

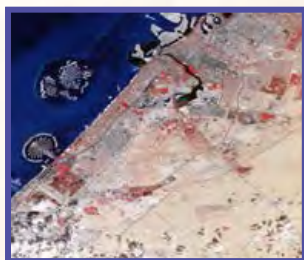
# SUMMARY

## State of the Marine Environment Report

2013

Sustainability Message to Decision - Makers

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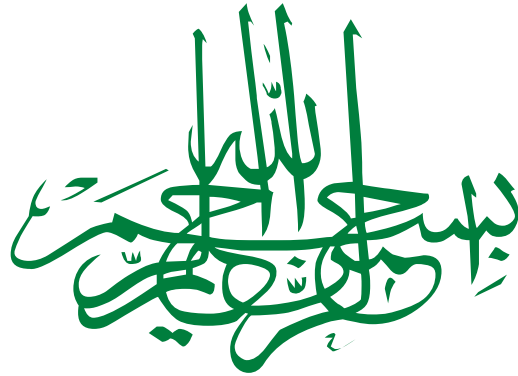
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In the name of God the  
Compassionate, the Merciful





## **SUSTAINABILITY MESSAGE TO THE POLICY AND DECISION-MAKERS IN ROPME MEMBER STATES**

### **“THE SUSTAINABILITY OF ROPME SEA AREA IS OUR COMMON RESPONSIBILITY”**

“THE ROPME SEA AREA (RSA) IS A COMMON RESOURCE, AND THE MEMBER STATES ARE ITS CUSTODIANS AND GUARDIANS. IT IS OUR DUTY COLLECTIVELY TO COOPERATE TO IMPROVE ITS ECOSYSTEM HEALTH AND SUSTAIN ITS FUNCTIONS AND SERVICES FOR THE PRESENT AND FUTURE GENERATIONS. A SHARED VISION FOR LONG-TERM ENVIRONMENTAL GOALS AND TARGETS NEED TO BE DEVELOPED AND MAINTAINED FOR THE RSA”.

***DR. ABDUL RAHMAN AL-AWADI***  
EXECUTIVE SECRETARY, ROPME





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The ROPME Region has witnessed considerable economic and social developments at a remarkable pace, particularly during the first decade of this millennium. It is timely, therefore, to revisit the "State of the Marine Environment" of the ROPME Sea Area, as requested by the ROPME Council.

The purpose of regular reporting process is to track possible environmental changes, resulting from development activities since the previous "State of the Marine Environment Report" (SOMER), the last of which was prepared and published by ROPME Secretariat in 2003, and to report on the likely impacts of such changes on the marine and coastal environments and their resources.

Clearly, the ultimate objective of such periodic reporting is to bring any observed environmental changes and their associated impacts on the RSA to the attention of the Governments of the Region. In doing so, we will be able to assess the existing environmental challenges and their root causes, and hence, to adequately define the priority actions that need to be taken by the concerned authorities in each of the ROPME Member States. These priority actions should be distinctly defined for different levels of the decision-making process individually by the State, and collectively by ROPME, to address the common concerns and the Regional emerging issues that threaten our RSA as a common heritage for the humankind, in general, and for all of us, in particular.

It is truly felt that SOMER 2013 and the environmental outlook of the RSA, contained therein, represent a real challenge to all of us in the Region. It clearly demonstrates that serious problems still exist in our marine environment, in spite of all the dedicated efforts of ROPME and the Member States throughout the 35 years of ROPME's existence. These environmental problems must be effectively addressed and remedied through our collective action.

SOMER 2013, like the preceding Reports in the SOMER series, has been prepared by ROPME in close consultation with, and based on inputs from individual National Focal Points of ROPME Member States, within the limits of the data and information available to each of them. Their time, effort, and dedication as well as those of the rest of the so many contributing individuals and cooperating organizations, particularly UNEP/ROWA and the AGU in Bahrain are gratefully acknowledged and highly appreciated.



H.E. DR. ABDUL RAHMAN AL-AWADI  
EXECUTIVE SECRETARY, ROPME

# F O R E W O R D





## I. INTRODUCTION

The Regional Conference of Plenipotentiaries on the Protection and Development of the Marine Environment and the Coastal Areas of Bahrain, I.R. Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates was convened in Kuwait from 15 - 23 April 1978. The Conference adopted on 23 April 1978 the Action Plan for the Protection and Development of the Marine Environment and the Coastal Areas, the Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution (The Convention), and the Protocol concerning Regional Co-operation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency.

On 30th June 1979, the Convention entered into force and the Regional Organization for the Protection of the Marine Environment (ROPME) was established. Since its establishment, ROPME has provided technical coordination to the Kuwait Action Plan (KAP) and assisted its eight Member States in the implementation of the Convention and its Protocols, as well as a large number of projects, covering environmental assessment and environmental management. The KAP and the following four Protocols with their specific mandates have been particularly supportive to the implementation of the Convention:

- Protocol concerning Regional Cooperation in Combating Pollution by Oil and other Harmful Substances in Cases of Emergency, adopted in 1978, entered into force in 1979.
- Protocol concerning Marine Pollution resulting from Exploration and Exploitation of the Continental Shelf, adopted in 1989, entered into force in 1990.
- Protocol for the Protection of the Marine Environment against Pollution from Land-Based Sources, adopted in 1990, entered into force in 1993.
- Protocol on the Control of Marine Trans-boundary Movements and Disposal of Hazardous Wastes and Other Wastes, adopted in 1998 and entered into force in 2005.

In addition, a Protocol concerning the Conservation of Biological Diversity and the Establishment of Protected Areas has been concluded for signing of Member States.



Further, through the dedicated efforts of ROPME and its Marine Emergency Mutual Aid Centre (MEMAC), the area located northwest of the rhumb line between Ras Al-Hadd (22°30' N, 59°48' E) and Ras Al Fasteh (25°04' N, 61°25' E) was declared as a “Special Area” by the International Maritime Organization (IMO) on 1st August 2008.

Meantime, ROPME is mandated to periodically issue a Regional “State of the Marine Environment Report” (SOMER). Each issue of SOMER assesses the current state of the marine environment of the ROPME Sea Area, and documents the most recent changes in the environmental conditions, taking into consideration the impacts of human activities on the marine environment and coastal areas. Each Report also identifies the crucial Regional concerns and the emerging issues imposing major challenges. Based on the findings, SOMER usually concludes with concrete recommendations on Regional policies and strategies, to be brought to the attention of the Governments of ROPME Member States to guide the environmental actions in the years to come.

This “Executive Summary” of SOMER 2013 is mainly addressed to “Policy and Decision-Makers” of ROPME Member States. It provides a brief up-to-date assessment of the “State of the Marine Environment” of the RSA up to the year 2012 and offers specific suggestions for priority actions to be taken at different levels to address the challenges at the National level, as well as at the Regional level within the Global context.

## II. KEY ENVIRONMENTAL CHALLENGES IN THE ROPME SEA AREA

**G**uided by the main conclusions of the regional assessment of UNEP’s Global Environment Outlook (GEO) with regard to the region of West Asia, the key environmental challenges in this geographic region, that includes ROPME Sea Area, are mostly related to the rapid social and economic developments and the political transformation that have occurred in the ROPME Member States. The Region has experienced unprecedented high rates of population growth, following the high financial returns from oil and the accompanied high rate of development, particularly in the coastal areas.

According to the GEO conclusions, the key environmental challenges and the focal Regional issues have been identified. They include: water

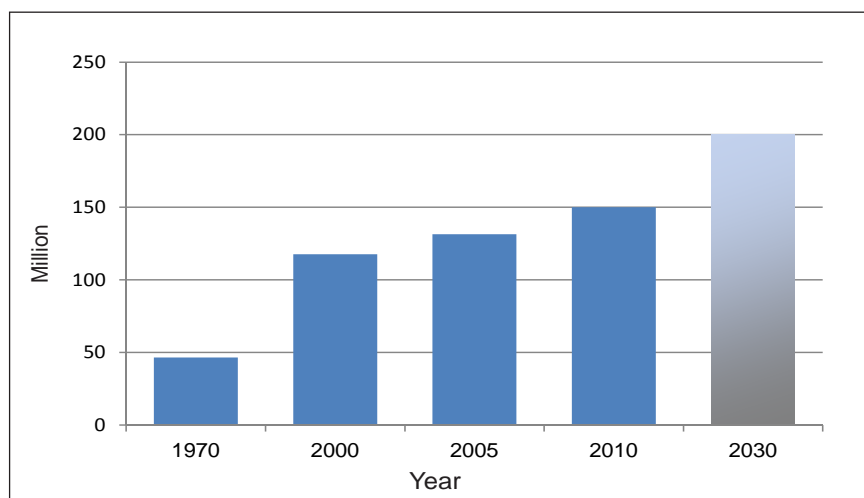


scarcity and quality, land degradation and desertification, degradation of coastal and marine environment, management of urban environment, over-exploitation of natural resources, and the negative impacts of the occasional armed conflicts and violence on the environment.

