ANNEX II

ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS OF WATER RELATED MAJOR CONCERNS AND PRINCIPLE ISSUES, TOGETHER WITH THEIR POTENTIAL TRANSBOUNDARY CONSEQUENCES

MAJOR CONCERN 1: FRESHWATER SHORTAGE

ISSUES	ENVIRONMENTAL IMPACTS	SOCIO-ECONOMIC IMPACTS	POTENTIAL TRANSBOUNDARY CONSEQUENCES
REDUCTION IN STREAM FLOW	1. Modification of riparian habitats 2. Depletion of fish stocks and species diversity 3. Water quality change 4. Decreased wetland areas 5. Reduced capacity to transport sediments, siltation 6. Reduced groundwater recharge 7. Saltwater intrusion 8. Changes in biological diversity and food webs 9. Changes in sediment budgets	1. Loss of agricultural uses (crops, livestock, aquaculture, mariculture) 2. Loss of human drinking water supplies 3. Loss of recreational use 4. Loss of hydro-electric power production 5. Loss of aesthetic values 6. Loss of coastal harbours and inland transport 7. Loss of industrial uses 8. Increased potential for upstream/downstream conflicts 9. Reduced availability of fish as food 10. Loss of waste assimilative capacity 11. Increased costs of alternative water supplies 12. Compromise of future use optional	- Shifts in freshwater/saltwater front - Changes in riparian communities - Changes in withdrawal uses - Potential for conflict over shared water - Potential for induced migration - Reduced groundwater recharge
POLLUTION OF EXISTING SUPPLIES	1. Modification of riparian habitat 2. Depletion of fish stocks and species diversity 3. Changes in terrestrial and aquatic biological diversity and food webs 4. Potential for impacts on migratory species such as water birds	1. Human health impacts 2. Reduced agriculture productivity (crops, livestock, aquaculture mariculture) 3. Loss of recreation possibilities 4. Loss of aesthetic values 5. Increased intake treatment cost 6. Increased damage to water-related equipment 7. Increased potential for upstream-downstream conflicts 8. Increased costs of alternative water supplies 9. Compromise of future use options	- Reduction in water use options - Human health impacts - Upstream/downstream conflicts
LOWERING OF WATER TABLE	1. Reduction in stream flows 2. Land subsidence 3. Reduced aquifer capacity 4. Reduced vegetation cover 5. Greater potential for saltwater intrusion 6. Water quality changes 7. Increased soil erosion 8. Increased penetration of contaminants into deep aquifers	1. Loss of aesthetic value 2. Damage to infrastructure 3. Increased costs of deepening wells and pumping 4. Population migration 5. Transboundary implications 6. Compromise of future use options 7. Increased costs of alternative water supplies 8. Increased vulnerability to sea level rise	- Transboundary groundwater supply conflicts - Contamination of transboundary aquifers - Potential for reduced transboundary streamflow

ANNEX II. Cont.

MAJOR CONCERN II: POLLUTION

ISSUES	ENVIRONMENTAL IMPACT	SOCIO-ECONOMIC IMPACT	POTENTIAL TRANSBOUNDARY CONSEQUENCES
MICROBIOLOGICAL (bacteriological, viral and other microbial)	1. Aquatic organism infections and diseases	1. Increased risks to human health 2. Increased costs of human health protection 3. Loss of potable water supplies 4. Increased costs of water treatment 5. Costs of preventative medicine 6. Costs of medical treatment 7. Loss of tourism/recreational values 8. Costs of increased fisheries product processing	The sub-group on pollution examined the entries under the various categories of pollutant for "environmental impact" and "socio-economic impact" with a view to determining the potential for these impacts to be transboundary. It was concluded that all such pollutants have the potential for transboundary impacts. Accordingly, rather than simply assigning each and every impact as "potentially
EUTROPHICATION	1. Redox changes [extreme Anoxia] 2. Increased algal blooms 3. Changes in algal community structure 4. Changes in macrophyte community structure 5. Loss of habitat (e.g. coral reefs) [Sedimentary composition changes] 6. Change in composition of feral fisheries and loss in case of anoxia	1. Loss of tourism/recreation 2. Loss of water supplies 3. Costs of water treatment 4. Change in fisheries value 5. Compromise of options for aquaculture development opportunities 6. Loss of property values 7. Loss of aesthetic value 8. Costs of weed control 9. Loss of wildlife sanctuaries 10. Costs of increased navigational clearance 11. Increased costs of human health protection 12. Increased costs of fish surveillance/processing in the case of toxin incidence 13. Costs of reduced fish marketability due to aesthetic perceptions	transboundary " it was decided that a text should be prepared to provide some qualitative discrimination to the likely magnitude of such transboundary impacts for each class of contaminants. The reason that <u>all</u> contaminant classes have the potential for transboundary impacts is due to the high probability both in riparian rivers and coastal margins that the introduction of substances will result in transport and effects beyond national boundaries. Nevertheless, the relative potential for these and other transboundary effects depends on both the conservatism and persistence of the contaminants. Thus,
CHEMICAL	1. Reproductive disfunction in aquatic organisms 2. Behavioral disfunction in aquatic organisms 3. Modified community structure 4. Increased mortality of aquatic organisms	1. Loss in fisheries 2. Loss of protected areas 3. Increased cost of human health protection measures 4. Increased cost of navigational dredging activities 5. Increased cost of fish processing activities 6. Reduced options for aquaculture development 7. Increased costs of water treatment 8. Loss of tourism/recreational opportunities 9. Compromise of other uses of freshwater (reduction in options) 10. Potential for international conflicts	lowest on the scale of potential for transboundary impacts are microbiological agents, solid wastes and thermal discharges. Next highest in probability are suspended solids and nutrients (as proxy for eutrophication). Of similar scales of impact and, therefore similar probability of transboundary consequences, are substances introduced by accidental spillage. The highest likelihood of transboundary impacts are posed by chemicals and radionuclides which, because many of them behave conservatively, can be transported great distances and pose increased risks of damage in remote areas.

ANNEX II. Cont.

SUSPENDED SOLIDS	1. Habitat modification 2. Changes in biological community composition 3. Changes in the growth/survival/reproduction of species 4. Reduced productivity 5. Enhanced erosion of coasts and river channels 6. Increased sediment deposition and siltation 7. Destruction (blanketing) of benthic communities 8. Changes in sediment redox conditions (organics)	1. Increased costs of navigational survey and dredging 2. Loss of reservoir storage capacity 3. Damage to equipment (particle impacts) 4. Reduced tourism/recreational amenities/opportunities 5. Increased water treatment costs 6. Increased costs of coastal protection from waves/storm surges/erosion 7. Costs of cleaning intakes	
SOLID WASTES (Bulk)	1. Habitat loss 2. Hydraulic modification 3. Entanglement/Suffocation of marine organisms 4. Beach and sediment compositional changes	1. Loss of aesthetic values/amenities 2. Endangerment of species 3. Increased costs of animal protection (esp endangered species) 4. Increased costs of human health protection 5. Increased costs of clean-up 6. Increased costs of navigational protection (survey & dredging)	
THERMAL	1. Population/community changes 2. Barriers to migration 3. Displacement of organisms 4. Changes to physical environment	1. Compromise of options for aquaculture development 2. Displacement of valued species 3. Increased risk to aquaculture (if improper siting)	
RADIONUCLIDE (from anthropogenic sources only)	1. Proximal and stochastic risks to animal life	1. Avoidance of amenities and products due to perceptions of effects of contamination 2. Costs of public reassurance 3. Risks to human health 4. Maintenance of monitoring and radiological protection activities for public reassurance purposes	
SPILLS (accidental episodic releases/introductions of substances to the aquatic environment)	1. Increased avian mortality 2. Increased mortality of aquatic life 3. Habitat damage 4. Long-term contamination of sediments and beaches with associated ecological changes	1. Costs of clean-up 2 Costs of preventive measures (e.g. tanker design/construction) 3. Costs of contingency measures 4. Real or perceived damage to feral and cultured fisheries 5. Loss of tourism and recreational amenities (temporary or permanent) 6. Costs of litigation 7. Costs of insurance 8. Loss of sanctuary and protected areas and associated wildlife 9. Costs of disruption to shipping, marine reserve and marine scientific activities during survey and clean-up	

ANNEX II. Cont.

