Executive summary

Regional Definition

The GIWA Caribbean Sea region is part of the Wider Caribbean and includes all or parts of 28 island and mainland states – Antigua & Barbuda, Anguilla, Aruba, Belize, Bonaire, Barbados, British Virgin Islands, Cayman Islands, Costa Rica, Curaçao, Colombia, Dominica, Grenada, Guatemala, Guadeloupe, Honduras, Martinique, Mexico (Quintana Roo state), Montserrat, Nicaragua, Panama, Saint Vincent & the Grenadines, Saint Kitts & Nevis, Saint Lucia, Trinidad & Tobago, Turks & Caicos, United States Virgin Islands and Venezuela. For the GIWA assessment, the region was divided into three sub-systems: the Small Islands (3a); Colombia & Venezuela (3b); and Central America & Mexico (3c). This report presents the results of the assessment of sub-systems 3b and 3c.

The Caribbean Sea is a semi-enclosed ocean basin bounded by the Lesser Antilles to the east and southeast, the Greater Antilles (Cuba, Hispaniola and Puerto Rico) to the north, and by Central America & Mexico to the west and southwest. Water flows from the Atlantic Ocean into the Caribbean Sea mostly through the Grenada, Saint Vincent, and Saint Lucia passages in the southeast, continuing westward as the Caribbean Current – the main surface water circulation in the Caribbean Sea – then out into the Gulf of Mexico via the Yucatan Channel between Mexico and Cuba.

The principal river discharge to the Caribbean Sea is from the Magdalena River, which drains an extensive basin between the Eastern and Central Cordilleras. While the Magdalena River Basin is entirely within Colombia, its river outflow affects a wide sweep of southern Caribbean coastal waters. The Orinoco River, a major river whose basin is shared between Colombia and Venezuela, was also included in this assessment. Although it discharges mainly to the Atlantic Ocean from a delta at the very margin of the Caribbean Sea region, its outflow has a significant impact on southern Caribbean coastal waters because of the prevailing ocean currents. The rivers discharging to the Caribbean Sea from the Central America & Mexico sub-system are small by comparison, though some of them, such as the San Juan River at the borders of Nicaragua and Costa Rica, are transboundary systems.

The Colombia & Venezuela (3b) and Central America & Mexico (3c) sub-systems are characterized by a wide variety of terrestrial and marine ecosystems with rich biodiversity. In the Colombia & Venezuela sub-system, most of the marine ecosystems of the tropical Western Atlantic are represented, including coral reefs, seagrass beds and mangroves. The Central America & Mexico sub-system has the second largest coral barrier reef in the world, extending along Belize's coast, as well as coastal wetlands subject to regional conservation initiatives. Its terrestrial biodiversity represents the confluence of flora and fauna from two biogeographical regions, the Nearctic of North America and the Neotropical of South and Central America, including the Caribbean.

Of the two sub-systems assessed, Colombia & Venezuela has the higher population (60.4 million), with 62% of this in Colombia. The urban population index is the highest in the Caribbean Sea region, with 75% and 87% living in urban areas in Colombia and Venezuela respectively. The inhabitants of Colombia are classified as having medium-low incomes and those of Venezuela, medium-high incomes. The total population of the Central America & Mexico sub-system is about 9.9 million inhabitants, of which 53% are from Honduras, 17% from Guatemala, 14% from Nicaragua, 5% from Quintana Roo (Mexico), 4% from Costa Rica, 4% from Panama and 1% from Belize. Except for Costa Rica, the infant mortality rates of the countries of the Central America & Mexico sub-system are higher than the rest of the region with an average rate of 33 per 1000 live births. The sub-system had an average *per capita* income of approximately 2 600 USD (current value) in 2001.

The regional environmental legislative regime comprises different international conventions that are related to marine and coastal resources management. The United Nations Environment Programme (UNEP) has played a leading role in the establishment of a number of conventions, action plans and protocols including the Caribbean Action Plan and the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region – the Cartagena Convention – and its protocols.

Assessment and Causal chain analysis of the Colombia & Venezuela sub-system (3b)

In the Colombia & Venezuela sub-system, freshwater shortage has *slight* impacts, although the pollution of existing supplies is having *severe* impacts. The environmental impacts of pollution are considered to be *moderate*, with oil spills and suspended solids assessed as the severest issues. Pollution is adversely affecting the health of the sub-system's population and has increased the costs of water treatment. The environmental impacts of habitat and community modification are *severe* and the economic impacts are *moderate*, particularly as they affect the fishing industry. The unsustainable exploitation of fish and other living resources has *moderate* environmental impacts, with the severest issues being overexploitation, destructive fishing practices and the impact on genetic and biological diversity, particularly in Colombia. The reduction in catches has impacted the fishing industry and affected health due to a reduction in food security. Global changes have caused changes in the hydrological cycle and ocean circulation resulting in *moderate* impacts. The climate change induced socio-economic impacts were assessed as *severe*. In future the impacts of freshwater shortage, pollution and the unsustainable exploitation of fish and other living resources are expected to diminish in severity due to the implementation of measures aimed at mitigating these concerns. However, the impacts of habitat modification and global change are expected to increase in severity.