This Executive Summary provides a brief account of key environmental issues related to the degradation of the marine and coastal environment in the ROPME Sea Area, which are being presented and fully addressed in SOMER 2013.

## 1. Impacts of Urban Development

Although ROPME Member States have different socio-economic and geopolitical characteristics, the exploitation of natural resources and the sustained growth of population and urbanization constitute major driving forces for the economies of all of them. In four decades, the total population of the RSA countries, including the expatriates, has tripled (Figure 1). Recently, there have been some efforts to control population growth in many ROPME Member States, and the population is currently growing at a slower rate compared to that at the turn of the century. Accordingly, it is projected that the rate of population growth in the RSA countries will decline to 2.1% or less than the global replacement rate during the next two decades, as the total population is projected to reach 200 million in 2030.



**Figure 1.** Total RSA Population in millions. (Sources: UNDP, 2009; UNDESA 2010)

Out of the total population of the Member States, the urban population was 21.8 millions in 1970. The urban population then increased to 84 millions

in 2000, 95.23 millions in 2005, 106.7 millions in 2010, and is projected to reach 153.3 millions in the year 2030. In States located on the western side of the inner ROPME Sea Area (i-RSA), almost 80% of the total population are living in urban settlements (Figure 2). Given the shortage of suitable land for development, in many Member States, such as Kuwait, Qatar and UAE, most major cities are situated on the coast, and almost up to 100% of the total population is living in urban areas, or being supported by services provided by coastal and marine ecosystems.

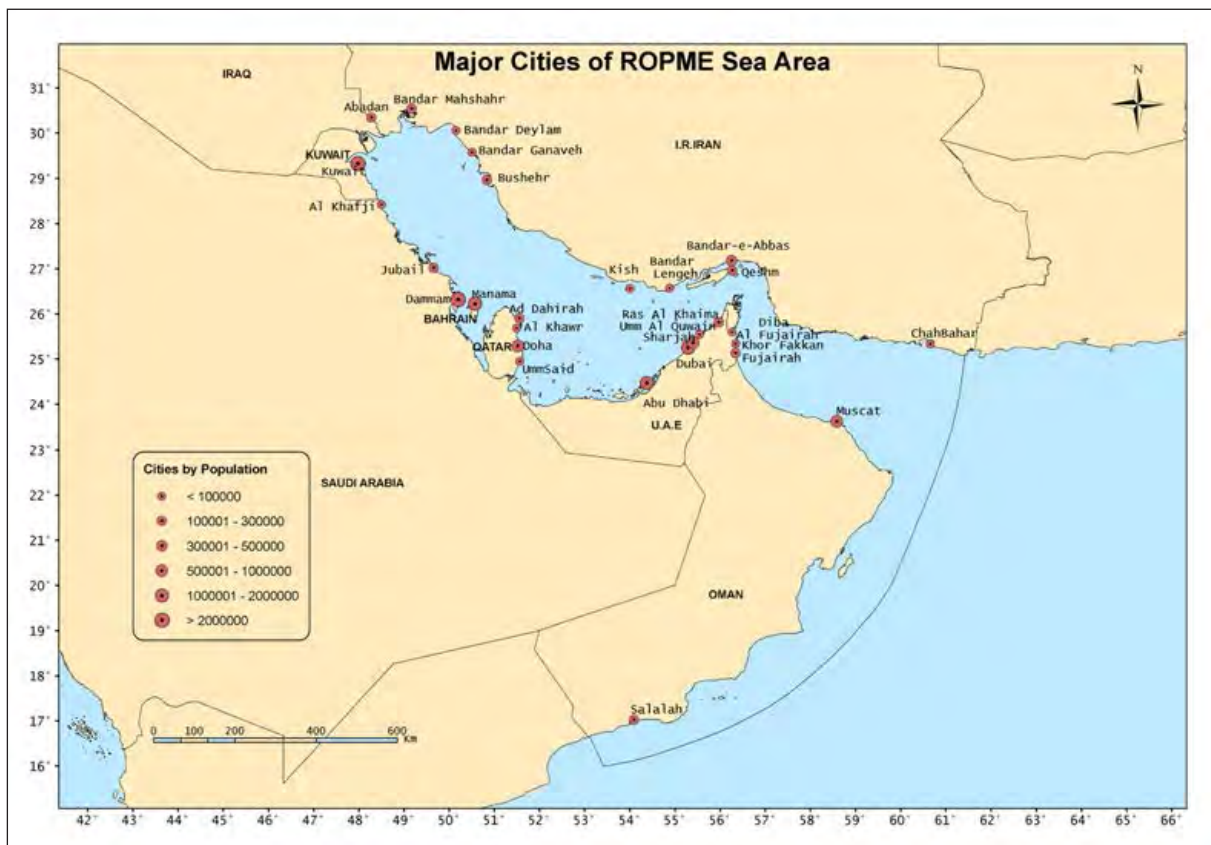


Figure 2. Major RSA Cities.

As urban areas expand, demand for land increases and prime coastal habitats are transformed into land for infrastructure, housing, tourism, recreation, industrial developments, and ports (Figure 3). In most countries of the RSA, the coastal ecosystems are continuously threatened by urban land conversion projects, which range from filling of coastal lowlands and marshes to large-scale dredging and sea-filling operations. Such population growth and urbanization rates create and continue to exert tremendous pressures on the marginal terrestrial resources and on the marine ecosystems of the



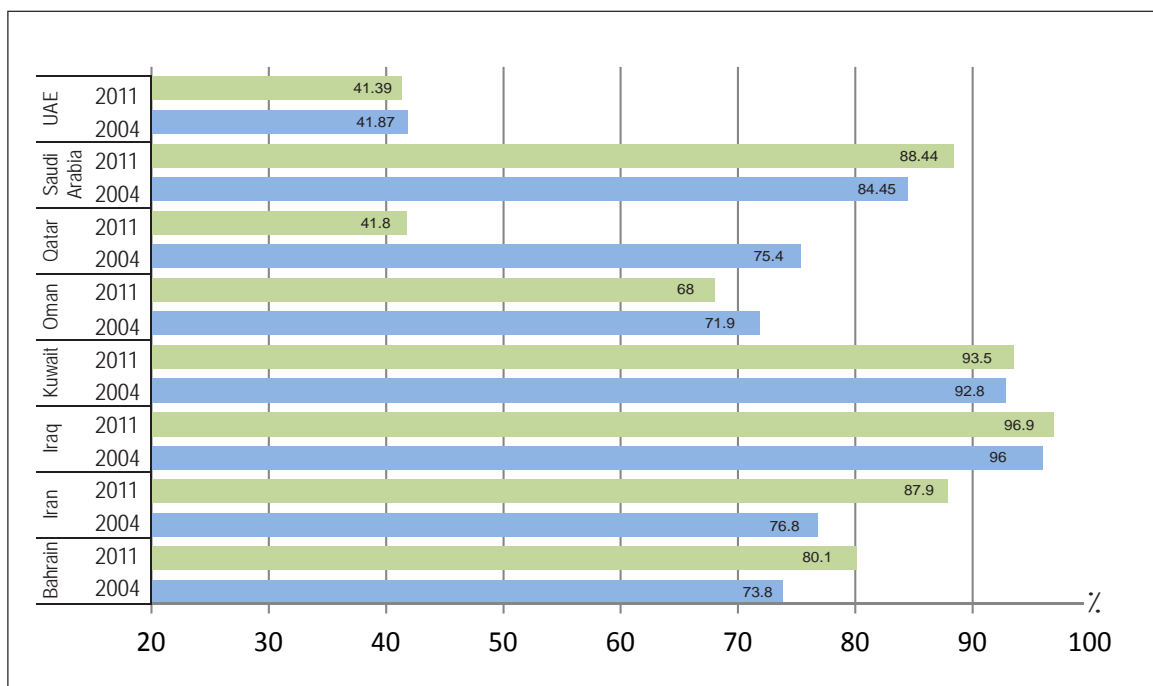


RSA. These development activities could lead to loss of agricultural lands, and accelerate the depletion of groundwater tables, salinization, pollution, and alteration of the biological and hydrological balances of the coastal ecosystems, as well as serious physical alterations of the coastline.

Addressing the problems of urban sprawl in the RSA is crucial for sustainable development. Any analysis should take into consideration sectoral, rural and urban socio-economic policies, which are key inputs for controlling current and future environmental degradation of the coastal ecosystems at the local, National and Regional levels. The trade-offs between preserving the existing marshes, wetlands and marine ecosystems, on the one hand, and the conversion of such areas into land suitable for urban developments, on the other, are often decided by policies based mainly on the economic interests and the need to satisfy the ever-growing demands for urban growth.