MAJOR CONCERN III: HABITAT AND COMMUNITY MODIFICATION

ISSUES	ENVIRONMENTAL IMPACT	SOCIO-ECONOMIC IMPACT	POTENTIAL TRANSBOUNDARY CONSEQUENCES
LOSS OF ECOSYSTEMS OR ECOTONES	1. Loss of natural productivity 2. Loss of biodiversity 3. Loss of natural storm barriers 4. Loss of natural protection from erosion 5. Loss of carbon sinks and release of carbon to the atmosphere 6. Loss of migratory species using the habitat and altered migratory patterns 7. Impacts of estuarine system changes on adjacent coastal marine ecosystems	1. Reduced capacity to meet basic human needs (food, fuel) for local pop'ns 2. Changes in employment opportunities for local populations and associated changes in social structures 3. Loss of aesthetic value/recreation for local populations 4. Loss of existing income and foreign exchange from fisheries, tourism, etc. 5. Loss of opportunity for investment income and foreign exchange from former ecosystem and possible new opportunities (e.g. loss of materials for potential pharmaceutical products) 6. Loss of cultural heritage 7. Human conflicts, nat'l & Int'l 8. Loss of education and scientific value 9. Increased risks to human population and capital investment; loss of land due to loss of physical protection 10. Costs of responding to risks 11. Intergenerational inequity, possibly	- Damage to transboundary ecosystems, including loss (or change) in productivity, biodiversity, or loss of stability in shared ecosystem, change in community structure, both plant and animal (regional) - Damage to endangered, threatened or endemic species (global) - Loss of stability in national or transboundary systems due to species introductions (global) - Spread of disease or exotic species to neighbouring countries (regional) - Reduced natural protection from storms or erosion in countries sharing ecosystems (regional) - Impacts of freshwater or estuarine system changes on international coastal marine ecosystems (regional) - Impacts of physical changes in beach dynamics on adjacent countries, erosion deposition (regional) - Damage to migratory species and their habitat changing patterns of migration (interregional and global) - Loss of carbon sinks and increased release of carbon to the atmosphere (global)
MODIFICATION OF ECOSYSTEMS OR ECOTONES, INCLUDING COMMUNITY STRUCTURE AND/OR SPECIES COMPOSITION (threatened/endangered species)	1. Modification of natural productivity 2. Modification of biodiversity including loss of species and genetic diversity 3. Changes in ecosystem stability 4. Changes in community structure both plant and animal 5. Susceptibility to disease 6. Changes in migratory species populations and migratory patterns 7. Modification in natural storm barriers and reduced protection from erosion 8. Increased vulnerability to opportunistic invaders	1-5 as above 6. Modification or loss of cultural heritage 7-11 as above 12. Costs of controlling invasive species 13. Costs of restoration of modified ecosystems	- Loss/damage of anadramous/catadramous stocks and their habitat shared by riparian fishing States (regional and interregional) - Reduced means of meeting basic needs (food and fuel) for pop'ns in countries sharing systems (regional) - Loss of existing and potential income from fishing, tourism, potential future resources (regional and global) - Loss of existing potential foreign exchange and investment in countries sharing damaged systems (regional) - Effects on movement of foreign investment, world prices (regional and global) - Costs of restoration to countries sharing damaged systems (regional) - Costs of controlling introduced species to shared marine systems (regional) - Costs of emergency response and rebuilding to shared systems for storm or erosion damage (regional) - Damage to shared cultural heritage (regional) - Reduced aesthetic recreational value in shared system (regional) and for international tourism (global) - Damage to educational and scientific value to shared systems (regional) and loss of potential knowledge (global) - Costs of dealing with human migration and possible international conflict (regional and global)

ANNEX II. Cont.

MAJOR CONCERN IV: UNSUSTAINABLE EXPLOITATION OF FISHERIES & OTHER LIVING RESOURCES.

ISSUES	ENVIRONMENTAL IMPACT	SOCIO-ECONOMIC IMPACT	POTENTIAL TRANSBOUNDARY ISSUES
INAPPROPRIATE HARVESTING PRACTICES Over-exploitation Destructive fishing practices	a. Changes in biological community structure due to overexploitation/depletion of one or more key species b. Changes in food webs favouring scavengers by Wastage of bycatch discards c. Increasing vulnerability of protected species populations d. Changes to habitat and community structure resulting from destructive fishing practices.	1. reduced economic returns 2. loss of employment 3. Conflict between user groups for shared 4. resources including space 5. (+): potential new source of employment 6. (-): loss of proteing for human or animal consumption 7. (-): Juveniles entering other fisheries destroyed, thus reducing earnings 8. Loss of protected species 9. Lost opportunities inter-generational equity issues	- For shared/straddling stocks - problem of sharing resources/management mechanisms by fishery commission. - Wastage of juveniles in one jurisdiction may affect earnings in other (through migration - International tensions due to conflicting claims - Pressure on States through international press (media)/NGOs
RESOURCE/HABITAT CHANGES	a. Changes in community structure by food chain manipulation b. Changes in community structure through restocking and habitat manipulation	1. Improved catch/earnings 2. Improved catch/earnings	- Assumes agreement of owners in other jurisdictions, for transboundary resources
HABITAT DESTRUCTION	a. Ecosystem degradation	1. Loss of employment/earnings	- Uncertain (see Habitat)
DECREASED VIABILITY OF STOCK THRO' CONTAMINATION & DISEASE	a. Possible physiological and ecological impacts on animal populations through chronic contamination	1. Possible Human Health impacts 2. Reduced commercial value resulting from tainting	- Effects in other jurisdictions of imported fishery products
MAN-INDUCED CHANGES IN THE PHYSICAL ENVIRONMENT	a. Potentially severe impacts on ecosystem	1. Loss of food sources and livelihood	
BIODIVERSITY IMPACTS	a. Long-term changes in population genome & gene frequencies b. Changes in biological communities thro' deliberate and accidental introductions	1. Possible effects on fishery (uncertainty) 2. Increased risks of predation, competition and/or disease for commercially valuable species	- Relevant to transboundary seas and waterbodies and shared resources

ANNEX II. Cont.

MAJOR CONCERN V: GLOBAL CHANGE

ISSUES	ENVIRONMENTAL IMPACT	SOCIO-ECONOMIC IMPACT	POTENTIAL TRANSBOUNDARY ISSUES
CHANGES IN HYDROLOGICAL CYCLE	1. Land cover change 2. Habitat/Biodiversity 3. Shifts in Boundaries between sea and fresh waters 4. Feedback to global climate change 5. Changes in thermohaline circulation 6. Extreme events (frequency and intensity) 7. Changes in precipitation, evaporation and snow accumulation and melting	1. Freshwater availability 2. Food security 3. Employment security 4. Changes in productivity of agriculture, fisheries and forestry 5. Changes in resources distribution and political jurisdiction over them 6. Human migration 7. Damage to human life and property 8. Response costs for extreme events 9. Costs for avoiding navigation hazards	N.B. Climate Change is by its very nature a Transboudary cause of environmental and socio-economic issues, many of the impacts of which are themselves transboundary.
SEA LEVEL CHANGE	1. Intrusion of sea water to fresh water 2. Modification of aquatic habitats 3. Loss of land, damage to coastal zones including productive land	1. Increased cost of coast protection and emergency response/forecast 2. Loss of income and employment 3. Loss of property & capital assets 4. Human migration	
INCREASED UV-B RADIATION AS A RESULT OF OZONE DEPLETION	1. Damage to flora and fauna at the water surface and sub-surface 2. Decrease of productivity	1. Loss of incomes and foreign exchange from fisheries 2. Loss of opportunity for investments (both domestic and foreign) 3. Increased costs of human health care	
CHANGES IN OCEAN CO_2 SOURCE/SINK FUNCTION	1. Feedback to global climate change		

ANNEX III

PRINCIPAL SOCIO-ECONOMIC ROOT CAUSES OF THE IDENTIFIED WATER RELATED MAJOR CONCERNS AND PRINCIPAL ISSUES

I. Policy and Legal Failures (Economic policy failures, see III below)

1. Policy and Legal failures including inadequate regulation and best practices, guidelines, etc.
2. Inadequate law and policy harmonization among international instruments
3. Property and user rights
4. Unethical transfer of goods, wastes and technology between countries

II Institutional Failures

1. Lack of capacity, budget, or will to implement policies and decisions
2. Lack of capacity, budget, or will to enforce policies and decisions
3. Lack of clearly defined responsibilities and poor coordination among national government agencies responsible for different sectors
4. Inadequate coordination between local and national levels of government and inadequate delegation responsibility
5. Deficiencies in stakeholder participation (a matter of law and policy in most cases)
6. Failure of institutions to utilize effectively current information in decision-making processes, including selecting inappropriate technology
7. Corrupt practices which subvert the effective implementation of policies and programmes

