may remain disaggregated (e.g. SIDs, the GEO-1 or the HD Report indicators) or else be aggregated if dimensionless or expressed in a common term (e.g., with the HDI and the vulnerability index..

Hence, indicators exist in non-numerical, physical and in monetary terms, and also aggregated to an index, and this is consistent with the requirement of point (I).

#### **4. Conclusions**

Much work is going on in the indicator movement in general. An indicators web site will provide users with the latest news related to the CSD indicators programme<sup>39</sup> Renewed impetus will also come from the agreement reached at Earth Summit+5 to strengthen efforts towards a sustainable use of the oceans. Lessons learned from like-minded initiatives (greener national accounts, functions of nature, CBA/EIA) in methodology, data generation and applications however should more systematically be exploited.

Gaps in ocean related indicators exist in general, specifically in descriptive social, economic and environmental indicators, in coping with uncertainty and concerning indicators for sustainable development.

Much of what exists has to be thought through in the light of the new economics for Common Heritage.

Concerning the holistic, multidisciplinary approach required, attempts are being made to

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<sup>38</sup> Same opinion as Hammond et al., 1995.

<sup>39</sup>Address: <http://www.un.org/desa/dsd/isd.htm>

## BOX 1

### **UNDP's HUMAN DEVELOPMENT REPORT WITH THE HUMAN DEVELOPMENT INDEX HDI**

UNDP's Human Development Report, annually published since 1990, presents Human Development Indicators and the Human Development Index for each of 175 countries, for some aggregates (regional, developing and industrial countries, North-South, rural-urban) and for the world as a whole; also, efforts towards further subnational disaggregations are ongoing.

The set of over 200 Human Development indicators concerns the human development/deprivation profile, wealth, and economic performance.

The Human Development Index reflects achievements towards a long and healthy life, knowledge, and a decent standard of living. In the first, descriptive step are produced the country's estimates for life expectancy, educational attainment (depending on adult literacy and school enrollment), and GDP per capita (adjusted for the local cost of living and for the diminishing utility of higher levels of income). In the following normative step, minima and maxima identical for every country are stipulated in each of the three components; each country's descriptive indicators are then compared to the corresponding minima; finally, the obtained measures of the way gone are put into relation with the full way, i.e. with the corresponding difference between the two extremes. The resulting dimensionless relative values then indicate how far that country already has gone towards the attainment of certain defined goals: the closer its indicators are to 1, the shorter is the remaining distance that country has yet to travel. At last, a simple average combines the three dimensionless indicators into one single HDI.

The HDI accounts for the social and the economic dimension. Proposals to include material intensity of economies, to adjust existing components of the HDI, or to construct an all new Green Index to stand alongside the HDI tend to introduce the environmental dimension.

Source: UNDP, 1997.

TABLE 4

### SOCIO-ECONOMIC VALUE OF THE FUNCTIONS OF THE GALAPAGOS NATIONAL PARK

(based on maximum sustainable use levels)

(Values are expressed qualitatively (++) or in US\$/ha/year) except column 7

Total surface area of the study area = 1,150,000 ha)

#### Types of values

Environmental Functions	1 Conser- vation	2 Existence Value <sup>3</sup>	3 + 4 Social Values	5 Consumptive Use value	6 Productive Use value	7 Value to Employment (People) <sup>1</sup>
<b>Regulation functions</b>	<b>&gt;63.00</b>	++	++		++	
Watercatchm./erosion	0.30		+		*	
prev.Bio-energy fixation (1,200.00) <sup>4</sup>		+			*	
Storage/rec./ human						
Waste	58.00 <sup>2</sup>		+		*	
Biological control	++	+	+		*	
Nursery f./migration hab.	7 <sup>2</sup>	++	++		*	
Maintenance of biol.div.	4.90	++	++		*	
<b>Carrier Functions</b>	<b>0.50</b>	++	+		<b>&gt;45.00</b>	<b>&gt;833</b>
Aquaculture					0.02 <sup>2</sup>	+
Recreation		+	+		45.00	772
Nature protection	0.55	++	++		*	61
<b>Production Functions</b>			++	+	<b>&gt;8.00</b>	<b>&gt;160</b>
Food/nutrition			++	+	0.70	156
Genetic resources					+	+
Raw materials for constr.					5.20	4
Biochemicals					++	+
Energy resources					1.50 <sup>1</sup>	+
Ornamental resources					0.40	+

	1	2	3 + 4	5	6	7
<b>Information Functions</b>	<b>0.50</b>		++	++	<b>&gt;3.00</b>	<b>&gt;67</b>
Aesthetic information			+	++	+	
Spiritual information	0.52		++	++	*	
Historic information			+	++	*	
Cultural/artistic insp.			+	+	0.20	+
Educ&scientific inf.				+	2.70	67
<b>TOTAL ANNUAL</b>						
<b>RETURN</b>	>64.00	++	++	++	>56.00	(1.060)
<p>1. This function applies to the terrestrial area only (720,000 ha).</p> <p>2. This function applies to the marine area only (430,000 h of which 4,100 intertidal zone).</p> <p>3. Social values consist of the importance of environmental functions to human health and the option value placed on a safe future.</p> <p>4. If a figure is given between brackets it was not used in calculating the total value because the calculation is too speculative.</p> <p>* These functions do contribute to economic productivity, either directly or indirectly, but no market or shadow price could be determined due to lack of information and/or shortcomings of the market mechanism.</p>						
<p>Source: De Groot, 1992, p. 235</p>						

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Founex, 17 April 1998

Prof. E. Mann Borgese  
IOI Dalhousie University  
1226 LeMarchant Street  
HALIFAX, Nova Scotia  
Canada, B3H 3P7

Dear Elisabeth,

I was glad in February reading your "everything is in good order now", and sad at your last fax from St.Moritz! I hope you had at least a good time skying, like last year.

Meanwhile, I discovered with Orio a copy of your 'First draft' pp. 1-362. Earlier, you had sent me a former version of chapter 3; so I looked in the 'first draft' for the indicator section and your chart p. 93-95, made some remarks on photocopies of relevant pages [as e.g. p. 136a, a tentative pro memoria for a bridge between the indicator section and the institutional Ch.5/annex p. 257/305] and listed them on an 'overview'. Please have them by express mail.

Also, Orio asked me to send copies of some excerpts of his D&P-CHM-indicator writings to experts, as described in his enclosed fax. We would be happy to join to them the indicator section in my original version (Bö-paper to you, September 1997). I shall start with it as soon as my wife no longer needs a maggiordomo-chauffeur-secretary because of her broken right hand, and shall assume your permission unless you do not fax otherwise by beginning of the last April week (by 27 April); thank you on behalf of Orio for your cooperation.

All the very best.

Encl.: - remarks p. 136a your 'first draft'  
- copy of fax from Orio Giarini

Annex by Worldexpress: Remarks re your 'first draft':

(1/2) 3 pages overview

(3) some 20 annotated pages incl. p. 136a

Letter with encl. also to home fax

*To Orio*

Already in our first Report to the Club of Rome<sup>39</sup> we recommended the elaboration of adequate indicators. More than a decade has passed since then; now it is possible and needed to give substance to that call for indicators. To

promote the development of ocean related indicators, consistent efforts should be undertaken especially by the task forces for sustainability indicators and for biodiversity indicators as well as by the regional training workshops on CSD indicators (e.g., the workshop conducted in June 1997 in Accra, Ghana, for Africa). Also, the greening of national accounts should extend to marine resources. I

Most importantly, the generation of adequate marine indicators should be institutionalised at the broad UNCLOS-level. In fact, it surprises that our following chapter on Ocean Perspectives: Institutional<sup>40</sup> cannot yet mention an actor entrusted with overall responsibility for marine indicator building. Perhaps a lesson could be learned from developments occurring within the Convention on Biological Diversity. For example, at a recent meeting of the governing body, it was decided to establish a "Core set" of biodiversity indicators covering the major biomes including marine/coastal; soon, the need for an informal, global dialogue to explore a range of options for biodiversity indicators was recognised; to begin this dialogue, a group of ten institutions and governments decided to sponsor jointly a meeting of the Global Biodiversity Forum<sup>41</sup> aiming at raising awareness of the state of the art, at examining options and identifying areas of agreement and disagreement, as well as at identifying options for a "core set" of biodiversity indicators. It may be worthwhile to think of options for a "Global Marine Indicator Forum" strongly linked with the two sustainable indicators and biodiversity indicators processes. Simultaneously,

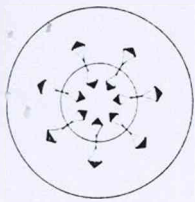
however, as Giardini put it, a new theory of value (utilisation value) must be developed. This will undoubtedly enhance the development of a new economics for the Common Heritage.