In the Colombia & Venezuela sub-system, habitat and community modification was identified as the priority concern. The Causal chain analysis focused on the Magdalena River Basin because of its concentration of human activities which are resulting in severe ecosystem degradation. The immediate causes of habitat modification are the large quantities of sediment and chemicals in the river's discharge; attributed mainly to the mining and agricultural sectors. Agro-chemicals used in crop production are used inappropriately and enter aquatic systems via runoff or leaching into groundwater. Mining activities have degraded forest, soil and water resources; commonly, the practices employed are non-compliant with environmental guidelines and highly destructive, and have adversely affected the environmental quality of aquatic habitats. Petroleum activities in the upstream areas of the basin are altering habitats by consuming large quantities of water and releasing pollutants, discharged by petroleum-water separating stations, as well as occasional spills and leakages from oil pipelines. Organic material in domestic and industrial wastewater degrades water quality and consequently the health of aquatic ecosystems.

The root causes of habitat and community modification in the Magdalena River Basin included:

- **Demographic:** Approximately 80% of the population of Colombia and the majority of its economic activities are concentrated in the Magdalena River Basin which is, therefore, subjected to a concentration of pollution.
- **Governance:** In general, there is an absence of an integrated development strategy and planning is sectorial. The planning process incorporates neither environmental impact assessments nor mitigation measures. The monitoring capacity of the institutions responsible for environmental management in the basin is inadequate as there is a lack of professional expertise and financial resources.
- **Economic:** Poverty has forced the inhabitants of the region to employ unsustainable practices to exploit natural resources for their short-term survival, using shorter crop-rotation cycles, clearing forests for agriculture and pastures, and overgrazing livestock. Farmers were encouraged to apply agro-chemicals in order to increase productivity. The high price for illegal crops encourages further deforestation to create more cultivated areas. There are insufficient financial and technological resources to develop adequate treatment systems or to use cleaner technologies.
- **Knowledge:** There are a lack of studies evaluating the efficiency and environmental impacts of current practices. There is a dearth of environmental information about the Magdalena River Basin and the Colombian Caribbean coast.

Assessment and Causal chain analysis of the Central America & Mexico sub-system (3c)

The assessment of the Central America & Mexico sub-system showed that freshwater shortage has *moderate* impacts, with the modification of stream flow and the pollution of existing supplies assessed as the most severe issues. The environmental impacts of pollution are *severe*, and chemical pollution was identified as having the greatest impact. Most economic sectors are severely impacted by the pollution concern. The environmental and economic impacts of habitat modification are *severe*, while the health impacts are *slight*. The unsustainable exploitation of fish and other living resources has a *moderate* environmental impact, due mainly to overexploitation and the use of destructive fishing practices. The principal global change issues were changes in the hydrological cycle and ocean circulation, and sea-level rise, which inflict *slight* to *moderate* impacts. The socio-economic impacts are *moderate* to *severe*, taking into account the consequences of natural phenomena such as El Niño. In future, habitat modification may become less severe, but the severity of the other concerns is likely to increase.

The immediate causes of habitat and community modification in the Central America & Mexico sub-system were identified as deforestation and increased erosion. Inappropriate agricultural practices have increased erosion and reduced the productivity of soils. The expansion of agriculture has required the deforestation of large areas of land, resulting in habitat loss and fragmentation. Some habitat modification, for example, from illegal clearance and slash and burn agriculture, can be controlled through more stringent regulations and by strengthening the institutions responsible for environmental management.

The root causes of habitat and community modification in the Central America & Mexico sub-system included:

- **Demographic:** With population growth, the demand for land escalates and environmental degradation intensifies as urban and agricultural areas expand. Land tenancy conflicts have been provoked mainly in zones of collective land use. The institutions responsible for land tenure have insufficient capacity to resolve these conflicts.
- **Governance:** There is a lack of regional policies which promote the development of river basin, coastal and marine planning and management. Surface water management plans at national or regional levels are inadequate. A lack of democratic participation mechanisms has hindered cooperation between governments and the community in the conservation of habitats. Economic and political interests often take precedence over social and environmental improvements. The institutions responsible for environmental management have insufficient financial and technical resources. Commercial fish stocks have declined due to illegal fishing, the weak enforcement of fisheries regulations and the lack of transboundary fisheries management.
- **Legal:** Regulations on the use of pesticides and fertilizers are very weak or non-existent. The main deficiency in water law concerns coastal and marine regulations.
- **Knowledge:** Decision-making processes are hampered by limited information on environmental and economic characteristics (including aquatic ecosystem values), and environmental degradation trends, of river basins and aquifers. There are insufficient research initiatives regarding sustainable technologies and few environmental education programmes.

Policy options

Feasible policy options were identified that target key components identified in the Causal chain analysis in order to minimise future impacts on the transboundary aquatic environment.

Recommended policy options for the Colombia & Venezuela sub-system (3b):

- Integrated River Basin and Coastal Area Management (policy option 1)
- Strengthen the scientific capacity of the sub-system (policy option 2)

Recommended policy options for the Central America and Mexico sub-system (3c):

- Institutional strengthening (policy option 3)
- Promote sustainable production (policy option 4)