## 2. Impacts of Land-Based Activities

The economic situation in most RSA countries is unique. While many countries of the Region have a small population, they have access to large oil and gas reserves. Statistics show that the countries on the



**Figure 4.** Percentage contribution of the oil sector in the economy of RSA countries. (Sources: National Central Banks for 2004 & 2007; Alkholiefy and Alreshan for 2010; OPEC for 2003 - 2011)



western coast of RSA collectively account for 40% of the World's proven oil reserves, which makes them among the leading oil producers of the World by supplying about 23% of the World's crude oil production. Further, the RSA countries have at their disposal up to 23% of the World's proven natural gas reserves and account for 8% of the natural gas production of the World. Therefore, the economies of most RSA countries have been dominated by the oil and gas sectors (Figure 4), although, the relative contribution of other sectors to GDP have increased over the years.

## 2.1 Disposal of Industrial Wastes

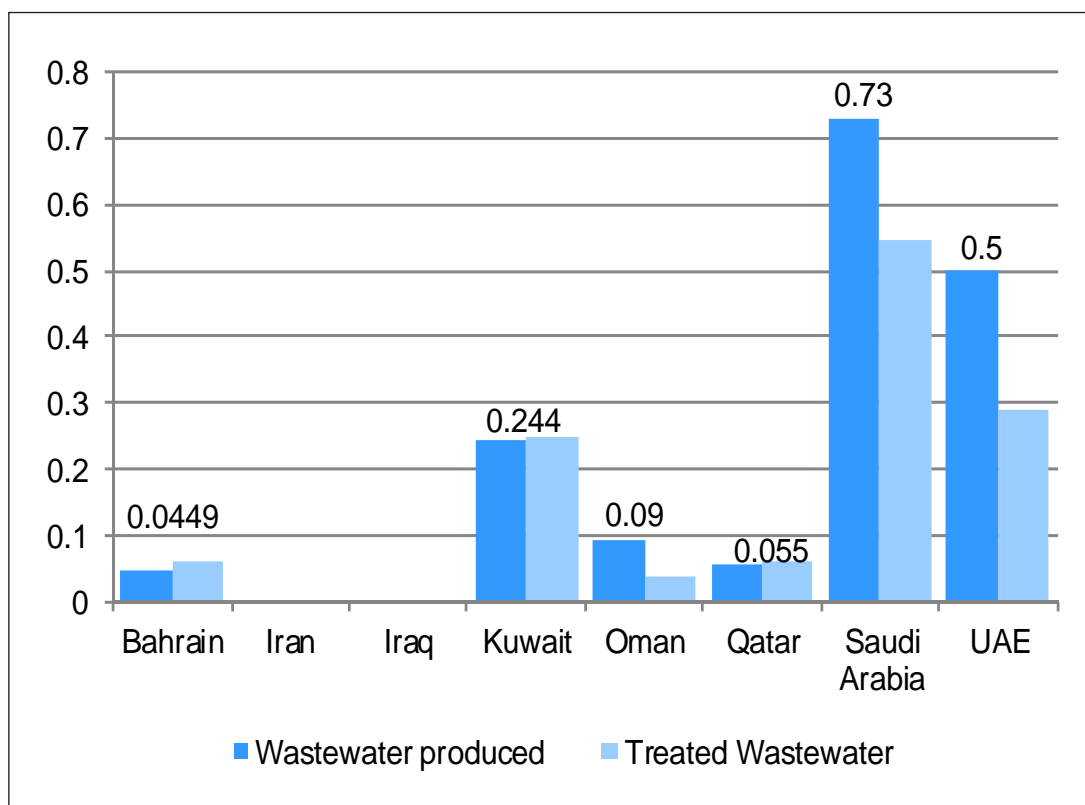
The key industries in the countries around RSA include petroleum refineries and petrochemical complexes, as well as desalination and power plants, in addition to some light industries such as agricultural and livestock production, and food and beverage processing. Generally, the oil and gas industries are the main sources of solid and liquid industrial wastes discharges into the RSA. The discharges consist mainly of drilling wastes, operational sludge and oily fluids from unused fracturing fluids or acids, plants cooling towers cleaning waste, painting wastes, waste solvents, and used equipment lubricating oils. The common contaminants are hydrocarbons, metals, slats and sulphides, as well those contributing to the pH level of coastal and marine waters.

As for the desalination/power plants, and while recognizing the vital role that these plants play in the urban and industrial development of the countries, the quantity and nature of cooling and brine water discharges from them represent high thermal and pollution loads. The discharges mainly include heated brine containing disinfection byproducts, corrosion products and additives of the desalination process, all of which have direct negative impact on human health, the sustainability of fisheries and the overall health of the marine environment. However, such wastes may not be a problem if proper regulations are enforced and they are adequately managed so that their impact on the environment and human health is minimized. The appropriate planning and the application of various established mitigation measures should be employed.



## 2.2 Discharge of Domestic Sewage and Liquid Wastes

In view of the fact that water is a scarce resource in many countries around RSA, most of them depend mainly on the available fresh water resources, and on what they produce by desalination and treatment of seawater. Nevertheless, and despite the scarcity of fresh water resources, the rate of water consumption is rather high with no incentives for the residents to conserve. The per capita consumed potable water in some RSA countries is 2 to 3 times of the basic needs for the average person.



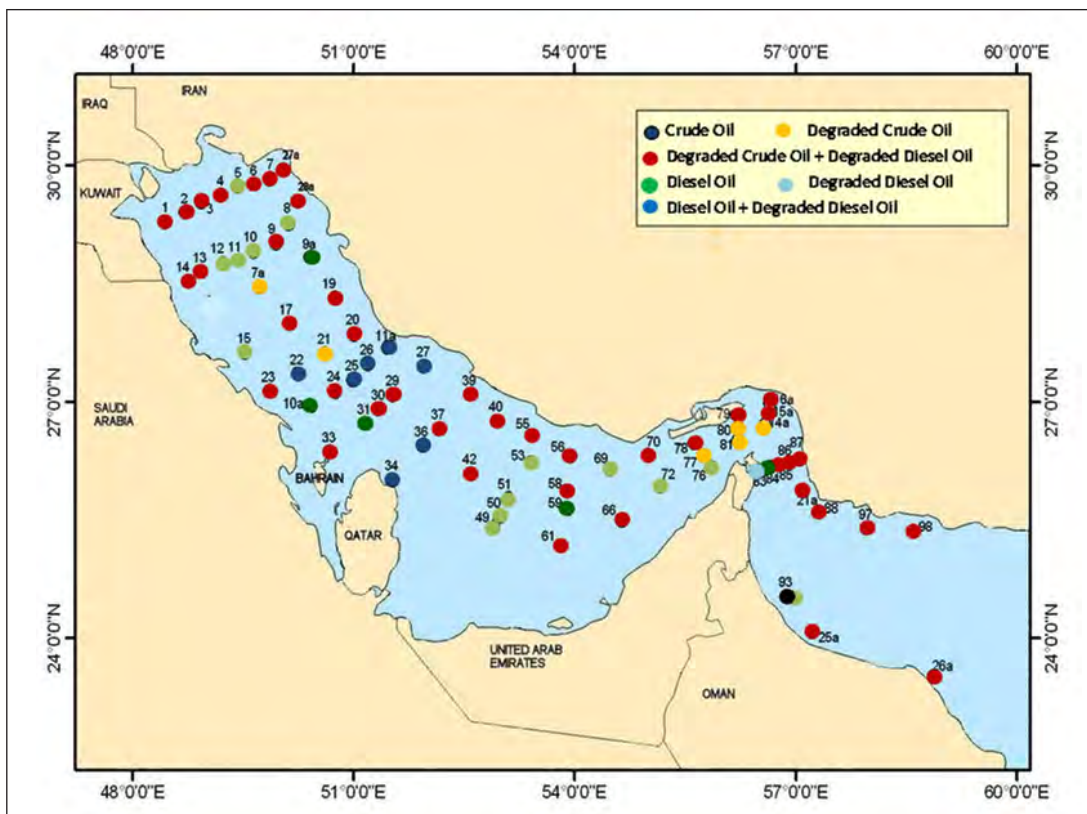
**Figure 5.** Wastewater produced and treated in RSA (10<sup>9</sup> m<sup>3</sup>/year).  
 (Sources: Choukr-Allah, 2010; Kuwait Ministry of Public Works, 2012)

The high water consumption also results in high domestic sewage and used water discharges from urban and rural areas of the Member States, with major impacts on the coastal and marine environment (Figure 5). Part of the sewage is either partially treated or untreated, depending on the source and the types of treatment available. The volume of domestic sewage is on the increase and the estimated capacity of the sewage treatment plants in the RSA is at present more than 2 million m<sup>3</sup>/day.

