Executive summary

The GIWA region 3 Caribbean Sea is located in the Wider Caribbean within tropical and sub-tropical latitudes, bounded to the east by the Antilles Island chain, to the west by the Central American isthmus, while the northern portion of the South American sub-continent limits the southern border. The region has some of the most diverse physical and socio-economic characteristics in the world, containing 28 countries or territories of the Central/South American sub-continents and the Lesser Antilles (Small Islands). The borders correlate in principal with those of the Caribbean Sea Large Marine Ecosystem (LME) with bathymetry as the main biophysical denominator. The Greater Antilles; Cuba, La Hispaniola, Puerto Rico, Jamaica and the Bahamas, are included in GIWA region 4 Caribbean Islands.

The Caribbean Sea region was divided into three sub-systems, delimited according to physical, biological and socio-economic characteristics. This report will focus in particular on sub-system 3a, the Small Islands, which is composed of Antigua and Barbuda, Anguilla, Aruba, United States Virgin Islands, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, Netherlands Antilles, Saint Vincent & the Grenadines, St. Kitts & Nevis, St. Lucia, Turks & Caicos and Trinidad & Tobago. Sub-system 3b consists of Colombia and Venezuela, and sub-system 3c contains Central America and Mexico (state of Quintana Roo), Belize, Guatemala, Honduras, Nicaragua, Costa Rica and Panama.

The Small Islands sub-system forms the eastern border of the Caribbean Sea and is characterised by a chain of islands of different size, that extend from the north of Venezuela to south of Florida, USA. Taking into account the geographical extent of most of the islands, the entire land area of the countries can be considered as coastal ecosystems. The influence of the surrounding sea is more pronounced on these small islands compared with large islands and continental landmasses (Khaka 1998, Kofi 1999). The islands are characterised by a variety of sensitive habitats including beaches, deltas, coral reefs, mangrove swamps, wetlands, seagrass beds, lakes, rivers and coastal lagoons. There are diverse communities of flora and fauna, including some endemic species. The islands have relatively limited surface areas and natural resources (arable land, freshwater, mineral resources, conventional energy sources), are isolated from continental landmasses, and are particularly vulnerable to natural hazards, principally hurricanes and other tropical storms.

Despite containing 18 countries and territories, the sub-system contains the smallest population in the Caribbean Sea region, but as a result of the countries limited land area, the population densities are the highest in the region; in 2001 the total number of inhabitants in Caribbean Small Islands sub-system was only 3.5 million) but there is an average of 232 inhabitants per km^2. Such high population densities place enormous pressure on the islands ecosystems. The countries in the Small Islands sub-system can be classified as having a medium-high income, with the most significant contribution to GDP provided by the agricultural sector, particularly crops such as bananas, sugar cane, coconuts and other fruits, and the services sector, which includes financial services, tourism and shipping.

The regional environmental legislative regime is comprised of different international conventions that are related to marine and coastal resource management. The United Nations Environment Programme (UNEP) has played a leading role in the establishment of a number of conventions, action plans and protocols. Some of these include: the Caribbean Action Plan; The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (the Cartagena Convention) and its protocol; the Protocol Concerning Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region; and the Protocol Concerning Pollution from Land-Based Sources and Activities (LBS).

The GIWA assessment evaluated the relative importance of different impacts on the international aquatic system of the Small Islands sub-system. The environmental and socio-economic impacts were assessed for present and future conditions, and overall impacts and priorities were identified. The concerns for the Small Islands sub-system were ranked in the descending order:

1. Global change
2. Habitat and community modification
3. Pollution
4. Freshwater shortage
5. Unsustainable exploitation of fish and other living resources

The GIWA assessment determined that the concern of Global change exerted the greatest impacts on the Small Islands sub-system. However, since it is an international concern addressed through other initiatives (e.g. the United Nations Framework Convention on Climate Change), Habitat and community modification was selected as the GIWA priority concern for further analysis in the Causal chain and Policy options analysis.

Hazards originating from Global change are a severe problem for the region. The islands are often impacted by hurricanes, and also, with less frequency, tornadoes. The islands are particularly vulnerable to future sea level rise, which may potentially submerge low-lying coastal areas, and more frequent and intense hurricanes. Coastal habitats, which provide coastal protection such as coral reefs, will be further threatened by these climate induced changes. Assessing the environmental and socio-economic impacts of global change on the region is problematic due to the lack of reliable data. The main socio-economic concern is the cost of protection from, or adaptation to, global change.