III Economic (Market) failures (many of these issues originate in Law and Policy)

1. Pricing issues, domestic and international
2. Subsidies
3. Investment policies
4. Valuation of environmental goods and services
5. User fees

IV Information failures in scientific, technical and economic aspects

1. Inadequate scientific understanding and uncertainty and related data
2. Inadequate economic analysis and related data
3. Inadequate or unreliable data collected through routine national data programmes
4. Inadequate knowledge of technological and technical response options

5a. Methodological failures in pre-operational prediction, such as prior comparative analysis of options, prior risk assessments, prior impact assessments

5b. Methodological failures in post operational or environmental analysis, such as environmental auditing, environmental accounting, cause effect analysis, source distribution analysis

6. Ineffective data interpretation for management purposes
7. Inappropriate expert advice and technology
8. Inadequate access to scientific information at the international level by governments and access to data collecting at the national level for international purposes
9. Poor public education and awareness regarding scientific and economic values and technical options

ANNEX IV

INTERACTIONS BETWEEN THE MAJOR CONCERNS AND PRINCIPAL ISSUES

1 = Low; 2 = Intermediate; 3 = High

			A			B		C							D						E		
			1	2	3	1	2	1	2	3	4	5	6	7	1	2	3	4	5	6	1	2	3
A WATER SCARCITY		A1 Pollution	*			3	3	3	3	2	2	1		1				2	3	2			
		A2 Lowering of water table		*	3	2	2												2	1	2		
		A3 Reduction in streamflow		3	*	3	3	3	3	3	3	2		2					3	2	2		
B HABITAT	B1	Loss of ecosystem/ecotones	3	2	3	*											2	2	3	3			
		B2 Modification of ecosystems/ecotones	3	2	3		*	3	3	3	2	1		2	2	2	2	2	2	2	3	3	2
C POLLUTION		C1 Microbiological	3		3		3	*										2	1	1			2
		C2 Eutrophication	3		3		3		*						1				2	2			
		C3 Chemical	2		3		3			*								3	3	2			
		C4 Suspended solids	2		3		2				*							2	2	2			
		C5 Solids	1		2		1					*						1	1	1			
		C6 Radionuclides											*					3	2	1			
		C7 Spills	1		2		2							*						2			
D FISHERIES	D1	Overexploitation					2		1						*	2	3	2	3	3			
		D2 Excessive by-catch					2								2	*	3		1	2			
		D3 Destructive fishing				2	2								3	3	*	2	1	1			
		D4 Disease/Pollution	2			2	2	2		3	2	1	3		2		2	*	2	2		2	
		D5 Biogenetic Diversity	3	2	3	3	2	1	2	3	2	1	2		3	1	1	2	*	2	2	1	2
		Fisheries biomass	2	1	2	3	2	1	2	2	2	1	1	2	3	2	1	2	2	*	2	1	1
E GLOBAL CHANGE		E1 Hydrological Cycle		2	2		3												2	2	*		
		E2 Sea-level rise					3											2	1	1		*	
		E3 UVB					2	2											2	1			*

ANNEX V

CAUSAL CHAIN ANALYSIS FOR IDENTIFIED WATER RELATED MAJOR CONCERNS AND PRINCIPAL ISSUES

MAJOR CONCERN I: FRESHWATER SHORTAGE

ISSUES	CAUSAL CHAIN				UNCERTAINTIES
	IMMEDIATE	SECONDARY	TERTIARY	QUATERNARY	
POLLUTION OF EXISTING SUPPLIES	a. Municipal waste water discharges b. Industrial waste water discharges c. Irrigation return flows d. Urban storm runoff e. agricultural storm runoff f. Evaporation induced concentration g. Atmospheric deposition	1. Inadequate waste water treatment (a,b) 2. Excessive use of fertilizers and other chemicals (c,e) 3. Excessive irrigation (c) 4. Lack of storm water controls and treatment (d,e) 5. Impoundments (f) 6. Poor air quality (g)	1. High cost of treatment (a,b,g) 2. Inadequate regulation and enforcement (a,b,g) 3. Poor operation of treatment plants (a,b) 4. Difficulty in monitoring (a-e,g) 5. Lack of knowledge of pollution impacts (a-e,g)	I 1 II 1, 2, 7 II 2 II 2 IV 4 IV 1, 9	- Effects of pollution - Ambient conditions - Future development patterns
LOWERING OF WATER TABLE	a. Excessive pumping b. Reduced recharge c. Reduced peak flow d. Vegetative cover including phreatophytes	1. Increased water demand from: Population growth; Life style; Industrialization; Food production; Urbanization (a,b) 2. Urban drainage and impermeability (b) 3. Lack of protection of recharge zones (b) 4. Climate change (b,d) 5. Rural land use patterns (b,d) 6. Impoundments (c)	1. Agricultural subsidies (a) 2. Lack of groundwater property rights (a) 3. Lack of regulation and enforcement (a,b) 4. Lack of basin-wide management (a-d) 5. Lack of conjunctive use management (a,b,c) 6. Inappropriate reservoir operation (b,c)	I 1 III 2 I 1 II 1, 2, 7 II 3, 4 IV 1-4	- Future land use and development patterns - Future demographic patterns - Effects of land-use change on hydrology - Regional effects of climate change - Effectiveness of regulations - Future technological changes - Future institutional changes
REDUCTION IN STREAMFLOW	a. Increased diversion for: domestic, industrial, public, irrigation, and recreational uses b. Decreased inputs from: changed rainfall-runoff relationships, and decreased groundwater inflow, c. Return flows d. Increased evaporation e. Reduced peak flows	1. Population growth (a) 2. Life style changes (a) 3. Industrialization (a) 4. Over pumping (a,b) 5. Urbanization (a,b) 6. Food production (a,f) 7. Inappropriate land-use practice (b,c) 8. Reduced recharge (b,c) 9. Irrigation practice (b,c) 10. Changes in channel (b,c) 11. Increased temperature (b,d) 12. Increased water surface, including impoundments (d) 13. Increased vegetative cover	1. Inappropriate investment policies and subsidies (a) 2. Inappropriate water pricing (a) 3. Lack of regulation and enforcement (a) 4. Absence of demand-side management (a,b) 5. Lack of water property rights (a,b) 6. Lack of basin-wide management (a-c) 7. Climate change (a,e)	III 2, 3 I 1 II 1, 2, 7 I 1, 3 II 3, 4 IV 1-4 IV 1	- Future land use and development patterns - Future demographic patterns - Effects of land-use change on hydrology - Regional effects of climate change - Effectiveness of regulations - Future technological changes - Future institutional changes

ANNEX V. Cont.

MAJOR CONCERN II: POLLUTION

ISSUES	CAUSAL CHAIN				UNCERTAINTIES
	IMMEDIATE	**SECONDARY**	**TERTIARY**	**QUATERNARY**	
EUTROPHICATION	a. Enhanced Nutrient Inputs (given appropriate turbidity, incident light and temperature conditions) b. Increased recycling/mobilization c. Trapping of nutrients (e.g. in river impoundments)	1. Use of fertilizers in crop production (a) 2. Use of animal wastes in agriculture (a) 3. Wastes from animal production (a) 4. Combustion of fossil fuel (a) 5. Forestry/Agricultural practices (a,b) 6. Phosphate detergents (a) 7. Sewage discharges (a) 8. Aquaculture (a) 9. Draining of wetlands (a,b) 10. Wildlife preservation e.g. accumulation of guano from sanctuaries for migratory birds (a) 11. Soil loss (a) 12. [Transport of micro-nutrients to the pelagic environment] 13. Water system impoundment (b,c) 14. Soil and sediment erosion, remobilization, leaching (a,b)	1. Enhanced food production via use of fertilizers (a) 2. Intensification of animal production (a) 3. Enhanced energy demand (a,c) 4. Urbanization (a) 5. Enhanced aquacultural production (a) 6. Land-use changes (a,b) 7. Enhancement of navigation, dredging of watersways and harbours (b) 8. Enhancement of water supplies (b,c) 9. Hydrolelectric power development (b,c)	1. Lack of internalization of costs of environmental degradation 2. Inadequate development and/or enforcement of regulations I 1, 2 II 1-7 III 1 - 5 IV 1 - 9	- Relative importance of given sources in a given situation (temporal & spatial variance) - Levels/input rates of nutrients that give rise to algal blooms (exceptional) - Limitations of information on the incidence and bio-availability of forms of nutrients (N & P) - Uncertainties in the precision of comparisons among options or, - Uncertainties in the predictions of the outcome of management intervention
[HARMFUL ALGAL BLOOMS] (Including shifts in phytoplankton community structure, e.g. diatoms to dinoflaggelate)	a.Alterations to the relative rates of input of nutrients (P & N) - Phosphate limitation (Enhancements of nitrogen supply/inputs, reduction in phosphorus inputs, abnormal mixing/upwelling (M) b.Alterations to the relative rates of input of nutrients (Si, P & N) (Increased N inputs, reduced Si inputs, reduced P inputs)	1.Reduction of Phosphorus containing detergents (a) 2.ncreased nitrogen emissions from agriculture especially animal husbandry (a) 3.Increased N emissions from agriculture (b) 4.River impoundment (b)	1. Intensification of agriculture (a) 2. Intensification of agriculture (b) 3. Runoff control/modification (b)	I 1, 2 II 1-7 III 1-5 IV 1-9	- Lack of understanding of phytoplankton metabolism in response to changes in availability of nutrients - Consequence on higher trophic structure of shifts in phytoplankton community structure