## 2.3 Status of Contaminants in the RSA

### Oil Pollution

The Oceanographic survey carried out by ROPME Winter 2006 Cruise showed that the offshore surface sediments of the Sea Area are characterized by background levels of natural hydrocarbons derived from mixed autochthonous and terrestrial origin, with low levels of anthropogenic input of degraded petroleum hydrocarbons from petrogenic sources. (Figure 6).



**Figure 6.** Types of Oil Pollution in offshore Surface Sediments of RSA during ROPME Winter 2006 Cruise.

Reconstruction of oil pollution history in the RSA carried out recently indicates that sediments in the middle of the Inner ROPME Sea Area (i-RSA) are polluted with degraded crude oil similar to the Kuwait crude oil spilled during the 1991 War.

Within the framework of the Regional Mussel Watch Programme, the state of oil pollution in the near-shore environment of the RSA in 2011 showed



that oil pollution in sediments is only a problem in some limited areas such as Askar (Bahrain) and Doha (Qatar) (Figure 7). In these areas, a special monitoring programme is to be initiated to trace out the source of pollution. Generally, the levels of oil pollution in bivalves have decreased to values reported before the 1991 War.

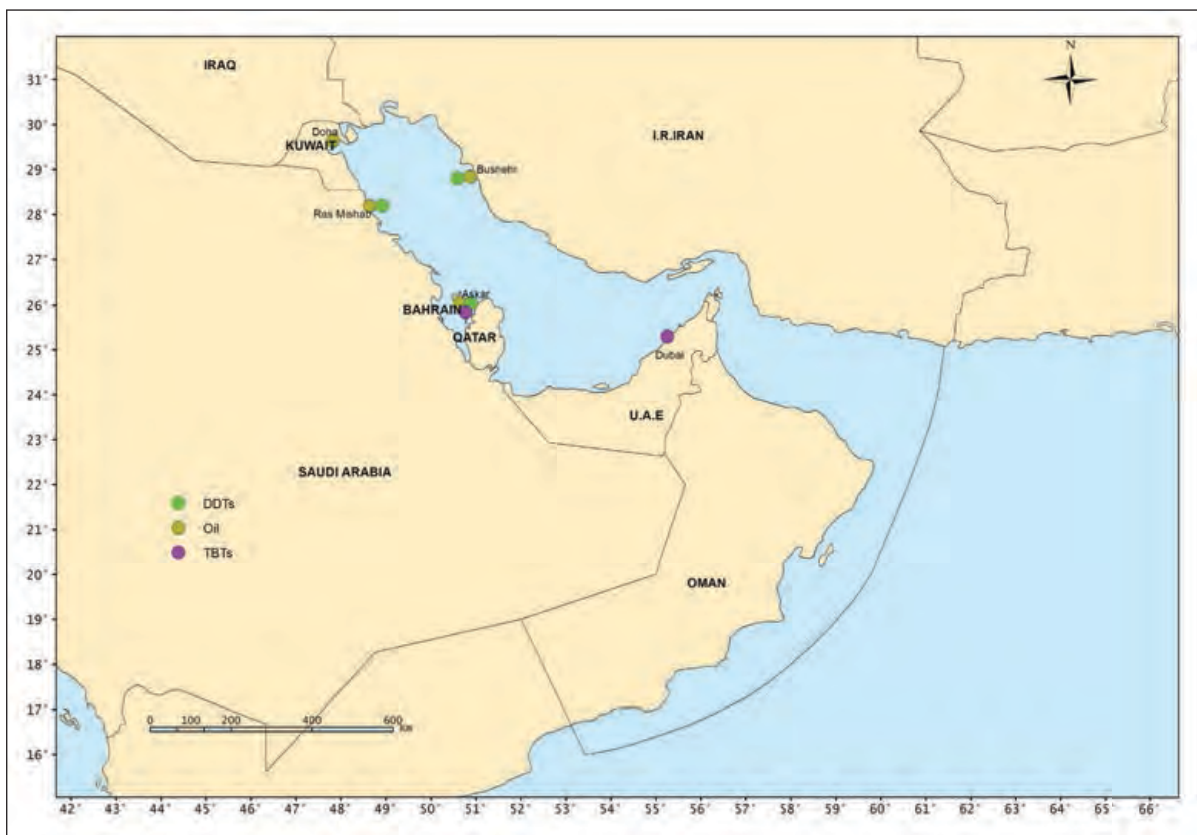


Figure 7. Sites in the RSA with levels of pollution in nearshore sediment exceeding relevant guidelines. (ROPME Mussel Watch Programme-2011)

## Organochlorinated Contaminants

Concentrations of organochlorinated compounds in the offshore sediments in the RSA have been relatively low by global standards.

Levels of country mean concentrations of Stockholm POPs and PTSs in near-shore marine environment of the RSA maintain their extremely lower levels in comparison to global standards, as recorded in the 1994 - 2005 surveys. The levels of total DDTs, total HCHs, and total PCBs in near-shore sediments are uniform except at three sites in I.R. Iran, Qatar and Saudi Arabia.



## Trace Metals

Arsenic, Chromium and Nickel in the offshore sediments have concentrations exceeding sediment quality guidelines. The high concentrations of Cr and Ni are undoubtedly originated from anthropogenic activities. Several other heavy metals (Cd, Pb, Hg, Ag) have relatively low levels that pose no environmental concerns.

For the nearshore environment, levels for most of the 22 trace elements screened in oysters during 2011 were generally in agreement with levels reported in the previous screenings, with the exception of Copper in the pearl oysters from Dubai. The very high levels of Lead in the sediments from Askar (Bahrain) that was observed during the 2005 survey were notably decreased in 2011 to below the Effects Range Low level. The high levels of Chromium observed at certain sites during 2000 and 2005 were also not noted in 2011.

## Radionuclide levels

The preliminary assessment of the concentration levels of five radionuclides (K-40, Cs-137, Pb-210, U-238 and U-235) in sediment samples collected in the offshore areas during the Winter 2006 Cruise, as well as in the near-shore areas during 2011 were very low compared to those reported worldwide or elsewhere in the Region. The concentration values did not show any clear spatial distribution trend.

## 2.4 Carbon Emissions

It is a well known fact that, to a certain extent, the atmospheric deposition contributes to regional marine environmental pollution. It is also known that all Member States of ROPME depend mainly on fossil fuels for energy. The availability of fossil fuels at low production costs in the Region has resulted in the investment in energy-intensive industries such as desalination, petrochemicals, and aluminum smelting. Thus, energy intensity is relatively high in the Region. The average energy required to produce one unit of GDP is 0.54 toe/thousand 2000 USD, which is nearly 3 times of the world average (0.19 toe/thousand 2000 USD) and more than those of some developed countries such as UK, USA, Australia and Japan, or emerging economies like China and India.



Meantime, the electricity consumption is relatively high in the RSA countries as well. The average electricity consumption is around 10,000 kWh/capita (Figure 8), whereas the world average is 2,729 kWh/capita, which means that the Regional consumption is more than 3 folds of the world average.

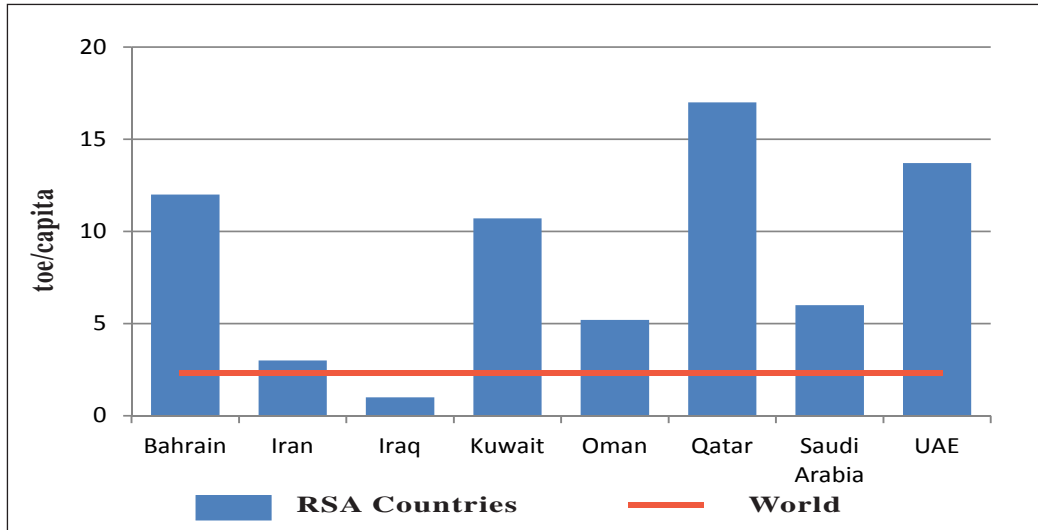


Figure 8. Energy consumption per capita in RSA countries in 2009. (Source: IEA, 2011)

The major sources of atmospheric emissions that pollute the environment of the RSA are heavy industries such as oil refineries, oil gathering centers, oil platforms, petrochemical and fertilizer plants, and desalination/power plants, as well as motor vehicles. The emission of polycyclic aromatic hydrocarbons (PAHs) from the combustion of fuel in motor vehicles poses great risks to both the environment and the human health.