<sup>39</sup> Borgese, 1986; cf. p. 107 above.

<sup>40</sup> Cf. Chapter 5 and the Annex below.

<sup>41</sup> Mentioned above in par. I.(a)(iii), p. 117 above.





**PROGRES**

**TELEFAX**

Research Programme on the Service Economy

ASSOCIATION DE GENEVE - THE GENEVA ASSOCIATION

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TO : **Max Börlin**  
**Patricia Goldschmid**  
**Patrick Liedtke**  
**Geneviève Reday-Mulvey**  
**Walter Stahel**

FROM: Orio Giarini

DATE: March 13, 1998

No. of pages (inc. cover sheet): 1

**Developments and Follow-ups of the reports on the Service Economy for the Club of Rome**

This is just to inform all of you that:

- Max Börlin has contributed to a report that Elisabeth Mann Borgese has now prepared for the Club of Rome on the value of the oceans, using our ideas in general on the service economy, particularly concerning the notions of wealth and value.
- Doing this activity, Max Börlin has also found several initiatives concerning the setting up of values indicators of wealth. All these indicators are becoming more and more important in different ways. They all need a basic reference to be linked to a new economic theory of the type we are proposing.
- Concerning the indicators in particular, there is a large section on this issue in the report "Dialogue on Wealth and Welfare". Max Börlin will make photocopies of these pages with others he has written himself and use them to establish a network with the major interesting people setting up indicator systems.
- It should be clear that indicators of wealth have to be integrated in a global economic theory and not simply taken as something outside economics per se. This is what the idea of the service economy is trying to achieve and therefore arrive at the new definition of wealth indicators in which GNP is only one among others even if always of course relatively important. Even in this case, GNP has to be readapted by integrating the notion of value deducted.
- All this again has to do with a clear differentiation of the notion of flow on the one hand and stock on the other, as well as on the notion of monetarized and non-monetarized values.

"First draft"

(the one with pp. 1-362 and the anecdotic indicator box on p. 109)

Remarks concerning the Indicator section at large, as well as the chart Table 2 p. 93-95: (1) Overview - List, (2) Overview - Annex, (3) Annotated pages End of March 1998

(1) Overview - LIST	
xx	Abbrev., acronyms MISSING
20	Almost only remark about form: Note <sup>12</sup> and <sup>13</sup> SHOULD BE Giarini/Liedtke.
89	<b>Ch.3</b> Econ.: Introd. SHOULD BE I. Introd.
93,95 ▼	" Table 2: Apparently, this is not yet the version corrected by Mr. Coffen-Smout. Cf. copies of my two letters below ▼▼.
109	. II. Indic: BOX SHOULD BE BOX I. . Cf. my remark on p. 109; re uncertainty e.g. the only certainty is that uncertainty is delt with half a douzen times in the Report: 19-20 Introduction, by EMB 109 BOX, by McA 117-119 as a dimension of indicators, by Bö 130 as an aspect of Comm Herit of Mankind, Bö 165 as a principle of C.H.M., by EMB 284 with the Recommend and Conclusions, by EMB . Why "launch the discussion"? Why not have a look at the bibliography and join those who discuss since long, or, even better, those who act now?
111- 121	(b) Social i. SHOULD BE; (i) 111 (c) Economic i. (ii) 113 (d) Environmental i. (iii) 114 (e) Uncertainty (iv) 117 (f) I. for sustainable development (b) 119 (g) Other relevant initiatives (c) 121
120 !	1.(b) ISDs: Eur. Commission's pilot study added.

<ul style="list-style-type: none"> <li>. © IV. Principles and guidelines for the econ. of the C.H., p. 162-169</li> <li>. • § 6. Recommendations and conclusions, p. 282-288</li> </ul>	<ul style="list-style-type: none"> <li>. 3.(a) Requirements for consistent indicators, p. 128-130</li> </ul>
1 * holistic approach	ii holistic view
5 + uncertainty	vii uncertainties
7 wealth: 166 285 f.	
* composite/holist. x x	ii holistic
stock, not flow x x	iii stock/flow
i. needed x x	i i. needed
non-remun. work . x	v non-remun. work
deducted values x x	vi deducted values
+ uncert/vulnerab/probability . x	vii uncertainties
8 value	iv utilization/exchange v.
Repetitions: ©•, **, ++.	

P. 93

24 Nov 1997

Dear Elisabeth,

thank you for the registered letter of November 1 with the chart/Table 2 and the second check. After coming back from an extended "journey within" I turn to your question concerning Table 2; I refer to my letter of 11 September and enclose Dr. A Behman's chart including 1995.

- a) In Table 2, col. 2 corresponds to the line Total of the group in col. 4, so in Oil & Gas, Fish etc.. If for every group with more than one activity the group Total is indicated in col.4 (e.g. in Coastal etc.), col. 2 could be eliminated, thus avoiding present redundancies.

b) Give the equation (intermediate + value added) = (total

P. 93, 95

date: 19 December 1997

Dear Mr. Coffen-Smout,

Your surprising fax dated 10 December reached me in a compact and later in a normal version; may I reply in four steps.

i Chronology. Versions:

23. 9.	EMB	6.5 trillion	mix	Annex A
6.10.	Bo	1.5 "	"	Annex A
1.11.	EMB	1,071 "	GDP	
24.11.	Bo	0,949 "	GDP	Annex B.g)

The 1.5 trillion are obsolete.

Chemin des Bosquets 1  
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Téléphone (022) 776 25 09  
Fax (022) 776 09 37

R E C E I P T

This is to confirm that I received from

Prof. Elisabeth Mann Borgese  
Founder and Honorary Chair  
International Ocean Institute  
Dalhousie University  
Halifax, Nova Scotia, Canada B3H 3P7

US\$ 10,000 of which  
US\$ 5,000 in March 1997 and  
US\$ 5,000 in November 1997

for the research

OCEAN RELATED INDICATORS - A contribution to Prof. Borgese's  
OCEAN PERSPECTIVES - A REPORT TO THE CLUB OF ROME.

Written in Founex (Switzerland) on 4 August 1998.  
Signed:

  
(Dr. Max Börlin)

## PART THREE

### REVIEW OF EXISTING MARINE RESOURCES DATA

#### 5. STATE OF INFORMATION BY ELEMENT

The contribution of ocean development to wealth and welfare discussed in Part one leads to definitions and concepts for ocean resource accounting developed in Part two. The more important available information about marine resources will now be listed according to the definitions and concepts developed earlier, i.e.

- by element:

1. Sea water
2. Minerals, energy
3. Natural areas
4. Flora
5. Fauna

- with the items:

- a) Quantity, stock
- b) deduction
- c) Quality, stock
- d) pollution from exploitation of marine resources
- e) pollution from other activities and from nature
- f) State of information
- g) Ocean development polluting other marine resources, as the inverse of (d).

## 5.1 Sea water

---

- (a) **Quantity, stock.** Sea level has been recognized as an important parameter in studies of climatic change. An increase in the global sea level of one or two meters would significantly affect coastal activities; a rise of 2 meters would inundate some major coastal regions and would flood many coastal beach resorts and marshes and low-lying flood plains along rivers and bays. A 0.3-meter rise would erode e.g. most sandy beaches along the US Atlantic and Gulf coasts 30 metres inland and could destroy buildings, roads and other structures and cause the intrusion of salt water into ground-water supplies (World Resources 1986, p. 177).

In response to the requirements expressed by the Joint SCOR/AIOC Committee for Climate Changes in the Ocean (CCCO), the IGOSS Sea Level Pilot Project in the Pacific Ocean (ISLPP0) will make available monthly data of sea level variations. Also, an Expert Group is evaluating the implication of climatic change and sea level rise for the Commonwealth countries.