ANNEX V. **Cont**

MICROBIOLOGICAL (Bacteriological, viral, and other microbiological agents)	a.Discharge of: sewage, animal wastes, contaminated solids, urban (runoff), inadequately treated hospital wastes, through point and diffuse sources	1.Inadequate regulation of waste management activities and/or 2.lack of enforcement	1. Governance and/or institutional failures 2. Lack of internalization of costs of environmental degradation 4. Lack of education 5. Deficiencies in sectoral management approaches	I 1, 2 II 1-7 III 1-5 IV 2, 3, 5a, 5b, 6, 7, 9	
CHEMICAL	a.Industrial and urban waste discharges b.Agricultural runoff c.Leachates from solid waste landfill d.Chemical releases from aquaculture e.Acid mine drainage f.Weed and pest control activities g.Disease vector control activities h.Emissions from fossil fuel combustion (electrical and vehicle) i.Increased combustion of natural vegetation	1.Road safety improvement (a) 2.Enhanced manufacture and use of chemicals in domestic applications (a, b) 3.Mineral extraction and refining (a, b, c) 4.Land clearance (and combustion) (a, b, c, i) 5.Human health protection (a, b, g) 6.Intensification of agriculture (b, f, i) 7.Aquaculture development (d) 8.Increased use of antifoulants (d) 9.Intensified forest management (f) 10.Intensified fossil fuel combustion (h)	1. Population growth (a, b) 2. Enhancements in standards of living (a, b) 3. Increased industrial development (a, b, e, h) 4. Increased urbanization (a, b, h) 5. Increased demand for food/proteins (a, d, f, i) 6. Reduction of risks to human health and safety (g) 7. Increased use of vehicles (h) 8. Continued reliance on fossil fuels (h)	1. Lack of internalization of costs of environmental degradation 2. Failure to limit population growth and migration 3. Poor development and/or enforcement of regulations pertaining to environmental impacts of social and industrial development. 4. Limitations in the international transport of hazardous substances 5. Deficiencies in sectoral management approaches I 1-4 II 1-7 III 1-5 IV 1-9	- Effects on the environment, Man and aquatic organisms imprecise (both deterministic and stochastic effects regimes) - Dose/response relationships uncertain - Difficulties in quantifying relative magnitudes of sources - Lack of information on production rates and use of chemicals and their locations
SUSPENDED SOLIDS	a.Soil erosion (aeolian and runoff transport) b.Land development/ excavation/earthmoving c.Dredging d.Aggregate recovery e.Mine waste discharges f.Placer mining g.Sewage (& sewage sludge) discharges, dumping h.Release of drilling muds and particulate additives i.Hydraulic mining j.Urban waste discharges (including plastic scrubbers in domestic and industrial cleaners)	1.Deforestation (a) 2.Agricultural activities (a) 3.Mineral mining, extraction and separation (a, b, d, e, h, i) 4.Reservoir maintenance (b, c) 5.Harbour development, maintenance (b, c, d) 6.Navigational improvements (c, d) 7.Inadequate treatment of urban wastes (g, j)	1. Urbanization (a, b, d, g, j) 2. Infrastructural improvement (a, b, c, d, g, j) 3. Industrial development (a, b, c, d, e, f, h, i) 4. Residential development (a, b, d, g) 5. Marine and riverine transport (c, d)	1. Population growth 2. Improvement in standards of living 3 Failure to internalize costs of environmental degradation 4 Deficiencies on the development and/or enforcements of regulations (unregulated activities) 5. Failures of sectoral management approaches I 1, 2 II 1-7 III 1-5 IV 1, 2, 3,, 5a, 5b, 6, 7, 9	

ANNEX V. Cont.

SOLIDS (Bulky wastes)	a.Deliberate dumping of objects b.Casual discard of buoyant and non-buoyant waste objects by individuals	1.Increased use of packaging 2.Misplaced reliance on public good behaviour 3.Thoughtlessness 4.Deficiencies in recycling programmes	1. Excessive/unnecessary use of packaging 2. Limitations in waste disposal options 3. Excessive pace of enhancements to standards of living without commcomitant development of recycling and disposal facilities	1. Deficiencies in the development and/or enforcement of regulations 2. Failure to internalize the costs of environmental degradation 3. Inadequate education 4. Deficiencies in the control of public behaviour 5. Deficiencies of sectoral (non-holistic) management approaches I 1, 2, 3, 4 II 1, 2, 3, 4, 5,7 III 1, 5 IV 2, 3, 5a, 5b, 6, 7, 9	
RADIONUCLIDES	a.Incidents at sea b.Spills from treatment facilities c.Discharges/emissions from nuclear power plants d.Discharges/emissions from nuclear fuel reprocessing plants e.Deliberate waste disposal at sea f.Accidents with nuclear weapons g.Accidents at nuclear power installations h.Accidents involving nuclear-powered vessels i.Fallout from nuclear weapons tests j.Contamination from underwater/underground nuclear tests (military and peaceful)	1.Deliberate use of the marine environment for waste assimilation and disposal 2.Use of nuclear power as an electrical generation source and for powering military and civilian vessels 3.Military activities	1. Peaceful applications of nuclear power 2. Military applications of nuclear power and nuclear weapons 3. Peaceful application of nuclear explosives	1. No global problems 2. Perceptions represent concerns only 3. Except for limited fail-safe provisions for release from nuclear weapons	
ACCIDENTAL SPILLS	a.Inadequate accident minimization measures b.Inadequate contingency, response measures c.Human error d.Force majeure	1.Lack of development or implementation of preventative and/or remedial measures	1. Failures in policy development 2. Failures in policy implementation	I 1, 2(f), 3, 4 II 1-7 III 3, 5 IV 1, 2, 4(f), 5a, 5b, 6, 7, 9 I 1, 2(f), 3, 4 II 1, 2, 3, 4, 5a, 5b, 6, 7 III 3, 5 IV 1, 2, 4(f), 5a,5b, 6, 7, 9	

ANNEX V. Cont.

MAJOR CONCERN III: HABITAT AND COMMUNITY MODIFICATION

ISSUES [1]	CAUSAL CHAIN				UNCERTAINTIES
	IMMEDIATE	SECONDARY	TERTIARY	POLICY MANAGEMENT FAILURES	
LOSS OF MANGROVE ECOSYSTEM	a. Conversion to aquaculture	1. High economic returns at individual and group level	1. Export drive & world market price of shrimp	1. Undervaluation of mangrove ecosystem 2. Government foreign trade & investment policies I-1, 2, 3; II-all; III-1, 3, 4; IV-1-7, 9	- Method of economic valuation and valuation of mangrove ecosystems
	b. Conversion to Agriculture for: (i) Subsistance requirements (ii) Intensive, commercial production	1. Subsistance requirements & food security eg rice 2. Economic returns from cash crops e.g. oil palm	2. High population pressures 3. Export drive and world prices of agricultural commodities	1. Undervaluation of mangrove ecosystem 2. Government foreign trade & investment policies I-1, 2, 3; II-all; III-1-4; IV-all	- Determination of carrying capacity
	c. Conversion to ports, airports and other public infrastructure d. Conversion to Tourism Infrastructure	1. National Development needs 2. High economic returns		1. Undervaluation of ecosystem 2. National policies on land-use 3. Coordination among sectoral agencies of government I-1, 3; II-all; III-3, 4; IV-all 4. Government policies on foreign investment I-1, 3; II-all; III-2, 3, 4; IV-all	- Determination of carrying capacity

[1] The examples specified are not meant to be comprehensive. Similar causal chains could be developed for coral reefs, seagrass beds, and many other tropical and temperate systems

ANNEX V. cont.