### 3. Impacts of Sea-Based Activities

According to the records of ROPME/MEMAC, the RSA is experiencing a high volume of maritime traffic (Figure 9). In 2010, MEMAC carried out a study to identify the Marine Environmental High Risk Areas (MEHRAs), which are at risk from shipping in the RSA. The project combined shipping risk assessment with a review of the environmental sensitivity of the coastline to identify candidate MEHRAs for each Member State. The study clearly showed that Oman had the highest accident frequency. In comparison with the other ROPME Member States, Oman has the largest sea area and includes shipping “hot-spots” such as the Strait of Hormuz. However, Iraq, which has the smallest sea area, had the lowest shipping accident frequency.



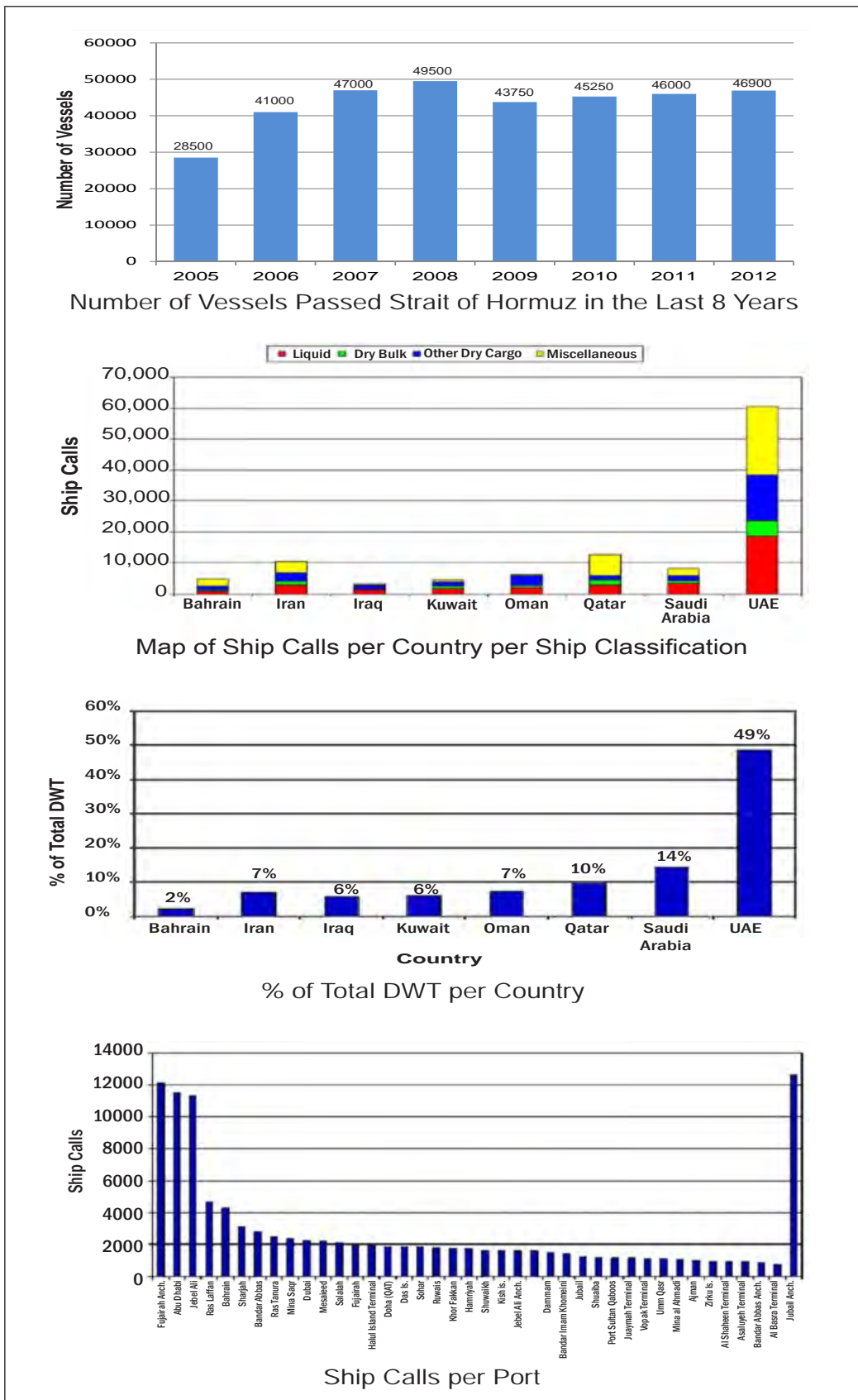


Figure 9. Status of shipping traffic in the RSA during 2012. (source: MEMAC, 2012)

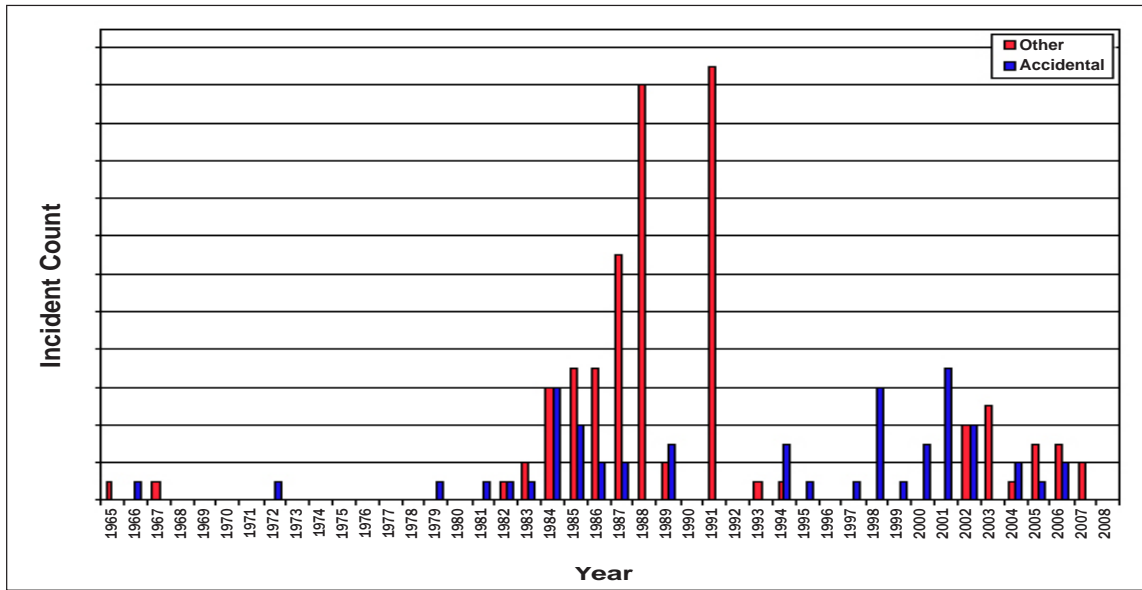


Figure 10. Historical review of number of Incidents per Year. (Source: MEHRAs, MEMAC, 2010).

For the last decade, ROPME and MEMAC have exerted efforts to control and mitigate the effects of maritime accidents, as relevant historical data indicates a general decrease in the number of maritime accidents observed in the Region. A total of 159 incidents were reported during the period of 1965 - 2008. The yearly variation in incidents (Figure 10) falls into major shipping accidents (e.g., collision, grounding, etc.), which were the focus of the study.