- (c) **Quality, stock.** In most cases sea water quality does not seem to be a valid indicator of the state of the marine environment, and preference tends to be given to measurements based on living organisms (fish, crustaceans, molluscs, algae) or on sediment. However, this is not the case when it is necessary to assess the health risks connected with, for example, bathing, in which case the quality of the sea water itself is assessed to establish the degree of risk for Man (pathogenic viruses and so on). For the Mediterranean, MED POL is trying to improve the state of information (Publication 33).

The EC State of the environment (Publication 27) reports data on heavy metal concentrations (copper, cadmium,

mercury, zinc), PCB and oil around platforms for the North Sea from the International Conference on the Protection of the North Sea and for the Mediterranean from the Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée (Croisière circumméditerranéenne CIESM-Calyпсо) (See Annex 8).

The bacteriological quality of marine waters for selected OECD countries is shown in a table of the OECD Compendium (Publication 28).

The accumulated radio-activity, now amounting to more than 1 mio curies, is reported in Table 11.5 of the OECD Compendium (Annex 9).

WCED (Publication 30, p. 264) resumes: "High concentrations of substances such as heavy metals, organochlorines, and petroleum have been found on the oceans' surface. With a continued accumulation, this could have complex and long-lasting effects. 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 these findings are encouraging, given accelerating pressures and the inadequacy of present data they provide no grounds for complacency".

(d, e) **Pollution, emissions.** The sources mentioned in Annex 9 contain data about

- sources of oil pollution: sea-based and anthropogenic, sea-based and natural, land-based
- dumping of industrial waste, sewage sludge, and dredge spoils
- dumping of nuclear waste.

A sizeable portion of the total pollution load reaching the seas is from natural sources; for example, the high

*propose better  
natural and anthropogenic  
pollution*

mercury content of the western Mediterranean is thought to be due, in part, to natural weathering processes acting on local rocks and soils (World Resources 1987, Publication 24, p. 126).

- (f) **State of information.** As OECD states (Publication 29, p. 86), the monitoring of water quality and of sediment and living organisms is in general quite recent and not yet sufficiently developed to show whether pollution is increasing or decreasing. Furthermore, the lack of uniformity between countries should be stressed, in regard both to pollution analysis and to ecological monitoring methods. The work of international bodies such as UNEP, CEC, IOC, and ICES that endeavour to harmonize marine environmental monitoring methods at international level are thus of special importance. Scientific monitoring and follow-up, both before and after the event, in areas where development has been undertaken is still not systematic. What is more, available data on the state of seas are often limited, difficult to compare and not widely published.

Similarly, the new director general of IUCN remains concerned that our monitoring and models may miss slow and insidious changes indicating serious problems ahead, which we need to detect while we have time for action (Publication 39, p. 41).

And World Resources 1987 (Publication 24, p. 126) states: "So far little is known about the amounts of pollutants in the open ocean or their effects on marine organisms ... Even for seas bordering on countries with highly developed statistical reporting systems, the data are relatively poor; for seas situated largely in the developing world, pollution data are practically non-existent, with the exception of a few regions including China, India, East Africa, and parts of the Caribbean".

Relevant Programmes in Annex 10: 4 EC Corine, 11 MAPMOPP, 12 GESAMP, 14 Global Warming, 15 IGBF, 16 ECE Compendium,



17 UNEP (GEMS climate, GEMS oceans, GRID), 18 HELCOM,  
19 OECD, 22 IUCN, 23 EPA.

Documented effects of particular marine pollutants are scattered, and almost no data are available on the impacts of pollutants on marine life in the open seas (World Resources 1987, p. 325, OECE State of the Environment 1985, p. 90).

OECD (Publication 29, p. 88) concludes: "There are still wide gaps in our knowledge (of the marine environment); a serious attempt needs to be made, in particular, to find out more about:

- the transfer of pollution between air and sea;
- the state of the high seas and the sensitivity of the high sea plankton to pollutants;
- the scale of pollutant discharge from coastal facilities and by rivers;
- ways of monitoring the discharge of oil transported by sea and the risks involved in the transport of toxic or radio-active substances;
- the environmental consequences of dumping toxic or radio-active waste at sea."

## 5.2 Minerals, energy

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Not much information was found yet besides off-shore production (= flow, value deducted), perhaps because our analysis has given priority to renewable resources and habitats. First experiences with estimating the contribution of ocean related activities to GNP (Cortez Publication 86) might be relevant.

- (a) **Quantity, stock.** A description of marine placer mineral deposits located on the sea-bed of the Continental margin, their use and the possible minerable marine areas is given in UN, Links ..., Publication 48.

Most oceanic mineral exploration in the near future will be limited to the Continental margins.

- (b) **Quantity, deductions.** For 1980, world annual production of minerals from oceans and beaches was estimated in US dollars as reported by Borgese, Publication 40; the covered minerals are:

- subsurface soluble minerals and florids
- surficial deposits
- subsurface bed-rock deposit
- extracted from sea-water.

Another estimate (of UN, Links ..., Publication 48) deals with the estimated output and value of off-shore petroleum, gas and hard minerals.

Some 95 % of the value of minerals from oceans and beaches is furnished by oil and gas, for which time series of production are given in "Ocean Yearbook 6" based on "offshore" and other sources, including:

- crude-oil, barrels, world production
- crude-oil, barrels, by region and country
- natural gas, cubic feet, world production
- natural gas, cubic feet, by region and country.

- (f) Pertinent programs in Annex 10: 17 GEMS Oceans, 17 GRID.  
(Some Programmes might be missing).

- (g) Minerals can cause pollution, although, as states the Global 2000 Report, no clear cut conclusions follow yet from available studies; local conditions such as extremely low temperatures in the Antarctica can turn an accident into a pollution disaster. Of the marine-based sources of pollution, production platforms are negligible in world terms, although spills can have a substantial impact on the

particular locality when they occur e.g. in land-locked seas (OECD Publication 29, p. 74; Annex 9).

Sea-borne oil transport is responsible for roughly 40 % of the total pollution of the sea by oil. However, such spills are confined to tanker routes and the vicinity of production areas and tanker terminals (OECD Publication 29, p. 90).

### 5.3 Natural areas

#### 5.3.1 Coastal areas and estuaries

- (a) **Quantity, stock.** The length of marine coastline given in Annex 7 can be interpreted as a stock figure for coastal areas. Surface of estuaries are also known.
- (b) **Quantity, deductions.** Today, ports, housing development, marines, etc. reduce the habitat character of coastal areas. As already noted, a sea-level rise would have the same effect.
- (d, e) **Pollution, emissions.** Many of the pollution forms mentioned in Annex 9 such as dumping of industrial waste, sewage sludge, and dredge spoils are primarily felt in coastal areas. Tourism and recreation might have the same effect.

#### 5.3.2 Coral reefs

- (a) **Quantity, stock.** Coral reefs do not exist in the Mediterranean. Worldwide, a source is IUCN's Coral Reef Directory (Publication 17).

A study of three major resources of the coastal tropics (World Resources 1986 Publication 24, p. 146-152, p. 313-314) covers also coral reefs; a table with their area and

length per country is reproduced in Annex 5. In this context an attempt was also made to elaborate a normalized resource abundance index calculated by deviding the linear extent of coral reefs by the country coastline length.

- (c) **Quality, stock.** The litterature informs about bleaching of coral reefs.
- (d, e) **Pollution, emissions.** According to the already mentioned study of the coastal tropics, sediment pollution from mismanagement, upland areas and destruction by mining or blast-fishing are the primary threats to reef ecosystems (Publication 24, 1986, p. 51). The experts of the East Asian Seas Action Plan came also to the conclusion that the destruction of support ecosystems, specifically coral reefs and mangroves, are the most severe problem, and this in the present as well as in ten years and in the long term (the Siren, Publication 39, p. 35).
- (f) **State of information.** No systematic monitoring of tropical coastal resources exist (World Resources 1986, Publication 24, p. 309).