MODIFICATION TO MANGROVE ECOSYSTEM	a. Subsistance wood harvest b. Commercial timber harvest (forestry ("sustainable") c. Selection of particular species resulting in monoculture d. Woodchip harvest for Rayon Production, based on clear-felled coups	1. Subsistance/Survival needs 2. Better economic returns 3. Commercial exploitation for export	1. Poverty, lack of employment, economic opportunities 2. Population growth and migration 3. High economic return to foreign investor but negligible return to country when resources is exploited	1. Government policies on foreign investment 2. Monopoly in world woodchips market; government policies on foreign investment; undervaluation of mangrove ecosystem I-1, 2, 3; II-all; III-1, 3, 4; IV-all	- Valuation of mangrove ecosystem - Lack of ecological understanding of ecosystem structure and function - Recovery time after extensive harvest - Extent of ecological damage after harvest
	a. Partial conversion to aquaculture b. Diminished freshwater & sediment supply due to dams, diversion c. Sedimentation from offshore mining d. Movement into mangroves	1. High economic returns 2. Comparative value of placer minerals such as tin 3. Population pressure		I-1, 2, 3; II-all; III-1, 3, 4; IV-1-7, 9 1. Inadequate consideration of downstream impacts and lack of coordination among different government Ministries in water allocation I-1, 2; II-all; III-1, 2, 4, 5; IV all I-1; II-all; III-3, 4; IV-1-7, 9 I-3; II-2, 3-5, 7; III-4; IV-9	- Scientific basis for buffer zone and protected areas - Scientific information on nutrient fluxes
MODIFICATION OF TEMPERATE ESTUARY Modification in biodiversity and system function, migratory species and patterns of migration, nursery and fishery productivity, recreational value	a. Sedimentation due to: Forestry, road and other construction; Dams, diversion; Cattle raising/riparian erosion b. Introduction of exotic species through aquaculture c. Disease from reintroduction of species for aquaculture d. Loss of habitat due to conversion to airports, marinas, housing, etc.	1. Food supply and cash crop 2. Food supply and cash crop 3. Relative valuation	1. Inadequate forest and watershed management practices 2. Inadequate consideration of downstream impacts and lack of coordination among different government Ministries in water allocation 3. Inadequate management practices to control erosion	I-1, 2; II-all; III-1, 2, 4, 5; IV all	- Agreed methods and economic valuation of system and system function - Change in flushing rates in some estuaries

ANNEX V. cont.

MAJOR CONCERN V: OVEREXPLOITATION OF FISHERIES & OTHER LIVING MARINE RESOURCES

ISSUES	CAUSAL CHAIN				UNCERTAINTIES
	IMMEDIATE	SECONDARY	TERTIARY	QUATERNARY	
OVER-EXPLOITATION	a. Excessive effort (too many boats, fishermen, etc.)	1. Possibility of individual/collective profits 2. Need for food for subsistence drives poor into fishery as "employment of last resort"	1. High prices, demand driven, international trade in fish 2. Migration to the coast 3. Lack of employment opportunities, poverty 4. Lack of other food options	1. Free access to resources 2. Human population growth and lack of land tenure in agriculture I 3 III 4 IV 1, 2, 3,5a,6, 7,9	- Inadequate information on resources and on socio-economic aspects; - Market uncertainties - Employment uncertainties - Impact of climate variability on resources (e.g. El Nino)
EXCESSIVE BYCATCH AND DISCARDS	a. Low economic value of discards	1. Poor Fishing Gear Selectivity 2. Perishability and/or lack of storage facilities and/or poor acceptance as food	1. Lack of research on fishing technology 2. Lack of research on product development	III 1, 4, 5 IV 1 IV 4	- Uncertainty of priority between reducing bycatch and utilising it
DESTRUCTIVE FISHING PRACTICES	a. Inappropriate technology and poor harvest procedure	1. Lack of "environmentally friendly" fishing gear 2. Lack of ecological ethics in harvesters/users	1. Lack of research on fishing technology 2. Lack of consideration of intergenerational equity issue	1. Lack of education of fishery I 1 II 1, 2, 5 III 4 IV 1	- Direct and indirect impacts of fishing difficult to distinguish
DECREASED VIABILITY OF STOCK THROUGH POLLUTION/ DISEASE	a. Unsuitable environment for survival or completion of life cycles	1. Anoxia 2. Contaminants 3. Loss of habitat 4. Disease-causing organisms	1. Pollution (See pollution and Habitat)		
IMPACT ON BIOLOGICAL AND GENETIC DIVERSITY	a. Increase in exotic species interferes with commercial species, competitors, predators) b. Reduction of the gene pool of wild stocks	1. Accidental introductions by shipping (ballast water), aquaculture 2. Intentional release of animals of a single genotype stock 3. Loss of diversity in breeding areas/ecosystems	1. Failure of regulations regarding ballast water treatment/quarantine of imported species 2. High returns from aquaculture and recreational fisheries investments	1. Lack of scientific research IV $_1$ II $_2$ 2. Poor planning (lack of consideration of intergenerational equity) when making investments	Inadequacy of controls Questionable enforcement capacity

ANNEX VI

MARINE GEOGRAPHICAL AREAS AND FRESHWATER BASINS

The following tabulation is a preliminary and far from complete geographic framework under which a GIWA Assessment might be organised. The Major Regions correspond to the 9 regional organisational Units. Columns one and two represent the major marine divisions, and columns 4 and 5 represent the major freshwater units, around which the regional assessments could be structured. Column 3 includes smaller marine sub-units for a number of areas where it is known that specialised assessment activities are already underway or have been completed in the past.

The following points should be noted:
- The columns headed Coastal and Riparian States & Relevant Institutions, Organisations and Programmes, are provided for guidance only and are NOT intended to be taken as an exhaustive listing;
- in a number of instances the inland or land-locked countries sharing freshwater basins have not been listed (e.g. the Nile)
- not all the world's rivers have been listed and in a number of instances where none are named, numerous smaller rivers drain into the coastal seas designated in columns 2 & 3; and,
- the geographic scope of each unit includes the entire area of the catchment basins draining to the designated marine area.
- nomenclature follows the Times Atlas of the Oceans
- A global map of Large Marine Ecosystems (LMEs) is included in Annex V of this report and individual LMEs are identified under each of the large regional units in the following tabulation.

ANNEX VI. Cont.

REGION I: ARCTIC & MAJOR FRESHWATER CATCHMENT BASINS

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Arctic Basin (I)[2]					Denmark, Norway, USA	AMAP; IASC; AOSB;
			MacKenzie		Canada	MIZEX; SHEBA; AII
			N. Dvina		Russia	
			Pechora			
			Ob			
			Enisey	Baykal Lake		
			Lena			
			Kolyma			

[2] Roman numerals in parantheses (e.g.I) correspond to the columns in Annex ##

ANNEX VI. Cont.

REGION II: NORTH ATLANTIC & MAJOR FRESHWATER CATCHMENT BASINS[3]

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Wider Caribbean	Gulf of Mexico (2) (LME)		Mississippi		USA Mexico	IOCARIBE; UNEP (CEP); Gulf of Mexico Program; Gulf of Mexico Fisheries Management Council; River Basin Commissions; National Estuary Programs; Watershed Councils; Universities; EPA; NOAA; USGS; National Water Quality Monitoring Council
			Rio Grande			
			Brazos			
			Grijalva Colorado			
	Caribbean Sea (3) (LME)		Magdalena		Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela	IOCARIBE, COSDLC, UNDP, FAO, CARICOMP, OAS MEXICO, UNEP, PNUMA.
		Caribbean Islands (4)			Aruba, Cuba, Haiti, Dominican Republic, Jamaica, Puerto Rico, Bahamas, US Virgin Islands, Antigua & Barbuda, Barbados, Bermuda, St.Kitts/Nevis, Dominica, St.Lucia, St.Vincent & the Grenadines, Grenada, Trinidad & Tobago, British Dependent Territories, The Netherlands Antillies, French Islands	UNDP; FAO; UNCHS; CRMI(OECS/NRMU); CCA; ECLAC; CARICAD; CEPPOL; COSALC; CFRAMP; CARICOMP; WIDECAST; IRF; CEHI; IMA; CMI; METEO-France; CARMABI; CANARI; Univ. of West Indies; MAREMP; CMS; UWICED.