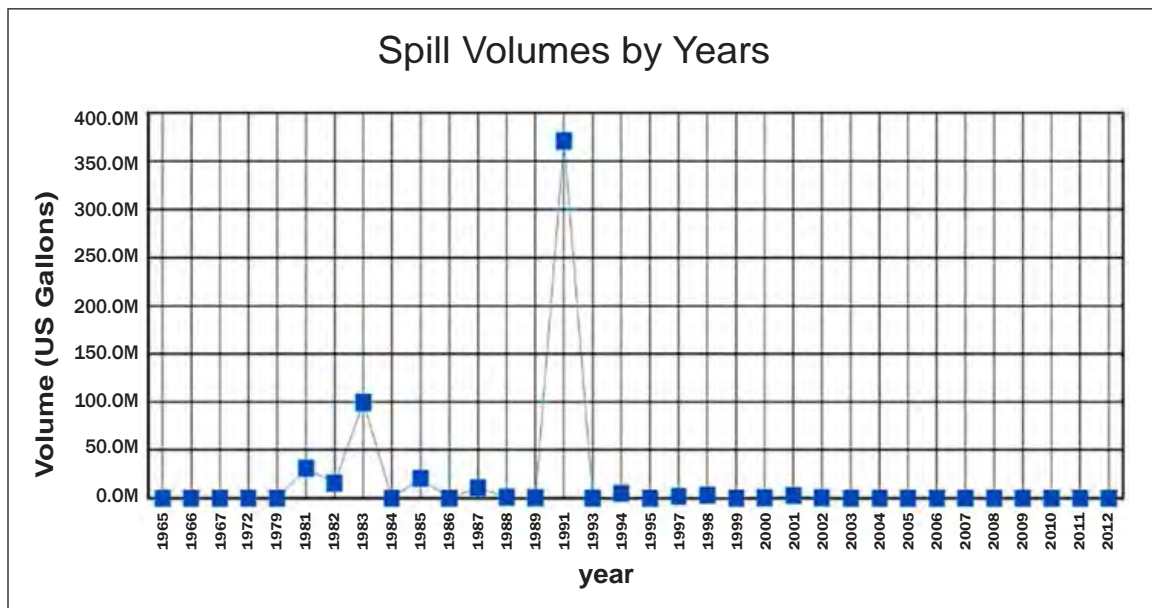
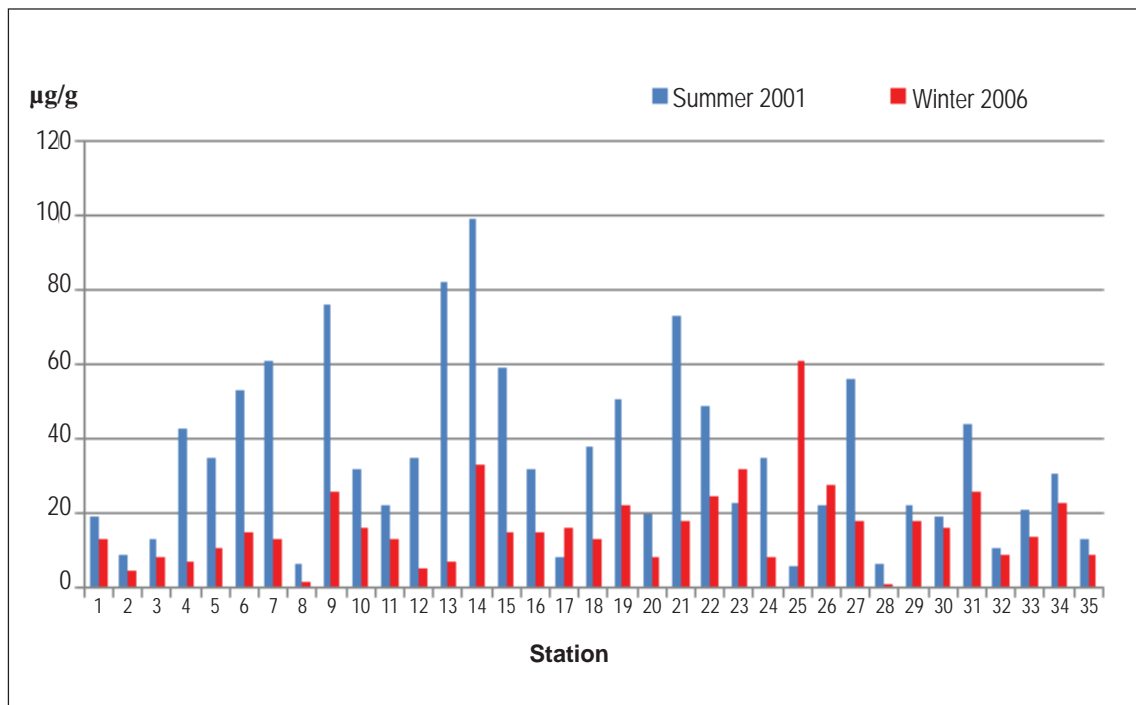


Figure 11. Volume of Oil Spills Recorded from Shipping Accidents (1965 - 2012). (as by first MEMAC Track Record)



High volume of maritime transportation presents high risk of adverse effects resulting from possible oil discharges or during accidents (Figure 11), an added value to the risk of oil spill from offshore oil operations. Historical data indicates that infrequent, major spills tend to dominate the risk picture. It is estimated that about 8598 tons of oil are spilled in the Region annually, with cargo oil accounting for about 86% by weight, and fuel oil contributing about 14%.



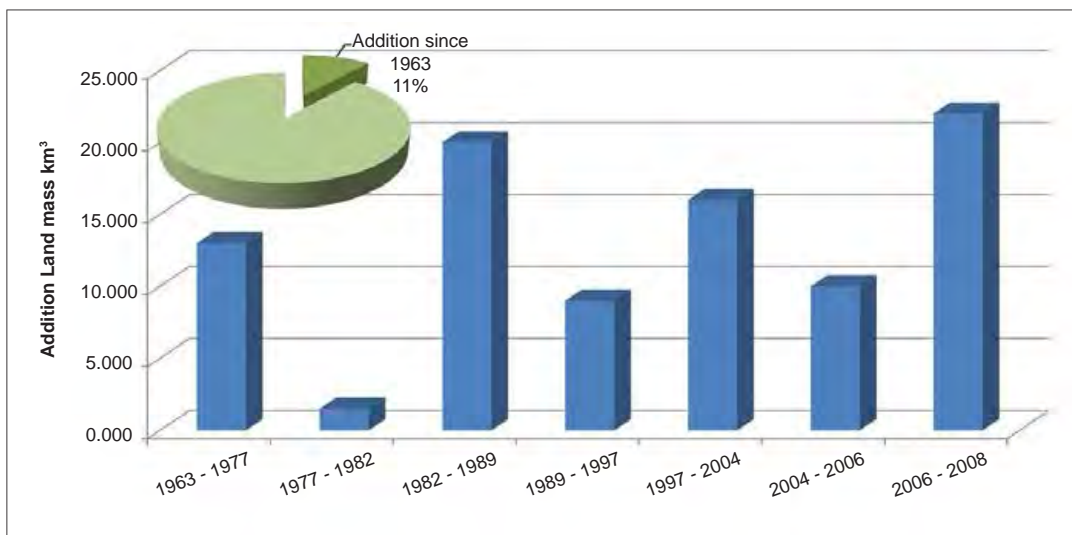
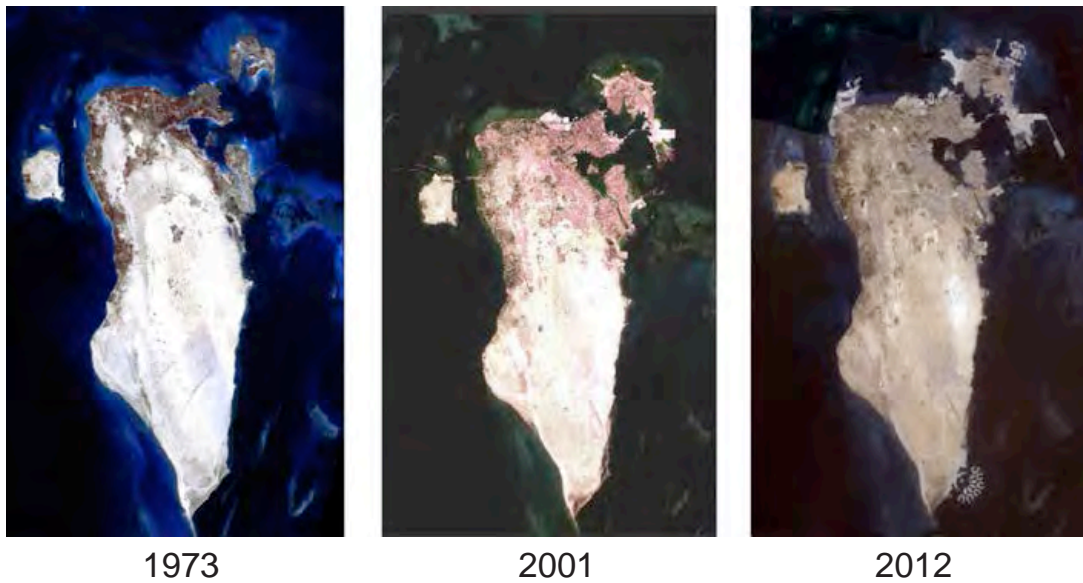
**Figure12.** Trend of Oil Pollution (as ROPME Oil Equivalent) in surface sediments of RSA during ROPME Summer 2001 and Winter 2006 Cruises. (Regional Guideline: 15 µg/g)

ROPME also undertook a study for “The Reconstruction of Oil Pollution History in the ROPME Sea Area”. The main goal of the study was to examine the effectiveness of the measures taken for the control of oil pollution in the Region during the last two decades. Interestingly, all of the four investigated sites did not exhibit important signs of oil pollution. Meantime, the substantial decreases in levels of hydrocarbons in sediments observed between 2001 and 2006 (Figure 12) could be attributed to the improvements in emission controls and to the continuous substitution of oil fuels by liquefied gases.