### 5.3.3 Wetlands (and estuaries)

- (a) **Quantity, stock.** IUCN has launched an extensive worldwide effort to identify fresh water and salt water wetlands of international importance. IUCN co-ordinators work with specialists and organizations within each country to collect data for a series of Directories listing with wetland sites, their ecology, flora and fauna, ownership, threats, and management plans. Two directories have been published (Publications 15, 16), and Directories for Africa and Asia are in preparation (see also the older Publications 14 and 21). For more information refer to World Resources 1987 (Publication 24, p. 86-90, p. 140) and to

(a) **Quantity, stock.** Relevant protection systems include:

- national systems: see Annex 5, IUCN Programme 3 and Publication 11 "UN list of national parks and protected areas"; IUCN's World Directory of national parks, Publication 10.
- UNESCO/MAB biosphere reserves, Programme 1 and Table 21.1 and OECD Table 7.3 mentioned in Annex 5.
- UNESCO Natural World Heritage Sites, Programme 2, Table 21.1 mentioned in Annex 5, Publication 12.
- wetlands of international importance: Table 21.1 mentioned in Annex 5.

ECE and OECD (see Annex 5) publish also data about these protected natural areas (see also Programmes 4 ECE Corine and 5 Council of Europe's European Network of Biogenetic reserves, and IUCN's Protected Areas Management Programme, Programme 22 e; as well as Publication 9).

The European Community elaborate a Biotopes Register (Annex 5).

It should be kept in mind, that these protected natural areas are mostly terrestrial areas. Example of a marine site is Table 38 about Finnish and Swedish seal sanctuaries mentioned in Annex 5.

The Bern Convention on the Conservation of European Wildlife and Natural Habitats (Programme 9) protects also natural habitats; also, it is possible that IUCN develops a Habitat Monitoring Unit (Programme 22 h).

#### 5.4 Flora

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##### 5.4.1 General remarks

(c) **Quality, stock.** Genetic diversity is the most important qualitative aspect of the stock of marine plants.

the tables of International Water Fowl Research Bureau, IUCN, OECD and UNESCO mentioned in Annex 5.

- (b) **Quantity, deductions.** Despite the fact that it is not possible to estimate the loss of coastal wetlands on a global scale, we know that their destruction is accelerating in many OECD countries (the OECD table mentioned in Annex 5 shows losses 1950-1980 of more than 50 % of the surface for Germany and Netherlands, to 23 % for Finland and 18 % for U.S.A.); in parts of the Caribbean, and in the Indo-Pacific region; worldwide, between 25 % and 50 % of the swamps and marshes have been lost (World Resources 1987, Publication 24, p. 87, 134). Causes of wetland destruction are the tendency to view wetlands as wastelands, the association of wetlands with disease, the flooding hazards that accompany the use of wetlands, the transfer of previously uncultivated wetlands into agricultural production, the lack of government interest, and the lack of financial support for wetland protection and management.

- (f) **State of information.** Programmes mentioned in Annex 10: 6 IUCN/RAMSAR, 22 b IUCN Wetlands Conservation Programme, with the objective of establishing a wetlands data base at the IUCN Conservation Monitoring Centre in Cambridge England.

#### 5.3.4 Parks, reserves, sites

National and international protection systems define natural areas for different functions and with different degrees of protection. These natural areas are part of the patrimony of mankind and, as far as they concern oceans, they should be included into D & P (see World Resources 1986, Publication 24, p. 94-99).

- (e) **Natural pollution.** Nothing final is known yet about degradation of marine flora following increased UV radiations because of the destruction of the ozone layer.
- (f) **State of information.** Programmes mentioned in Annex 10: 4 Corine, 5 Biogenetic reserves, 13 Nature Conservancy International, 17 UNEP's GEMS oceans and GRID, 22 IUCN.

#### 5.4.2 Mangroves

- (a) **Quantity, stock.** A study published in World Resources 1986 (Publication 24, p. 56-156, p. 313-316) about tropical coastal resources deals also with mangrove forests and seagrass beds. As for mangroves, it gives the area (see Annex 5), its abundance (see Annex 13) and its distribution worldwide (Publication 24, p. 57).

Mangroves are defined as tidal forests found inland along rivers, in infrequently flooded inland pools, along coasts and lagoons, and on low-lying nearshore islands in the humid tropics.

- (b) **Quantity, deductions.** This same study published in World Resources 1986, indicates also a "vulnerability" index calculated by multiplying the GNP per capita for each country by the population density raised to the power of the natural rate of increase (see Annex 13). By far the greatest threats are clear-cutting, diversion of freshwater from upland watersheds, and reclamation for agriculture and aquaculture. One major consequence of such mangrove degradation is falling fish yields. Avoiding destruction of support ecosystems including mangroves was also given highest priority in a comparative study done by experts of the East Asian Seas Programme (Publication 39, p. 35).

Destruction of mangroves occurs also during exploitation of other marine resources, including clearing for aquaculture (see also IUCN Publication 19).

- (f) **State of information.** Because there has been no systematic monitoring of tropical coastal resources, the database required to fully analyse trends in the extent, use and condition of these resources does not exist (World Resources, 1986, p. 309).

#### 5.4.3 Seagrass, algae

- (a) **Quantity, stock.** The World Resources study mentioned in 5.4.2 covers also seagrass beds and reports about their areas (Annex 5), their abundance (Annex 13), and their distribution.

Known species of algae are published by OECD for some member countries, as mentioned in Annex 13.

- (b) **Quantity, deductions.** FAO collects data about harvest of marine plants; the Publication for OECD entries is mentioned in Annex 7.

The major threats to seagrasses are dredge and fill operations, fishing practices that use bottom trawls, and water pollution such as that caused by industrial waste, discharges from power plants and accidental spills of petroleum products (World Resources 1986, p. 148).

World Resources has calculated a "vulnerability" index based on the GNP per capita, population density and natural rate of population increase by country also for seagrass, and compared it with a resource abundance index, thus obtaining as a result an estimate of increasing risk to the resource (see Annex 13).

Destruction of seagrass bed results also from fishing practices that use bottom trawls (World Resources 1986, p. 148).



(d, e) **Quantity, pollution and emissions.** Before leading to destruction as mentioned in (b), pollution results in a degradation of the seagrasses.

(f) **State of information.** As mentioned in section 5.4.2, there has been no systematic monitoring of tropical coastal resources.

Programmes and Publications such as Programme 7 (ECE Red Data Book, ECE Programme 23, Plant Red Data Book, Publications 1, 22) are not restricted to marine plants.

#### 5.4.4 Aquaculture, mariculture

(b) **Quantity, deductions.** In 1980 some 25 % of the harvest from aquaculture, measured in metric tons, were red and brown algae (Annex 7; for further information see OECD Publication 29, p. 88, World Resources 1987 Publication 24, p. 135).

### 5.5 Fauna

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#### 5.5.1 Marine fauna in general

An IUCN Red Data Book (Publication 7) covers also amphibians, and Annex 6 contains several tables about threatened amphibians. These species however will not be dealt with.

(b) **Quantity, deductions.** For all marine fauna, a rise of the sea-level as well as a rise of the water temperature will have important impacts, both in terms of disappearance of present species as well as appearance of locally new species.

(c) **Quality, stock.** Genetic diversity is the most important qualitative aspect of the stock of marine fauna.

(d, e) **Pollution, emissions.** The depletion of the ozone layer will almost certainly have effects on the marine fauna. Also, there is no doubt that marine organisms absorb oil or that it can be lethal, but there is little convincing evidence for its bioaccumulation. Oil slips at sea can kill or adversely affect zooplankton, shellfish, marine mammals; apparently, crustaceans are the most sensitive to oil pollution (World Resources 1987, Publication 24, p. 129).

According to the US National Academy of Sciences, commercial fishermen loose more than 22'000 metric tons of plastic packaging into the sea and loose or discard about 136'000 metric tons of plastic nets, lines, and buoys every year (World Resources 1987, p. 128).

Seabirds can also be heavily affected from oil pollution (see Annex 12). This fact represents a "value deducted" from non-ocean resources resulting from the use of marine resources. Yet, seabirds will not be covered in our analysis.