[3] NB. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of UNE the legal status of any State, Territory, City or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. This document cor acting in their individual capacities, and may not necessarily correspond with the views of the sponsoring organisations.

ANNEX VI. Cont.

REGION II: NORTH ATLANTIC & MAJOR FRESHWATER CATCHMENT BASINS[4], Continued.

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Western North Atlantic	Southeast Shelf (5) (LME)	Pamlico Sound	Pamlico		USA	NAFO; ICES;
			Neuse			
	Northeast Shelf (6) (LME)	Gulf of Maine	Androscoggin		USA	National Estuary Programs;
			Penobscot			
		Bay of Fundy	St. John			National Water Quality Monitoring Council
		Long Island Sound	Connecticut			
			Hudson			
		Delaware Bay	Delaware			
		Chesapeake Bay	Susquehanna			Chesapeake Bay Programme
			Potomac			
			James			
		Albermarle Sd.				
	Scotian Shelf (7) (LME)		St. John		Canada	
	Gulf St. Lawrence (8)		St. Lawrence	Great Lakes	USA, Canada	International Joint Commission;
	Newfoundland Shelf (9) (LME)				Canada	Fisheries Management Councils States/Tribes;
	Baffin Bay, Labrador Sea, Canadian Archipelago (10)					
	East Greenland (15) (LME)				Greenland	
	West Greenland (16) (LME)					
	Iceland Shelf (14) (LME)				Iceland	

[4] NB. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of UNE the legal status of any State, Territory, City or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. This document cor acting in their individual capacities, and may not necessarily correspond with the views of the sponsoring organisations.

REGION II: NORTH ATLANTIC & MAJOR FRESHWATER CATCHMENT BASINS[5], Continued.

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Eastern North Atlantic	Barents Sea (11) (LME)		Tuloma		Russia, Norway, Faroes	ICES: UNDP Barents Sea Oslo & Paris Commission
	Norwegian Sea (12) (LME)		Namsen			
	Faroe Plateau (13) (LME)					
	Baltic Sea (17) (LME)				Sweden, Finland, Estonia, Latvia, Lithuania, Denmark	HELCOM; ICES; EU (Phare/Tacis, MAST); NSP; SKAGEX; Baltic Agenda 21, BALTEX
			Oder		Germany	
			Vistula	Bug	Poland, Belarus, Ukraine	
			Neva	Ladoga Lake	Russia	
			Dalelven		Sweden, Norway, Denmark	Oslo & Paris Commission
	North Sea (18)		Rhine		Switzerland, France Netherlands	Int. Rhine Comm.
			Shelde			
			Elbe		Germany	Int Elbe Comm.
			Weser			
			Humber		UK	
			Tyne			
			Thames			
	Celtic-Biscay Shelf (19) (LME)		Avon		UK,	Oslo & Paris Commission
			Loire		France,	
			Shannon		Ireland,	
	Iberian Coastal (20)(LME)		Douro, Tejo		Spain,	Oslo & Paris Commission
			Tambre		Portugal	
	Mediterranean Sea (21) (LME)	Western Mediterranean			Malta, Morocco , Algeria, Monaco	UNEP/MAP; EU; WB/UNDP/EIB-METAP WB
			Ebro		Spain	
			Rhone		France Switzerland	
		Eastern	Po		Italy. Slovenia, Croatia, Greece	

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Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
		Mediterranean	Nile[6]		Egypt. Albania, Turkey, Cyprus Syria, Lebanon, Israel, Tunisia, F. Yugoslavia, Bosnia-Herzegovina, Libya	

[6] The countries of the Nile Basin are not listed in the Right Hand Column

ANNEX VI. Cont.

REGION II: NORTH ATLANTIC & MAJOR FRESHWATER CATCHMENT BASINS[7], Continued.

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
	Black Sea (22) (LME)				Bulgaria Georgia Romania Russia Turkey Ukraine	BSEP- UNDP/UNEP/WB /EU; TU-Black Sea - NATO; EROS-2000 - EU; COMSBlack - IOC IOC Reg. Programme.
			Danube		Austria, Bulgaria, Romania, Germany, Slovakia, Slovenia, Moldova, Hungary, Croatia, Czech Republic, Bosnia, F.Yugoslavia	Danube River Basin - EU/GEF Sub-regional: Danube Delta GEF (PDF)
			Dnipro		Belarus, Russia, Ukraine	Dnipro GEF (PDF)
			Dniestr		Moldova	
			Chorokh		Georgia, Turkey	
		(Azov Sea)	Don		Russia, Ukraine	Azov Sea DSS - Netherlands; Lower Don (WB)
	Caspian Sea (23)	North Caspian			Turkmenistan, Iran	WB/EU
			Volga		Russia	
			Ural		Kazakhstan	
		South Caspian	Kura		Turkey, Georgia, Armenia, Azerbaidjan	
			Aral Sea (24)	Amudariya	Kirgistan, Turkmenistan Kazakhstan, Uzbekistan	

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ANNEX VI. REGION III: NORTH PACIFIC & MAJOR FRESHWATER CATCHMENT BASINS[8], Continued.

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment Level 2	Coastal & Riparian States	Relevant Institutions, Organizations & Programmes
North Pacific	California current (26) (LME)		Columbia		Canada	CALCOFI; GLOBEC;
			Sacramento		USA	COOP; WOCE
	Gulf of California (27) (LME)		Colorado		Mexico	
			Fuerte			
	Gulf of Alaska (25) (		Columbia			INPOC; WOCE;
			Susitna		USA	GLOBEC; COOP
			Matanuska			
			Copper			
			Fraser		Canada	
			Skeena			
	Bering Sea	E. Bering Sea (28) (LME)	Yukon		USA, Canada,	BERPAC
		W. Bering Sea (29) (LME)	Anadyr		Russia	
	Sea of Okhotsk (30) (LME)				Russia, Japan	
	Oyashio Current (31) (LME)				Japan	NOWPAP
	Kuroshio Current (32) (LME)				Japan, China	NOWPAP
	Sea of Japan[9] (33) (LME)		Amur		Russia, Japan, S.Korea, N.Korea, China	NOWPAP
			Tumen			
	Yellow Sea (34)	Bohai Sea (35	Hai		Japan, N. Korea, S.Korea	NOWPAP
			Liao			
			Yellow		China	
	East-China Sea (36) (LME)		Yangtse		China, Japan, S. Korea	EASAP
			Huai			
Central Pacific	Hawaiian Archipelago (37) (LME)				USA & International Water	UNCLOS

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[9] Also known as the East Sea

ANNEX VI. Cont.

REGION IV: EASTERN SOUTH AMERICA & MAJOR FRESHWATER CATCHMENT BASINS[10]

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Southeast Atlantic	Patagonian Shelf (38) (LME)		La Plata/Parana	Paraguay	Chile, UK Brazil, Paraguay,	La Plata Treaty
				Bermejo	Argentina, Bolivia	GEF Project
				Uruguay	Uruguay, Brazil	
				Parana	Paraguay, Argentina, Brazil	Itaipu Agreement
	Brazil Current (39) (LME)		Paraibe do Sul Guanabara Bay Sao Francisco Patos Lagoon		Brazil	Brazilian Government PDBG
					Uruguay	CEIVAP
	Northeast Brazil Shelf (40) (LME)		Tocantins,	Araguia	Brazil	Brazilian Government
				Xingu		CEVASF
			Amazon (33b)		Peru, Colombia, Venezuela, Brazil, Equador	Amazon Treaty

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ANNEX VI. REGION V: SUB-SAHARAN AFRICA & MAJOR FRESHWATER CATCHMENT BASINS[11]