## 4. Physical Alterations and Destruction of Habitats

Given that the development of recreational and touristic facilities in the coastal area is an important industry for the diversification of National economies, ROPME Member States are developing, at a rapid rate, recreational and touristic facilities in the coastal zone, along with necessary coastal roads and other infrastructures to cater for the various needs of individual travelers and tourist groups.



**Figure 13.** Landfilling in Bahrain. (Many RSA countries have already developed 40 per cent of the coastline. For instance, 10 kms of the Omani coastline has been reclaimed with quarry and sand beach material. Landfilling activities in Bahrain increased considerably since the 1970s, due to industrial and residential pressures. In Bahrain, the land area has increased 11% since 1963). (Source: [http://www.seos-project.eu/modules/world-of-images/images/bahrein\\_kompsat.jpg](http://www.seos-project.eu/modules/world-of-images/images/bahrein_kompsat.jpg))



**Figure 14.** Industrial development in Jubail. (In Saudi Arabia, approximately 40% of the coastal area on the RSA has been developed into industrial and supportive residential and commercial areas along the coast. Particularly Jubail, Tarut Bay, Dammam and Khobar, demonstrate the extent of coastal infilling and landfilling in the Region. In Jubail city, more than 200 million cubic meters of sediments adjacent to the development have been removed and 46.5 square km of coastal habitat have been dredged in Jubail and Dammam. These areas of shallow subtidal coast are highly productive and form nursery and feeding grounds for most commercial shrimp and fish species).



**Figure 15.** Development of Khiran in Kuwait. (Considerable parts of the inter-tidal area in front of Kuwait city and in areas on southern coast have been developed, leading to significant erosion problems along most of these areas).

In the last decade or so, coastal development activities have considerably increased, particularly in Bahrain (Figure 13), Oman and UAE. Similar activities are also taking place in Saudi Arabia on the Jurayd and Jana Islands and in Jubail, Muntazah, Dawhat Assayh, Zalum and Al-Khobar (Figure 14); in the I.R. Iran on Kish and Qeshm Islands; and in Kuwait along the waterfront of Kuwait City and at Al-Khiran recreational areas (Figure 15). Mega coastal developments in the Region are by far much larger in proportions than those globally.

The alarming magnitude of the physical alteration of the RSA coastline has several major adverse environmental effects on the coastal and marine ecosystems, including damages to the spawning ground of various marine species, sea grass beds, and the benthic communities. This has been augmented by an increase in siltation due to the release of fine material during the dredging operations, resulting in considerable increase in water turbidity, which, in turn, irritates fish gills, interferes with visual feeding and inhibits photosynthesis.

Ultimately, the coastal land-filling and marine dredging activities are physically changing large sections of the coastline along the entire RSA, fragmenting the proper habitats of many organisms, decreasing the biodiversity in the Region and disrupting the entire food chain with cascading effects leading to great reductions in the fish stock.

## 5. Climate Change

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in 2007, has noted that among the areas, most vulnerable to climate change are the coastal plains, whose economics are closely linked with climate-sensitive sources, and those areas prone to extreme weather events. The Assessment Report also categorized the RSA within the regions that have witnessed an increase in temperature of 1 to 2 degrees Celsius in the years between 1970 - 2004. The changes may impact the RSA by affecting the coral reefs and reef associated invertebrates; causing more harmful algal blooms; degrading water quality and leading to mass marine mortality; and ultimately reducing the landings of fisheries in the Region.



Further, it is expected that future increases in climatic variability will lead to adverse impacts on a number of vulnerable sectors, systems, and livelihoods in the countries of the RSA. This will most likely place additional stress on the political and economic systems of the Region, due to the decrease in precipitation and a projected temperature and sea level rise.

As the coastal and marine environment gets degraded due to human pressure, the ecosystem services will diminish and the resilience of the environment to endure the climate change effects drops. Other areas of particular concern in the Region are the increased frequency of dust storms and cyclones, and the expected sea level rise due to the climate change.

## **6. Over-Exploitation of Living Marine Resources**

### **6.1 Decreases in Fish Landing of Priority Species**

The contribution of marine fisheries sector to the economy of the ROPME countries may appear to be of low importance compared to the oil industry. Nevertheless, fish is one of the most important natural renewable resources in the Region, contributing to local food supply and exports of fisheries products. In addition, the fisheries sector (including aquaculture) provides employment to some 250,000 people in RSA countries directly, and assuring livelihood for more than one million people. According to FAO estimates, the total catch from the RSA was 792,000 tons in 2007 and 766,000 tons in 2008, and trade in fisheries products accounted for 996 million US\$ in 2007.

However, the highly productive intertidal zones of the Region have severely been impacted by the coastal area development projects for residential, industrial and commercial purposes thus reducing the nursery and feeding grounds for a large number of commercial shrimp and fish species.

Further, the fisheries resources of RSA are over-exploited or have already reached optimum exploitation rates for some major species. The over-exploitation of fish, crustaceans and molluscs species have become a serious concern, particularly for certain species of high commercial value.



Meantime, the population expansion will continue to place increasing pressures on the marine resources and especially on high value resources. The total landings of priority species remained relatively stable in the i-RSA division, around 50% of the total landings from 2000 to 2007, whereas it decreased from more than 50% in 2001 to 30% in 2006 in the Sea of Oman division. Generally, the demersal resources including shrimps, and species such as silver pomfret, hilsa shad, rock lobster and abalone are over-exploited and some species such as king mackerel has reached the optimum exploitation, although there are limited studies to properly assess stocks exploitation level. A simple Productivity-Susceptibility Analysis (PSA) conducted in 2008 by the RECOFI Working Group on Fisheries Management revealed that shrimp trawls and driftnets were the two main gears that could have greater impact on priority species and that sharks were the most sensitive to gears used in the Region, followed by groupers and emperors.

## 6.2 Marine Protected Areas (MPAs)

In the last decade or so, ROPME Member States have designated specific areas in key ecosystems as Marine Protected Areas (MPAs) (Figure 16), and are planning further allocations of MPAs, to safeguard the Region's biodiversity. All Member States have ratified/ acceded to the UN Convention on Biological Diversity (UNCBD), and accordingly are committed to the strategic goals of Aichi Biodiversity Targets, which were set forth in 2011. In particular, the Member States are working specifically towards implementing the Strategic Goal "C", intending to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. It stipulates that by the year 2020, Member States are to allocate 10 percent of the coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, as protected. These areas are to be effectively and equitably managed, ecologically representative, well connected with other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

However, there is a need to develop sound Regional management plans and build the capacity of Government staff through intensive training on coastal zone management and planning to proceed with the objectives.