(f) **State of information.** In these days, scientists were surprised by the epidemic appearance of certain types of algae in the North Sea; nobody had paid attention before to this plant. Simultaneously, they found many dead seals in the North Sea. The two events might be inter-related. This experience illustrates uncertainty in knowledge: the risk of manmade imbalances of ecosystems always exists.

Specific Programmes and Publications will be mentioned in the following sections; for general, overall information see:

- the Programmes mentioned in Annex 10: 4 Corine, 7 ECE Red Data Book, 9 Bern Convention, 12 GESAMP, 13 Nature Conservancy International, 16 ECE Compendium, 17 UNEP OCA/PAC, GRID, 18 HELCOM, 21 FAO, 22 IUCN including

Coastal and Marine Programme. Species conservation  
Programme;

- Publications from Annex 14: 2 IUCN Red list, 18 IUCN Oil  
pollution, 23 conservation in the EC, 26 Council of  
Europe, 81 world environment 1972/1982, and others.

### 5.5.2 Marine mammals

Examples are cetaceans like whales, dolphins, pinnipeds like  
seals and sea lions, sirenia like sea cows, otters.

- (a) **Quantity, stock.** Estimates of threatened species like those  
for threatened mammals mentioned in Annex 6 or otters in  
the ECE Compendium (Publication 74, p. I-24) give some  
hints about stock, without however separating marine from  
terrestrial populations.

A very detailed table of population and catch of threatened  
and nonthreatened species, by species and regions, for  
marine mammals, 1920-85, from World Resources 1987 is  
mentioned in Annex 12.

Some regional data about specific species (whales, Medi-  
terranean monk, seal, etc.) are also available (and  
mentioned in Annex 12).

- (b) **Quantity, deductions.** The Table "marine mammals, 1920-80"  
mentioned in Annex 12 gives very detailed information  
about reported world catch. Figures for whales alone are  
published by OECD (Annex 7) and by the Committee for  
whaling statistics (Annex 12). For general information  
see also OECD State of the Environment (Publication 29,  
p. 142).
- (c) **Quality, stock.** The death of mammals found in the North Sea  
and on US coasts has partially been explained by stress of

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1 February 1997

**REVIEW OF INTERNATIONAL PROGRAMMES RELEVANT TO THE WORK OF  
THE INDEPENDENT WORLD COMMISSION ON THE OCEANS**

prepared for the  
Independent World Commission on the Oceans  
by  
Stjepan Keckes

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the animals due to eco-system conditions (pollution, disturbance by pleasure boats, etc.).

Concentrations of DDT and PCBs, which are persistent substances, have also been noted in numerous marine species such as whales in the Pacific (OECD State of the Environment, Publication 29, p. 81).

- (f) **State of information.** Data on populations of marine mammals are very limited. Estimating species populations requires counts of animals in particular regions and information on species' breeding habits, survival rates, and migratory habits. These data have not been gathered for most marine mammals species (World Resources 1987, Publication 24, p. 325).

Programme in Annex 10: 8 marine mammals.

Publications in Annex 14: 4 and 5 IUCN Red Data Books, 36 AMBIO.

### 5.5.3 Reptiles

Examples: crocodiles, turtles.

- (a) **Quantity, stock.** Global marine and terrestrial figures for threatened species are reported in the tables of Annex 6.
- (b) **Quantity, deductions.** Crocodylians are hunted mainly for their leather; such illegal trade threatens several species of crocodiles (World Resources 1987, Publication 24, p. 80).
- (f) **State of information.** Publication in Annex 14: IUCN 6 crocodiles, 7 reptilia.

#### 5.5.4 Fish

- (a) **Quantity, stock.** Estimates of stock of fish are available in management studies for fisheries (as a start, see Revelle in Repetto Publication 82, Charles Publication 83). Stock of North Sea herring for example is given in terms of total biomass in Annex 12.
- (b) **Quantity, deductions.** "Of the 20'000 known species of fish, around 9'000 are currently exploited. However, only 22 species are routinely harvested in quantities exceeding 100'000 metric tons a year with just 5 groups - herrings, cods, jacks, redfishes, and mackerels - accounting for roughly half the annual catch" (World Resources 1987, Publication 24, p. 135). Artisanal (traditional) fisheries provide a substantial amount of the protein consumed in coastal developing countries. In the majority of tropical Asian countries, for example, artisanal fisheries contribute more than 50 % of the animal protein intake. Further, the production from artisanal fisheries as a percentage of total fisheries production per nation ranges from 20 % in Hong Kong to 100 % in Tansania, Guyana, Trinidad and St. Vincent and the Grenadines (see Annex 7; World Resources 1987, Publication 24, p. 135-136).

Annex 12 recalls data on fish and invertebrate harvests from selected reef systems; unfortunately, catch statistics are fragmentary because overall data from reef fisheries do not exist. Relatively good data exist for the United States, but the reefs are so lightly fished that it is difficult to draw reliable conclusions about the limits of coral reef productivity (World Resources 1987, Publication 24, p. 136).

In 1985, world aquaculture production amounted to over 11 % of the total world harvest of fish and shellfish.

Statistical data are available from the International Aquaculture Foundation (see section 5.4.4 and Annex 7).

Deductions from fish stock can result from a sustainable harvest, overfishing, destruction because of man-made pollution, and destruction because of natural events. Catch statistics are elaborated by FAO as mentioned in Annex 7; most of them include also invertebrates. A table in Docter 1987 (Publication 75) p. 523 is insofar especially interesting, as the landings of the fisheries in the Wadden Sea is expressed in value terms, for the years 1960 to 1973. Another graphical representation from International Conference on the Protection of the North Sea is also peculiar, because it compares total international catch of herrings with total biomass for the years 1964 to 1982.

Several of the world's largest fisheries have collapsed following periods of heavy fishing; from the remaining, most major familiar fish stocks throughout the waters over the continental shelves, which provide 95 % of the world's fish catch, are now threatened by over-fishing. Heavy fishing has been followed by marked changes in species composition, and the reasons for these changes are not well understood. The World Conservation Strategy argued, that landings in 1980 were 15 to 20 mio tons less than they would have been had management been better (World Resources 1987, Publication 24, p. 263, 266; Holdgate Publication 83).

Another major cause of depletion of fish stocks is man-made and natural pollution. UNDP attributes the slow-down since the 1970s of spectacular growth rates of catches inter alia to increasing amounts of pollutants entering the ocean and to degradation of coastal estuaries and wetlands. Coral reef species are declining too as a result of coral removal and dynamite fishing (Publication 24, World Resources 1986, p. 89, 1987, p. 135). The new Director General of IUCN was less pessimistic: "The pollution of the seas has not yet

reduced their productivity except in a few localized areas" (Holdgate et. al. Publication 81), and he confirmed this view this year (interview in Siren, Publication 39, p. 41).

Finally, natural events can destroy fish stock. Examples are the rise in water temperature due to "El Nino", as well as the probability that the depletion of the ozone layer has negative effects on fish. Moreover, it appears that substantial concentrations of mercury and arsenic found in the Mediterranean derive from natural sources (OECD, Publication 29, p. 86).

- (c) **Quality, stock.** Besides quantitative destruction of fish stock, pollution can lead to its qualitative deterioration. In the Mediterranean, concentrations of mercury in certain species - notably tuna - appear to be high (EC Publication 27, p. 275), and Annex 8 mentions data about the levels of organochlorine compounds in fish flesh in the North Sea, 1979-1982. Mutant and crippled fish have also been observed (see also World Resources 1987, Publication 24, p. 126-128, p. 131; OECD Publication 29, p. 80-86).
- (d, e) **Pollution, emissions.** Considerations about pollution have been made under (b).
- (f) **State of information.** Publications in Annex 10: 58 Worldwatch, 59 UNDP, 60 OECD, 61 and 63 FAO. More general Programmes and Publications are mentioned in section 5.5.1 (f).
- (g) According to the US National Academy of Sciences, commercial fishermen dump more than 22'000 metric tons of plastic packaging into the sea and loose or discard about 136'000 metric tons of plastic nets, lines, and buoys every year (World Resources 1987, p. 128).



### 5.5.5 Invertebrates

Examples: shellfish, molluscs, crustaceans.