Marine Area Level 1*	Marine Sub-area, Level 2* (description)	Marine Sub-area, Level 3* (description)	Freshwater catchment(s) Level 1	Associated catchment Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
West & Central Africa	Canary Current (41) (LME)				Guinea Bissau	ORSTOM, ECOWAS, CECAF
			Senegal		Senegal, Mauritania, Mali	Senegal River Commission
	Senegal/Cape Verde Island		Gambia		Gambia, Senegal, Guinea	
			Lake Chad (43)		Nigeria, Chad, Sudan, Cameroon, Niger	Lake Chad River Basin
	Gulf of Guinea (42) (LME)				Sierra Leone, Liberia, Cote d'Ivoire, Sao Tome & Principe, Equatorial Guinea, Gabon	ECOWAS, Central Africa Economic Community, CECAF, GEF
			Volta		Ghana, Benin, Burkino Faso, Togo	Volta River Authority, CEB
			Niger/Benue		Niger, Guinea, Nigeria, Benin, Cameroon, Chad, Mali	Niger River Authority
			Congo		Congo Brazzaville, Congo Kinshasa, Angola	Economic Community of Central Africa
	Benguela Current (44) (LME)		Cunene		Angola	BENEFIT, SADC
			Oranje		Namibia, South Africa	SADC,
			Okavango (internal)		Namibia, Botswana, Angola	SADC, OKACOM
East Africa - Western Indian Ocean	Agulhas Current (45) (LME)		Great Ruaha		Tanzania, Comoros,	SADC, COMESA, IOCIMCWO
			Mangoky		Madagascar	
			Limpopo		Botswana, Zimbabwe	
			Zambezi		Mozambique, Zambia, Malawi, Namibia, South Africa	
	Somali Coastal Current (46) (LME)		Tana		Kenya	IGAD; EAS; IOCINWIO
			Ruyuma		Tanzania, Mozambique	
			Juba		Somalia, Ethiopia, Kenya	

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Marine Area Level 1*	Marine Sub-area, Level 2* (description)	Marine Sub-area, Level 3* (description)	Freshwater catchment(s) Level 1	Associated catchment Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
			East African Rift Valley Lakes (47)		Kenya, Tanzania, Uganda, Ruanda, Burundi, Congo-Kinshasa, Ethiopia, Zambia, Zimbabwe, Mozambique	GEF

ANNEX VI. Cont.

REGION VI:INDIAN OCEAN & MAJOR FRESHWATER CATCHMENT BASINS[12]

Marine Area Level 1*	Marine Sub-area, Level 2* (description)	Marine Sub-area, Level 3* (description)	Freshwater catchment(s) Level 1	Associated catchment Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Arabian Sea	Gulf of Aden (48)				Yemen, Djibouti, Somalia	PERSGA
	Red Sea (49) (LME)				Eritrea, Sudan, Egypt, Palestine, Israel, Syria, Jordan, Saudi Arabi	PERSGA
			Jordan (land-locked river) (51)		Izrael, Syria, Jordan, Palestine, Lebanon	EU Database Project
	Persian Gulf (50)		Tigris-Euphrates		Turkey, Syria, Iraq, Iran, Saudi Arabia, Kuwait, Bahrain, Qatar, United Arab Emirates	ROPME
South Asia Seas	Arabian Sea (52) (LME)		Narmada		India Oman, Somalia, Yemen, Pakistan, Maldives, Iran.	SACEP, ICIMOD, SAARC, IOMAC, START - SEACOM, ESCAP JGOFS, PERSGA, WOCE
			Indus		Afganistan, Pakistan, India	Indian/Pakistan Agreement
	Bay of Bengal (53) (LME)		Ganges		Sri Lanka, Thailand Bangladesh, India, Bhutan, Nepal	GEF ICIMOD, Indo/Bangladesh Agreement, India/Nepal Agreement
			Brahmaputra			
			Irriwaddy		Myanmar	

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ANNEX VI. REGION VII: SE ASIA AND THE SOUTH PACIFIC & MAJOR FRESHWATER CATCHMENT BASINS[13]

Marine Area Level 1*	Marine Sub-area, Level 2*	Marine Sub-area, Level 3*	Freshwater catchment(s) Level 1	Freshwater catchment(s) Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
South-East Asia (incl. North Australia)	South China Sea (54) (LME)				Malaysia, Philippines, Indonesia China Vietnam, Laos, Cambodia, Thailand	START - SARCS; ASEAN; COBSEA Mekong Commission
			Pearl River			
			Red River			
			Black River			
			Mekong (55)			
		Gulf of Thailand	Chaophria			
	Sulu-Celebes Sea (56) (LME)				Indonesia	
	Indonesian Seas (57) (LME)				Indonesia	
	Northern Australian Shelf (58) (LME)				Australia Indonesia	
South Pacific	Coral Sea Basin (59)				Australia New Zealand	
	Great Barrier Reef (60) (LME)				Australia	GBRMPA
	Great Australian Bight (61)		Murray-Darling		Australia	Murray-Darling Commission
	Small Islands (62)				Cook Islands; Fiji; Kiribati; Niue, Marshall islands; Federated States of Micronesia; Papua New Guinea; Tonga; Tuvalu; Vanuatu; Western Samoa; Nauru; Solomon Islands; Territories & Dependencies of UK & USA; France	SPREP, ESCAP, University of South Pacific, SPC, SPEC, South Pacific Forum, Forum Fisheries Agency, SOPAC, Tourism Council of the South Pacific
	Tasman Sea (63)	New Zealand Shelf (LME)			New Zealand	

[13] NB. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of UNI the legal status of any State, Territory, City or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. This document cor acting in their individual capacities, and may not necessarily correspond with the views of the sponsoring organisations.

ANNEX VI. Cont.

REGION VIII: SOUTH-EAST PACIFIC & MAJOR FRESHWATER CATCHMENT BASINS[14]

Marine Area Level 1*	Marine Sub-area, Level 2* (description)	Marine Sub-area, Level 3* (description)	Freshwater catchment(s) Level 1	Associated catchment Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Southeast Pacific	Humboldt Current (64) (LME)		Bravo		Colombia, Panama Chile, Peru, Equador	CPPS
			Lake Titicaca (landlocked)		Peru, Bolivia	
			Chilean Southern Lakes			
Eastern Equatorial Pacific (65)					Guatemala, Nicaragua, El Salvador, Costa Rica, Honduras	

REGION IX: ANTARCTIC[15]

Marine Area Level 1*	Marine Sub-area, Level 2* (description)	Marine Sub-area, Level 3* (description)	Freshwater catchment(s) Level 1	Associated catchment Level 2	Coastal/ Riparian States	Relevant Institutions, Organizations & Programmes
Antarctic (66) (LME)	Southern Ocean				Antarctic Treaty Countries	Scientific Committee on Antarctic Research CCAMLR
		Weddell Sea				

[14] NB. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of UNI
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acting in their individual capacities, and may not necessarily correspond with the views of the sponsoring organisations.

ANNEX VII

PRELIMINARY CONSIDERATION OF THE REGIONAL IMPORTANCE OF THE MAJOR WATER-RELATED CONCERNS AND PRINCIPAL ISSUES

The following tabulation provides an initial expert opinion concerning the relative importance of the identified major concerns and principal issues on a regional basis. It was constructed as a means of scoping the full assessment and does not constitute, in itself, an assessment of the relative importance of the major concerns and principal issues.

During the preparation of these tables and the subsequent plenary discussion it was clearly recognised that:

- the contents of this Annex provide a guide to the scope and nature of the final assessment and should not be taken as a quantitative statement concerning the importance of the concerns in each region;
- the highlighted concerns (shaded cells) represent an opinion by members of the Group concerning the comparative importance of each issue in a regional and global context;
- Individual regional assignments should not be taken out of the context of the entire table; and,
- participants in the exercise noted that in many cases, either information was lacking, or the collective knowledge of the Expert Group was insufficient for a well-qualified judgement regarding the degree of concern, such cases are indicated by ii = insufficient information.

In some cases the designated regions could be further subdivided on the basis of available information and expert knowledge, hence the final page of this annex provides a more detailed geographic breakdown for the Mediterranean, Black and Caspian Seas.

NB. The designations employed and the presentation of the material in this Annex do not imply the expression of any opinion whatsoever on the part of UNEP or the GEF concerning the legal status of any State, Territory, City or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. This document contains the views expressed by experts acting in their individual capacities, and may not necessarily correspond with the views of the sponsoring organisations.

ANNEX VII. Cont.