The assessment ranked Habitat and community modification as having severe impacts. The main anthropogenic impacts stem from deforestation, extraction of marine resources and tourism. Deforestation and the cultivation of steep slopes cause considerable land degradation, which has increased the sediment load of rivers and eventually coastal waters. Consequently, seagrass beds and coral reefs have been affected by chronic sedimentation that reduces sunlight penetration and increases ecosystem stress. Tourism is affecting the health of coastal ecosystems: mangroves are cleared for developments, which also once constructed further disturb coastal habitats due to their proximity to the high water mark; harbour dredging destroys benthic fauna and increases the turbidity of coastal waters; boat anchors and dive activity damages reefs and seagrass beds; and tourist activities result in a variety of pollution impacts. In addition, dredging, sand extraction, groyne construction and sewage effluents have affected reefs, especially in US Virgin Islands around St. Thomas and St. Croix. These anthropogenic stresses weaken the ecosystems ability to withstand and recover from natural disturbances such as hurricanes and places a risk factor for the sustainable use and harvest of goods and services provided by marine ecosystems (e.g. recreational values, protection of coast line).

The environmental impacts of pollution were assessed as moderate to severe. The discharge of nutrient-rich sewage and agricultural run-off is causing euthrophication. The resultant algal blooms deoxygenate freshwater and coastal waters after collapsing, and prevent sunlight from penetrating surface waters, consequently reducing bioproductivity. The discharge of sewage is also causing micro-biological contamination of drinking water and can cause a proliferation of diseases with subsequent human health impacts. Pollution has had a variety of impacts on the marine environment and severely affected economic activities. For example, pollution has adversely affected tourism due to the loss in aesthetic value of beaches, and marine species have been injured or killed from entanglement and ingestion of solid wastes.

The environmental impacts of freshwater shortage on the Small Island sub-system were assessed as moderate, although it is not strictly a transboundary issue in this region. Many small islands have virtually no freshwater ecosystems (Virgin Islands, Netherlands Antilles, Antigua, Barbados), and groundwater resources in many islands are being exhausted, polluted or contaminated by saltwater intrusion. Polluted surface and groundwater are major causes of degradation of coastal and near-shore marine ecosystems and declines in biodiversity, including critical salt-pond, mangrove, estuary, seagrass and coral reef systems. Socio-economic impacts associated with freshwater shortage are, for example, the high cost of producing desalinated water, hygiene prolems and diseases realted to sanitation problems.

The impacts of the unsustainable exploitation of living resources result principally from overexploitation and destructive fishing practices. Certain stocks are exploited beyond maximum sustainable yields, and as a consequence, techniques such as closed fishing seasons, and restrictions on certain species, have been used as fisheries management tools. Destructive fishing methods have increasingly been employed by fishers, including the use of explosives, poisons, large small-meshed traps, and scuba gear. Degradation of fisheries habitats is considered to have also significantly reduced the size of fish stocks. It is expected that in the future, this situation will not have changed significantly, although the rate of exploitation may increase with the employment of more efficient fishing technologies.

The Causal chain analysis identified the root causes of the prioritised concern of Habitat and community modification. It was found that the governments of the region have sought to develop their economies rapidly, which they have failed to balance with the conservation and protection of ecosystems, in order to achieve sustainable development. This can be attributed to institutional weaknesses that have facilitated a lack of cross-sectoral coordination and uncontrolled development of the coastal zone. Stakeholders are not involved during the planning and implementation of development projects, and therefore the needs of the local community are not considered. For example, there has been inadequate valuation of the essential income and nutritional benefits that habitats provide for local communities, prior to land clearance for development.

Regional conventions such as the Cartegena Convention and national legislation aimed at managing natural resources, have not been implemented due to enforcement agencies lacking the capacity to do so, and as a result of fragmented management, with government agencies and stakeholders having ill-defined and often conflicting responsibilities. National laws related to the environment are not harmonised and there is an absence of integrated management of the coastal zone at the national and regional level. In addition, informed decision-making is inhibited by the lack of monitoring programmes and appropriate technologies to adequately assess the current, and predict the future, status of the ecosystems in the region.

A fundamental hindrance to sustainable development is the lack of understanding, from the public to policy makers, of the importance of conserving aquatic ecosystems. This may stem from unsatisfactory incorporation of environmental issues in educational curriculum, and the lack of public awareness programmes.

The policy options section aimed to describe alternative courses of action that may be taken by policy makers in the region, and discusses the projected outcomes and trade-offs of each action. These actions were designed to address the root causes identified in the causal chain analysis.

The first policy option aims to build institutional capacity in order to integrate land and water resources management with development planning within the regional context. This should improve the ability of the islands to actively manage and conserve their natural resources, and allow the implementation of further initiatives. A second policy option proposes designing and implementing a Strategic Regional Plan for Integrated Coastal and Marine Management. This was formulated to organise economical activities and define environmental protection areas on the basis of a legal framework. Additionally, the establishment of such a plan will clearly define the responsibilities of the relevant authorities and the principal mechanisms to coordinate the formulation and implementation of policies at a regional level.

These policy options should be supported by appropriate monitoring and data management. Stakeholders should be involved in the planning and implementation of the policy options and a continuous evaluation and review process conducted.

It should be noted that the policy options are a preliminary analysis of conceptual ideas and actions that are currently being considered. Therefore more detailed assessment of the options is necessary. However, these policy options are promising solutions to some of the fundamental problems facing the region.