- (a) **Quantity, stock.** Threatened invertebrate species are reported by OECD and ECE (see Annex 6), where however marine and terrestrial species are not separated.
- (b) **Quantity, deductions.** Data about catches of crustaceans and molluscs are elaborated by FAO. An OECD Publication of these data is mentioned in Annex 7; sometimes, data about invertebrates are included in publications of fish catch.

Crustaceans and molluscs are also harvested from aquaculture (see section 5.4.4 and Annex 7).

- (c) **Quality, stock.** Attention is being paid to concentrations of pollutants in marine invertebrates, notably mussels. Estimates about concentration of hydrocarbons in mussels from various locations worldwide are recalled in Annex 8. Other data reported in Annex 8 deal with heavy metal concentrations in mussels from the Mediterranean Sea and concentrations of PCBs in Blue Mussel in North Sea waters.

The considerations presented for fish are also valid for marine invertebrates.

- (f) **State of information.** Programme 10 Charter on Invertebrates; Publication 8 IUCN Red Data Book.

## 6. STATE OF INFORMATION BY FUNCTION

Marine resources satisfy human needs as goods which can be exploited; these situations and their statistical coverage was the subject of Chapter 5. In these cases, we say that marine resources provide production functions, as mentioned in item 3 of the Table 1. Moreover, marine resources satisfy human needs

performing certain services. This is typically the case when they fulfil regulation functions mentioned in Table 1, like the regulation of certain climatic conditions, which is indirectly satisfying human needs and will be discussed in section 6.3. Other functions already mentioned in Chapter 5 are the recycling of wastes in estuaries, the use of coastal areas for construction.

Other services performed by marine resources which have to be taken into account in elaborating an indicator of wealth and welfare of oceans, satisfy directly human needs. Navigation and transportation is in this context an example of a career function of marine resources (as mentioned in item 2 of Table 1), and bathing is an example of their capacity to provide opportunities for recreation (item 4 of Table 1); they will be briefly recalled, being understood that this Chapter about statistical data by functions which are not yet covered in Chapter 5 should be further elaborated. It should for instance be checked how far first efforts for estimating the contribution of ocean related activities to GNP quantify the functions dealt with in this chapter (see Cortez Publication 86).

#### 6.1 Navigation, transportation

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Over 1'000 mio tons of international freight were carried by sea to the Community in 1981. Shipping statistical tables like for example Lloyd's Register (see the table about world shipping tonnage by type of vessel reproduced in the Ocean Yearbook 6, p. 642) and relatively easily available transportation statistics should allow to evaluate the contribution of oceans to wealth and welfare through navigation.

In section 3.2. attention was drawn to qualitative competition between ocean environmental functions; shipping is an example for this type of competition, since it uses the oceans as carriers and also as a deposit of wastes, thereby limiting other functions of marine resources. In fact, the main source of marine-based pollution is shipping: roughly 1 ton of oil is discharged annually into

the sea for every 1'000 tons transported by sea; about two thirds of the discharges are non-accidental in origin and are the result of the regular discharge of oil by ships at sea (contaminated ballast water and water used for flushing out tanks), whereas the remainder is the result of tanker accidents (see Annex 9 and Publication 18).

The amount of spoils from regular dredging of harbour channels the amount are larger than any other type of waste and cause pollution problems because spoils often contain high levels of toxic contaminants, particularly PCBs, DDT, hydrocarbons, and heavy metals. This situation is typical of the conflict between the uses of the marine environment (World Resources 1987, p. 130-131; OECD State for the Environment 1985, p. 78; Annex 9).

## 6.2 Bathing

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The importance of bathing and more generally of coastal tourism is regularly studied by the International Tourism Organization. Their data help to evaluate the value added to GNP thanks to marine resources.

For being utilized for this purpose however, beaches must satisfy certain quality standards. This value added then is a function inter alia of the bacteriological quality of the water. This qualitative aspect of sea water is statistically represented e.g. in tables mentioned in Annex 8. In this context, the Commission of the EC has developed an interesting device, in giving a so-called "blue EC-flag" to beaches satisfactory from the point of view of water quality, hygiene, security. In 1987, 382 blue flags were given to beaches in member countries, in 1988 392 flags.

The coasts of southern Europe and of other areas such as Florida are being particularly affected by the growth of leisure activities to meet increasing demand, both from nationals and from foreigners. Activities along the coasts for tourist development for examples affect the marine environment by way of the discharge

of pollutants, changes in currents and encroachments on the sea (OECD Publication 29, p. 70, 90).

### 6.3 Global issues

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Cycles of chemical elements are essential to life. This is especially true for the cycles of carbon (C), nitrogen (N), phosphorus (P), and sulphur (S); moreover, synthetic chloro-fluorocarbons are depleting the stratospheric ozone layer. This section deals rapidly with a connection between the depletion of the ozone layer and marine resources, and more extensively with the carbon cycle and the rise in temperature and the roles played and suffered by the oceans. The nitrogen and the sulphur cycles are especially important for estuaries; still, this section will not deal with these two and other cycles.

#### 6.3.1 Ozone depletion and marine resources

The depletion of the ozone layer is assumed to be one of the causes of global warming; insofar it influences the ocean as described in section 6.3.2.

Moreover, ozone depletion could have effects on aquatic organisms. No estimate however is now possible (World Resources 1986, Publication 34, p. 173; mentioned in Annex 9), but WCED is pessimistic: "New evidence of a possible rapid depletion of the ozone layer and of a consequent increase in ultra-violet radiation causes 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 (Publication 30, p. 264).

#### 6.3.2 Greenhouse effect and the oceans

This section presents pertinent considerations and statements from "11. Global systems and cycles" from World Resources 1987

(Publication 24, p. 163-179). Repeatedly, attention of the reader was drawn to the present lack of knowledge in this area.

(a) Role of the oceans

The ocean is the second most abundant reservoir for carbon (see Table 11.1 in Annex 11). Moreover, large amounts of carbon are exchanged between the oceans and the atmosphere each year (see Table 11.3 in Annex 11). These two facts illustrate the role of oceans in the carbon cycle.

Also, the ratios of carbon, nitrogen, and phosphorus required by marine phytoplankton interact with the sulphur and oxygen cycles to regulate the primary productivity of the oceans; this is an example of interactions between the carbon and other cycles.

Atmospheric carbon accounts for the Greenhouse effect and thereby global warming leading to higher water temperatures and a higher sea-level.

(b) Warming of the oceans and living marine resources

During the so-called El Nino event, the surface water off the coasts of tropical South America becomes warmer than usual. There is substantial rainfall. Nutrient-rich water no longer rises into the euphotic zone, and there is a great reduction in phytoplankton growth. The result is a sharp reduction of fish populations. On the other hand however, species well adapted to the warmer temperatures, or that profited from the decline in competition for food or the disappearance of predators, flourished, like the Peruvian schrink.

The decline in fish stocks was also reflected in a steep drop in marine primary productivity (photosynthesis by phytoplankton), as mentioned in Annex 11. Overall, scientists calculated a theoretical 1983 fish production deficit of 94 mio metric tons, a loss exceeding the total world fish catch for 1981.

It must be expected, that the Greenhouse effect will also result in major changes in fish stock.

(c) Warming of the oceans and sea-level rise

A higher temperature of the oceans will accelerate the melting of the polar ice-caps which may result in higher sea-levels and increased production of icebergs. The effects of a higher sea-level for the coastal regions have been mentioned in section 5.1.a.

(d) Research Programmes

As mentioned in Annex 14: 14 Global warming and the Greenhouse gases (Villach), 15 International geosphere-biosphere Programme IGBF, 17 UNEP-GEMS Climate, 23 EPA Sea-level rise project.

For the "World Ocean Circulation Experiment (WOCE)", which is being planned under the auspices of the international "Committee on Climatic Change and the Ocean (CCCO)", the

"World Climate Research Program" and for its "Tropical Ocean and Global Atmosphere Study" see World Resources 1987 as mentioned at the beginning of section 6.3.2.