		REGION I ARCTIC	REGION II - NORTH ATLANTIC																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A FRESHWATER	A1 Pollution		ii	ii																ii					
SHORTAGE	A2 Changes in Water Table		ii	ii																ii					
	A3 Reduction in streamflow		ii	ii	ii															ii					
B HABITAT	B1 Loss of ecosystems/ecotones			ii																ii		ii			
MODIFICATION	B2 Modification of ecosystems ecotones																			ii					
C POLLUTION	C1 Microbiological																								
	C2 Eutrophication																								
	C3 Chemical			ii																					
	C4 Suspended solids		ii	ii																					
	C5 Solids																			ii					
	C6 Radionuclides																								
	C7 Spills																								
D FISHERIES	D1 Overexploitation																								
OVEREXPLOITATION	D2 Excessive by-catch																								
	D3 Destructive Fishing		ii	ii																					
	D4 Diseases/Pollution		ii	ii																		ii			
	D5 Biogenetic diversity		ii	ii	ii																				
	D6 Fisheries biomass																								
E GLOBAL CHANGE	E1 Hydrological cycle		ii	ii																					
	E2 Sea level change		ii	ii																ii					
	E3 UVB		ii	ii	ii															ii		ii	ii	ii	ii

REGION I ARCTIC

1. Arctic

REGION II - NORTH ATLANTIC

2. Gulf of Mexico LME
3. Caribbean Sea LME
4. Caribbean Islands
5. South East Shelf LME
6. Northeast Shelf LME
7. Scotian Shelf LME
8. Gulf of St. Lawrence
9. Newfoundland Shelf LME
10. Baffin Bay, Labrador Sea, Canadian Archipelago
11. Barents Sea LME
12. Norwegian Sea LME
13. Faroe Plateau
14. Iceland Shelf LME
15. East Greenland Shelf LME
16. West Greenland Shelf LME
17. Baltic LME
18. North Sea LME
19. Celtic-Biscay Shelf
20. Iberan Coastal LME
21. Mediterranean Sea LME
22. Black Sea LME
23. Caspian Sea
24. Aral Sea

ANNEX VII. Cont.

		REGION III - NORTH PACIFIC													REGION IV - EASTERN SOUTH AMERICA				REGION V - SUB-SAHARAN AFRICA						
		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40a	40b	41	42	43	44	45	46	47
A FRESHWATER	A1 Pollution				ii		ii															ii			
SHORTAGE	A2 Changes in Water Table				ii		ii																		
	A3 Reduction in streamflow				ii		ii															ii			
B HABITAT	B1 Loss of ecosystems/ecotones				ii		ii																		
MODIFICATION	B2 Modification of ecosystems ecotones				ii		ii															ii			
C POLLUTION	C1 Microbiological				ii		ii																		
	C2 Eutrophication				ii		ii						ii												
	C3 Chemical				ii		ii																		
	C4 Suspended solids				ii		ii																		
	C5 Solids				ii		ii																		
	C6 Radionuclides				ii		ii																		
	C7 Spills						ii																		
D FISHERIES	D1 Overexploitation				ii								ii												
OVEREXPLOITATION	D2 Excessive by-catch				ii																				
	D3 Destructive Fishing				ii		ii																		
	D4 Diseases/Pollution				ii		ii													ii			ii		
	D5 Biogenetic diversity				ii		ii								ii	ii				ii			ii		
	D6 Fisheries biomass				ii		ii																		
E GLOBAL CHANGE	E1 Hydrological cycle				ii		ii															ii	ii		
	E2 Sea level change				ii		ii														ii	ii	ii		
	E3 UVB				ii		ii														ii	ii	ii		

REGION III NORTH PACIFIC

25. Gulf of Alaska, LME
26. California Current LME
27. Gulf of California LME
28. West Bering Sea LME
29. East Bering Sea LME
30. Sea of Okhotsk LME
31. Oyashio Current LME
32. Kuroshio Current LME
33. Sea of Japan LME
34. Yellow Sea LME
35. Bohai Sea
36. East China Sea LME
37. Hawaiian Archipelago LME

REGION IV

EASTERN SOUTH AMERICA

38. Patagonian Shelf LME
39. Brazil Current LME
40. Northeast Brazil Shelf LME
    40a. Brazilian Northeast
    40b. Amazon

REGION V SUB-

SAHARAN

AFRICA

41. Canary Current, LME
42. Gulf of Guinea, LME
43. Lake Chad
44. Benguela Current, LME
45. Agulhas Current, LME
46. Somali Coastal Current, LME
47. East African Rift Valley Lakes

ANNEX VII. Cont.

		REGION VI - INDIAN OCEAN						REGION VII - SOUTHEAST ASIA AND THE SOUTH PACIFIC										REGION VIII SOUTHEAST PACIFIC		REGION IX ANTARCTIC
		48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63			
A FRESHWATER	A1 Pollution									ii	ii	ii	ii		ii		ii			
SHORTAGE	A2 Changes in Water Table									ii	ii	ii	ii		ii		ii			
	A3 Reduction in streamflow									ii	ii	ii	ii		ii		ii			
B HABITAT	B1 Loss of ecosystems/ecotones	ii		ii		ii	ii					ii	ii		ii		ii			
MODIFICATION	B2 Modification of ecosystems ecotones			ii		ii	ii			ii		ii	ii		ii		ii			
C POLLUTION	C1 Microbiological	ii								ii	ii	ii	ii		ii		ii			
	C2 Eutrophication	ii	ii			ii				ii	ii	ii	ii		ii		ii			
	C3 Chemical									ii	ii	ii	ii		ii		ii			
	C4 Suspended solids		ii		ii	ii				ii	ii	ii	ii		ii		ii			
	C5 Solids				ii	ii	ii			ii	ii	ii	ii		ii		ii			
	C6 Radionuclides			ii						ii	ii	ii	ii		ii		iii			
	C7 Spills									ii	ii	ii	ii		ii		ii			
D FISHERIES	D1 Overexploitation									ii	ii		ii		ii					
OVEREXPLOITATION	D2 Excessive by-catch			ii						ii	ii		ii		ii					
	D3 Destructive Fishing					ii				ii	ii	ii	ii		ii		ii			
	D4 Diseases/Pollution		ii		ii	ii	ii	ii		ii	ii		ii		ii		ii			
	D5 Biogenetic diversity	ii	ii	ii	ii	ii		ii		ii	ii		ii		ii		ii			
	D6 Fisheries biomass		ii	ii	ii	ii		ii		ii	ii		ii		ii		ii			
E GLOBAL CHANGE	E1 Hydrological cycle									ii	ii		ii		ii		ii			ii
	E2 Sea level change									ii	ii		ii		ii		ii			ii
	E3 UVB									ii	ii		ii		ii		ii			

REGION VI INDIAN OCEAN

48. Gulf of Aden
49. Red Sea LME
50. Persian Gulf
51. Jordan(Land-locked River system)
52. Arabian Sea, LME
53. Bay of Bengal

REGION VII SOUTHEAST ASIA & THE SOUTH PACIFIC

54. South China Sea LME
55. Mekong River
56. Sulu-Celebes Sea, LME
57. Indonesian Seas, LME
58. North Australian Shelf, LME
59. Coral Sea Basin
60. Great Barrier Reef, LME
61. Great Australian Bight
62. Small island States
63. New Zealand Shelf, LME

REGION VIII SOUTHEAST PACIFIC

64. Humboldt Current LME
65. Eastern Equatorial Pacific

REGION IX ANTARCTIC

66. Antarctic LME

ANNEX VII. Cont.

		REGION II NORTH ATLANTIC																
		SUB-REGION 21 MEDITERRANEAN							SUB-REGION 22 BLACK SEA							SUB-REGION 23 CASPIAN SEA		
		21	A	B	C	D	E	F	22	G	H	I	J	K	L	23	M	N
A FRESHWATER	A1 Pollution																	
SHORTAGE	A2 Changes in Water Table																	
	A3 Reduction in streamflow																	
B HABITAT	B1 Loss of ecosystems/ecotones	ii	ii	ii	ii	ii												
MODIFICATION	B2 Modification of ecosystems ecotones																	
C POLLUTION	C1 Microbiological																	
	C2 Eutrophication																	
	C3 Chemical																	
	C4 Suspended solids																	
	C5 Solids																	
	C6 Radionuclides																	
	C7 Spills																	
D FISHERIES	D1 Overexploitation																	
OVEREXPLOITATION	D2 Excessive by-catch																	
	D3 Destructive Fishing																	
	D4 Diseases/Pollution	ii	ii	ii														
	D5 Biogenetic diversity																	
	D6 Fisheries biomass																	
E GLOBAL CHANGE	E1 Hydrological cycle																	
	E2 Sea level change																	
	E3 UVB	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii	ii

SUB-REGION 21

SUB-REGION 22
MEDITERRANEAN

A. Western Mediterranean
B. Eastern Mediterranean
C. Ebro
D. Rhone J.
E. Po
F. Nile

SUB-REGION 23
BLACK SEA

G. Azov Sea
H. Danube
I. Dnipro
Dniestr
K. Chorokh
L. Do

CASPIAN SEA

M. Volga
N. Kura