## CONCLUSIONS, FOLLOW-UP

- 1) The theory of wealth and welfare has developed concepts which are useful for understanding and promoting the contribution of marine resources through wealth and welfare of mankind. The review of existing approaches for environmental accounting allows to refine pertinent aspects of the theory in order to enhance its application to the concept of common heritage of mankind. It will only be possible to evaluate properly the economic importance of the oceans as contributors to wealth, when an economic theory and above all, an economic and political consensus will be built on what constitutes real wealth in the present world.
- 2) The exercise we are proposing in this paper, has to be considered as a practical tentative to assess, through the choice of monetarized and non-monetarized indicators those which can provide a more adequate accounting of oceans' contribution to wealth and development, in order to better use, preserve and enhance this component of the earth patrimony.
- 3) Such indicators should also cover the contribution from natural areas, marine flora and marine fauna.
- 4) Although being related to Man less directly than other aspects of oceans, the regulation functions of marine resources such as global issues, food chain, etc. must be covered by the indicators.
- 5) Chapter 3 and 4 have shown that important ideas of the theory of wealth and welfare are already finding their way into application, for example in some areas of national accounts, guidelines for environmental accounting, etc.; the elaboration of our indicators can draw upon these activities.

- 6) As far as data by elements are concerned, many data are available, many of them are incomplete; Table 4 gives a very preliminary overview over the statistical information. Some data result from periodic monitoring, some are results of a "one-shot" exercise. The problem of aggregation over space and elements is an arduous one.
- 7) Data by functions, for example for navigation and tourism, are more easily available because they are part of the traditional monitoring of economic activity.
- 8) Within this framework, the role of an institution like ICOD could be to operate in a role of co-ordinator of all the work already being done all through the world in this data and indicators collection and to constitute a general theoretical frame of reference, capable of answering the question in quantified terms: Which is the contribution to wealth by the oceans ? Through which actions can this contribution be improved for the benefit of mankind and specifically for developing countries ?

Such a project could become a catalyst to ICOD to strike new development frontiers and initiatives as well as to increase public awareness and attitudes on a worldwide basis.

Also, a global programme of this type could use on-going ICOD projects such as the one concerned with the Pacific Information Centre for a Pacific Islands Marine Resources Information System as an input; inversely, it would be useful to on-going ICOD projects e.g. the one concerned with management of marine resources.

- 9) The long-term programme discussed in this paper should be accompanied by a team in which the relevant institutions are represented, including:
  - the relevant UNEP Regional Seas Programme
  - the World Resources Institute



TABLE 4

## STATISTICS BY ELEMENTS (Ch. 5)

Elements	Quantity		Quality		State of information (f)
	Stock (a)	Deductions (b)	Stock (c)	Deduction Pollution (d, e)	
5.1 Sea Water	Sea-level rise		A8		+
5.2 Minerals, Energy		X			
5.3 Natural Areas					
1 Coasts, Estuaries	A7				
2 Coral reefs	A5			X	-
3 Wetlands	A5	A5			+
4 Parks, Reserves	A5				
5.4 Flora					
2 Mangroves	A13	A13			-
3 Seagrass, algae	A13	A13			-
4 Aquaculture		A7			
5.5 Fauna	Threatened species	A7			
2 Mammals	A6, A12	A12			-
3 Reptiles	A6				
4 Fish	X	A7	A8	X	
5 Invertebrates	X	A7	A8		

Explanation: A Annex  
+, - Relatively good/bad informations  
X Some information available

- the UN-ECE and Conference of European Statisticians, for the Mediterranean and the North Sea
- IUCN, with its Conservation Monitoring Centre in Cambridge and its Oceans and Coastal Programme in Gland

10) UN-ECE has published its very basic compilation of environmental data under the modest name of "experimental compendium". Similarly, the elaboration of indicators of wealth and (1) welfare of the oceans would modestly proceed by trial and error; a project would be an on-going process and not the production of a final product.

44/OG/MB/mp/bm

Geneva, October 1988

SOME ACRONYMS

	See Programme
BAPMoN	Background Air Pollution Monitoring Network 17
CES	Conference of European Statisticians 16
CMC	Conservation Monitoring Center of IUCN 3, 22
ECE	UN Economic Commission for Europe 16
GEMS	Global Environment Monitoring System 17
GRID	Global Resources Information Database (Nairobi, Geneva) 17
GESAMP	Group of Experts on Scientific Aspects of Marine Pollution 12, 17
HELCOM	Helsinki Commission (Baltic Sea) 18
IOC	Intergovernmental Oceanographic Commission of UNESCO, WMO and UNEP 17
IGOSS	Integrated Global Ocean Station System 17
IUCN	International Union for the Conservation of Nature and Natural Resources, new : "IUCN, The World Conservation Union" 22
MAPMOPP	Marine Pollution Monitoring Pilot Project 11
MED-POL	Co-ordinated Mediterranean Pollution Monitoring and Research Programme 17
MEDSAP	A Strategy and a Plan of Action for the Protection of the Mediterranean (EC) -
OCA/PAC	UNEP's Oceans and Coastal Areas Programme Activity Centre 17
UNEP	United Nations Environment Programme 17
UNCLOS	UN Conference on the Law of the Sea -
WCED	World Commission on Environment and Development -
WHO	World Health Organisation -
WMO	World Meteorological Organisation -



ANNEX 1, 2, 3

1. Orio Giarini : The Notion of Economic Value in the Post-Industrial Society : Factors in the Search for New Economic Paradigms
2. Orio Giarini: Developing Productive Activities for the Wealth of Nations in the Service Economy
3. Orio Giarini : The Service Economy and the Management of Risk

Are presented separately.

IMPORTANCE OF MARINE RESOURCES

TABLE 3.1. Global net primary production and plant biomass.

	Net primary production (dry matter)				Biomass (dry matter)		
	Area (10 <sup>6</sup> km <sup>2</sup> )	Normal range (g/m <sup>2</sup> /yr)	Mean (g/m <sup>2</sup> /yr)	Total (10 <sup>11</sup> g/yr)	Normal range (Kg/m <sup>2</sup> )	Mean (kg/m <sup>2</sup> )	Total (10 <sup>11</sup> g)
Tropical rain forest	17.0	1000-3.500	2.200	37.4	6-80	45	765
Tropical seasonal forest	7.5	1000-2.500	1.600	12.0	6-60	35	260
Temperate forest:							
evergreen	5.0	600-2.500	1.300	6.5	6-200	35	175
deciduous	7.0	600-2.500	1.200	8.4	6-60	30	210
Boreal forest	12.0	400-2.000	800	9.6	6-40	20	240
Woodland and shrubland	8.5	250-1.200	700	6.0	2-20	6	50
Savanna	15.0	200-2.000	900	13.5	0.2-15	4	60
Temperate grassland	9.0	200-1.500	600	5.4	0.2-5	1.6	14
Tundra and alpine	8.0	10-400	140	1.1	0.1-3	0.6	5
Desert and semidesert scrub	18.0	10-250	90	1.6	0.1-4	0.7	13
Extreme desert — rock, sand, ice	24.0	0-10	3	0.07	0-0.2	0.02	0.9
Cultivated land	14.0	100-4.000	650	9.1	0.4-12	1	14
Swamp and marsh	2.0	800-6.000	3.000	6.0	3-50	15	30
Lake and stream	2.0	100-1.500	400	0.8	0-0.1	0.02	0.0
Total continental:	149.0		782	117.5		12.2	1.837
Open ocean	332.0	2-400	125 *)	41.5	0-0.005	0.003	1.0
Upwelling zones	0.4	400-1.000	500	0.2	0.005-0.1	0.02	0.0
Continental shelf	26.6	200-600	360	9.6	0.001-0.04	0.001	0.27
Algal beds and reefs	0.6	500-4.000	2.500	1.6	0.04-4	2	1.4
Estuaries (excluding marsh)	1.4	200-4.000	1.500	2.1	0.01-4	1	1.4
Total marine:	361.0	—	155	55.0	—	0.01	3.9
Full total:	510.0	—	336	172.5	—	3.6	1.841

Source: Wittaker and Likens, 1975. From : The Global Possible, Publication 82.

(\*) Table 9.2

**Table 9.2 Comparative Productivity of Selected Ocean, Coastal, and Terrestrial Ecosystems**  
(grams of carbon per square meter per year)

EcoType	Average Gross Primary Production	Average Net Primary Production
● Mangrove Forest <sup>a</sup>	2,300-5,110	X
● Marine Grass Beds	4,650	2,500
● Coral Reef	4,200	2,500
● Tropical Rain Forest	X	2,500
● Salt marsh (U.S.)	X	2,000
● Estuaries	X	1,500
● Open Ocean	X	.25 *)
● Upwelling Zones (e.g., Peruvian Current)	3,650	X
● Sugar Cane Fields	3,450	X
● Cultivated Land	X	650
● Field Grass, Minnesota	500	X

X = not available

Notes:

<sup>a</sup> Receives wet season terrestrial nutrient runoff

Sources:

1 J.B. Lewis, Processes of Organic Production on Coral Reefs, *Biological Review* Vol. 52 (1977), pp. 305-347

2 A.E. Lugo and S.C. Snedaker, The Ecology of Mangroves, *Annual Review of Ecological Systems*, Vol. 5 (1974), pp. 39-64.

3 S.C. Snedaker and M.S. Brown, *Water Quality and Mangrove Ecosystem Dynamics* (U.S. Environmental Protection Agency, Environmental Research Laboratory, Gulf Breeze, Florida, 1981).

4 R.H. Whittaker and G.E. Likens, eds., "The Primary Production of the Biosphere," *Human Ecology*, Vol. 1, No. 4 (1973), pp. 298-368

WR 1986, /134

\*) Table 3.1

**6.1 Number of Species by Class**

Class	Identified Species	Estimated Species
Mammals	4,170	4,300
Birds	8,715	9,000
Reptiles	5,115	6,000
Amphibians	3,125	3,500
Fishes	21,000	23,000
Invertebrates	1,300,000	4,400,000 <sup>a</sup>
Vascular Plants	250,000	280,000
Nonvascular Plants	150,000	200,000
<b>Total<sup>b</sup></b>	<b>1,742,000</b>	<b>4,928,000</b>

Notes:

<sup>a</sup> This figure is a minimum. Recent research suggests there could be as many as 30 million insect species in tropical forests alone.

<sup>b</sup> Totals are rounded.

Sources:

1 International Union for Conservation of Nature and Natural Resources (IUCN), *Threatened Plants and Animals in Danger: What Do We Know* (IUCN, Conservation Monitoring Centre, Cambridge, England, 1985).

2 P.H. Raven, et al., 1981, Reference 8.

3 P.R. Ehrlich and A.H. Ehrlich, 1982, Reference 10.

4 E. Mayr, 1973, Reference 11.

5 N. Myers, 1979, Reference 1.

6 P.H. Raven, 1980, Reference 13.

WR 1986, p. 86.

**Table 9.5 Important bird sites in Community member states.**

MEMBER STATE	TYPE OF SITE					TOTAL
	Coastal	Wetland	Grassland	Woodland	Peatland	
Belgium	7	51				168
Denmark	95	132				371
France	45	103				391
Germany	48	129				331
Greece	146	214				648
Ireland	47	42				128
Italy	46	133				472
Luxembourg	0	0				1
Netherlands	22	81				208
United Kingdom	126	128				416
<b>TOTAL</b>	<b>582</b>	<b>1013</b>	<b>707</b>	<b>423</b>	<b>407</b>	<b>3132</b>

Source: data from CORINE data base.

EC State Envi. 1986, p.334.

MARINE AREAS AND PLANTS

	WR 86	WR 87	OECD Compendium	ECE Compendium	EC State 86
Tropical Marine Coastlines	T 10.3	T 24.1			
Tropical seasonal forest					
Temperate Coral Reefs	T 10.3				
Wetlands		T 18.2	T 5.4		
Woodland and shrubland		T 21.1			
Natural Areas					
Protected Areas					
. Biosphere Reserves			T 7.3		T I-14
. National and International Protection Systems		T 21.1	T 7.4		
. EC Biotopes Register					T 9.2 T 9.3
. Seal Sanctuaries					T II-38
Mangroves	T 10.3				
Seagrass	T 10.3				



THREATENED MARINE AND TERRESTRIAL WILDLIFE

	OECD Compendium 1987 p. 122-125	ECE Compendium p. I-22-23	World Res. 1987 p. 295-298
VERTEBRATES	X	X	X
. Mammals	X	X	X
. Reptiles	X	X	X
. Amphibians	X	X	X
INVERTEBRATES	X	X	-
Area:	OECD countries; Western Europe, North America, Japan, Australia, New Zealand	Eastern and Western Europe, North America	OECD countries, Africa, Latin America

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2 January 1999

Prof. E. Mann Borgese  
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Halifax, Nova Scotia, Canada

*Oceanic Circle  
sent 7<sup>th</sup> Jan. 1999*

fax of 1 page

Dear Elisabeth,

The International Year of the Oceans vanished, hopefully with a smooth transition (with no 99-bug) into a New Year I wish you happy and successful!

For bare 10 minutes I had in hands the ocean book of the World Commission, but it was long enough to realize how poor the chapter on ocean economics is compared to the one in your Ocean Report. I am eager to see somewhere your publication, please be assured it would be of great satisfaction to your former 'partial coauthor' to receive a copy from you, perhaps even with a dedication.

Con cari auguri,

*Max*

IDV/Borlin, Max

RECEIVED FEB 23 1999

**MAX BÖRLIN** Consultant en Economie de l'environnement, des ressources et du développement

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22 February 1999

Dear Elisabeth,

"am diesem Buch mitschuldig"? I wish  
all Schuld so easy to be carried!

Danny thanks for THE BOOK: Analysis  
and synthesis; strong personal lived Credo,  
existential in its need for implementation.  
This is the flavour THE BOOK radiates, in my  
modest view.

Cari anguri,  
Dax

Date: Fri, 01 Dec 2000 18:53:52 +0100  
From: " Max P. and/or Ruth Zeno Boerlin" <pzboerlin@bluewin.ch>  
To: "Prof. Elisabeth Mann Borgese" <ioihfx@dal.ca>  
Subject: 28th PIM in Hamburg

Dear Elisabeth,

Dr. Kullenberg kindly had sent a programme to me, so I am happy to find you again as Key Speaker of Day 4. Felicitazioni ed auguri di successo nei Suoi sforzi. Most probably I soon shall be able to learn about the final results on [www.IOInst.org](http://www.IOInst.org).

Also, <the IOI Network, Centres> in the PIM brochure looks beautiful; I would guess at <the time of your book> full and affiliate members were not yet 13.

As you probably know, the UN Intellectual History Project (UNIHP), with a new Liaison Office in Geneva, has a facet <The UN and Global Resource Management>; I shall keep an eye at [www.unhistory.org](http://www.unhistory.org) to see what it says about UNCLOS, the oceans, your book. I certainly would love to help you again if you have or plan an initiative in this field.

My sister and her husband Luciano (of the Comitato Bauer) in Milano told me about the Enciclopedia Microsoft with an entry on Prof. Borgese <in rotta con il fascismo>, about a lecture of Luciano at a Bauer Conference saying <non c'era in quel tempo un professore - salvo dieci - che sapesse dire di no al fascismo>, about a novel <La figlia di 'Peppe'>. Also, our TV had a reportage on Annemarie Schwarzenbach, a neighbour of my mother's Ghei in Kilchberg. But then came my urgent aorta prothesis, and so my intention to refer to you did not realize.

Please, Elisabeth, accept my love with best wishes. max

[Part 2, Text/HTML 24 lines]

[Unable to print this part]

Date: Sun, 3 Dec 2000 15:17:03 -0400 (AST)  
From: International Ocean Institute <ioihfx@is.dal.ca>  
To: pzboerlin@bluewin.ch  
Subject: 28th PIM in Hamburg (fwd)

----- Forwarded message -----

Date: Sun, 3 Dec 2000 00:39:13 -0500  
From: "Elisabeth M. Borgese" <EBorgese@compuserve.com>  
To: International Ocean Institute <ioihfx@is.dal.ca>  
Subject: 28th PIM in Hamburg (fwd)

Dear Max,

good to hear from you after all this long time!

I am in Hamburg right now -- and things re hectic (but very good!)

I'll be in touch with you when things have settled down a bit towards the end of the month!

Love,

Elisabeth