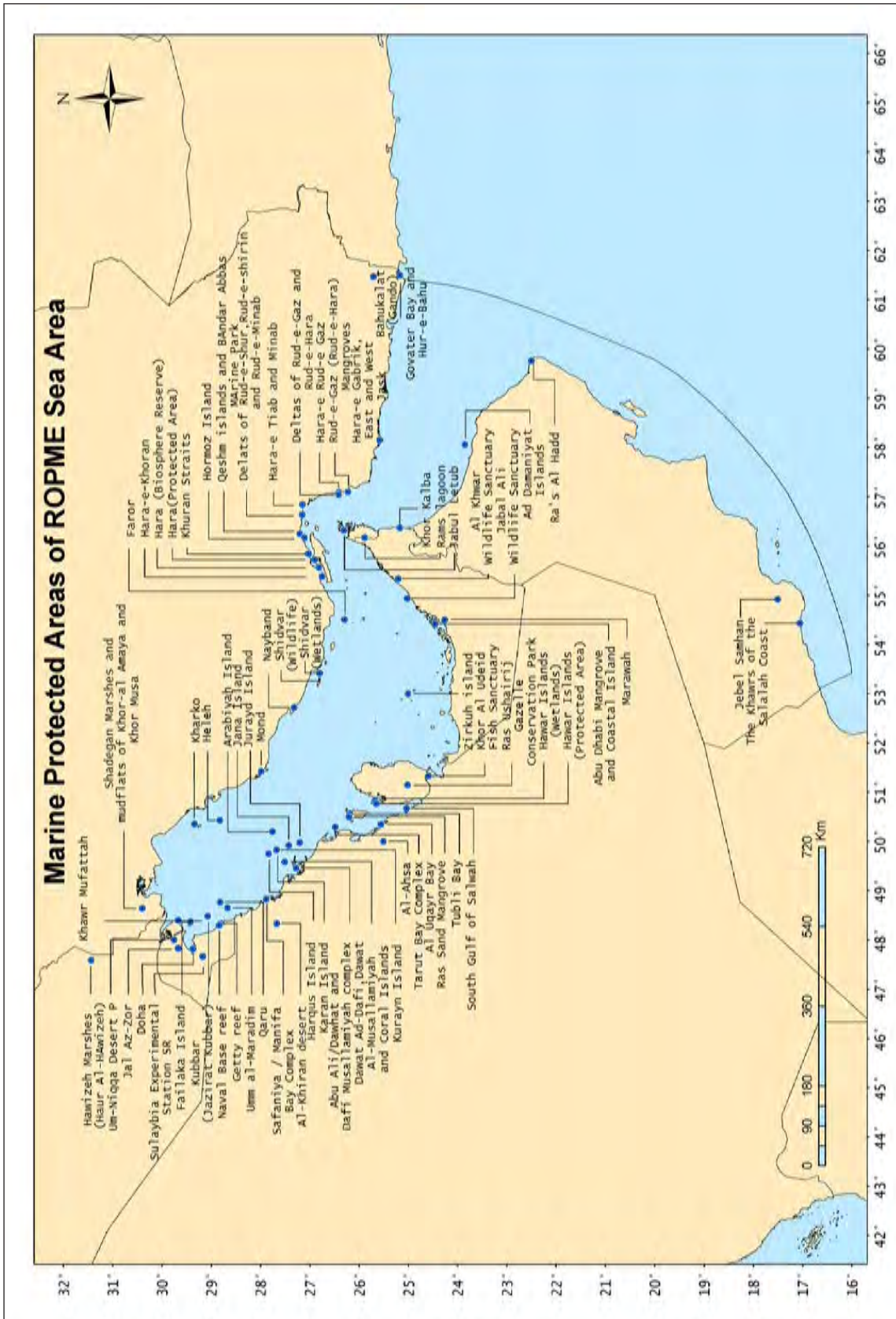
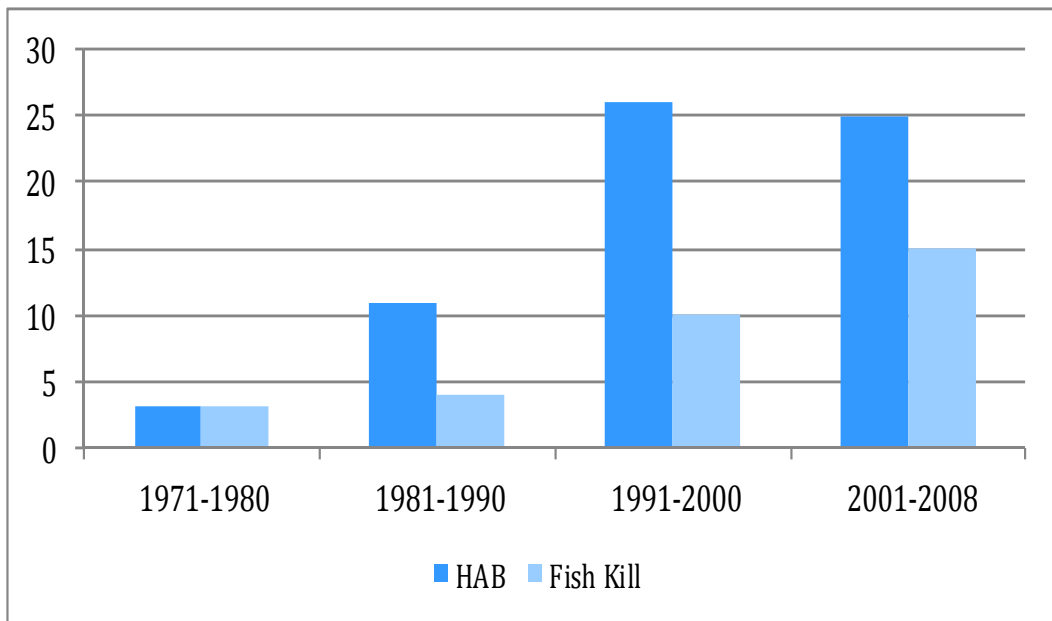


Figure 16. Marine Protected Areas in RSA. (Source: WDPA data for 2011)

## 7. Harmful Algal Blooms (HABs)

The RSA, being a semi-enclosed, shallow body of water that experiences increasing human influence, is susceptible to the frequent development of HABs. The busy maritime traffic can provide a channel for the introduction and establishment of new algal populations, through discharge of ballast water into the warm stable waters of the Region with enriched nutrients. The construction of further engineering projects in protected lagoons, the increases in anthropogenic discharges, and the sporadic warming events, may create suitable conditions for the expansion of HAB events throughout the Inner ROPME Sea Area (i-RSA).

In the last decade, the RSA has been witnessing increasing occurrences of Harmful Algal Blooms (HABs), with some of the incidents assuming disastrous proportion, resulting in fish kills and affecting coastal and marine environment services. MODIS observations, regularly monitored by ROPME's Ground Station, and the feed-back received from Member States, indicate the presence of HABs and the occurrence of fish kills associated with HABs, as averaged over decades.

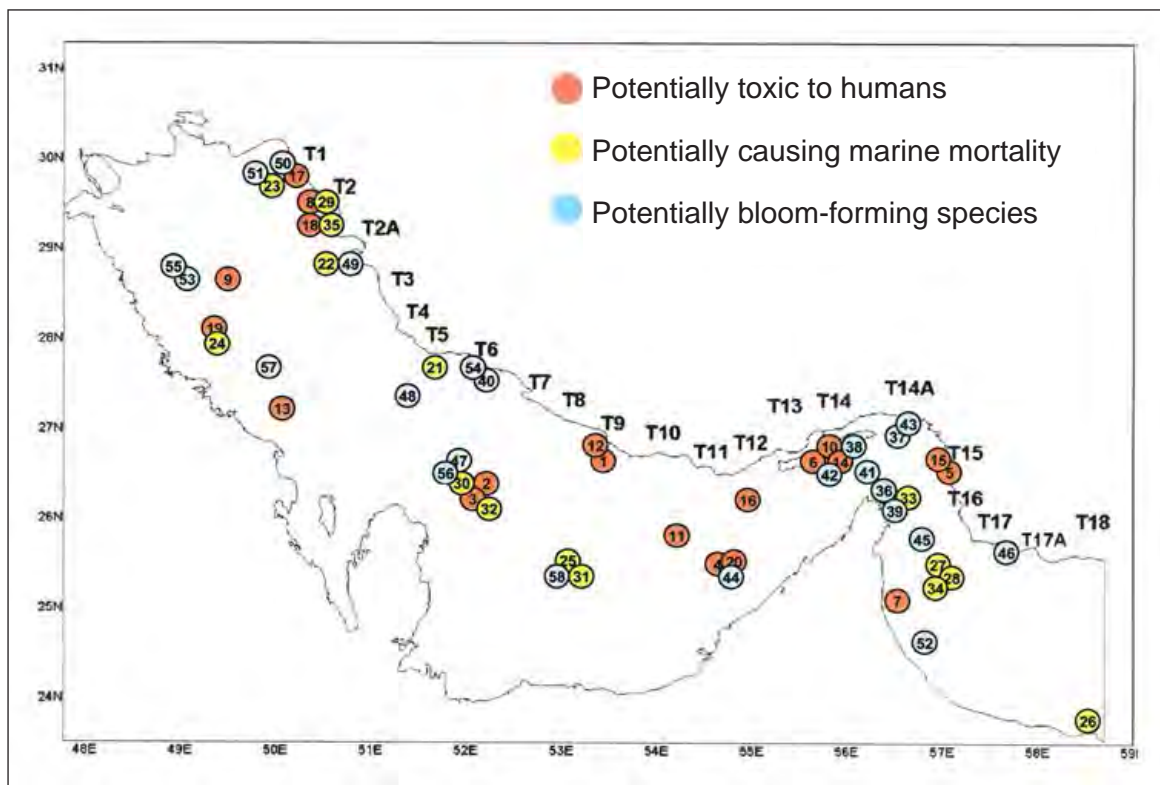


**Figure 17.** Inter-annual change and trend in the HABS and Fisk Kill events in the Sea of Oman.  
(Source: <http://omansea.org>/Modified after Piontkovski, omansea.org)



A significant feature implied by the analysis is the ratio between HABs and fish kills incidents. Throughout four decades, the frequency of HABs has exceeded the frequency of fish kills (Figure.17). This means that not all HABs had caused fish kills. Nevertheless, the causative pattern of this relationship makes its way throughout decades of observations. In the last decade, more algal blooms had reached the HAB category and the number of fish kills had increased and became more associated with HABs, in comparison to the previous three decades.

The widespread area covered by potentially problematic species of HABs (Figure 18), and subsequent catastrophic impacts caused in the marine environment clearly illustrate the need for coordinated Regional monitoring programmes for HABs in the RSA. There is also a need for the development of test protocols and/or technology to avoid the closure of desalination plants during severe HAB events.



**Figure 18.** Distribution of the maximum abundance for the potentially harmful algal species in the RSA during ROPME Oceanographic Cruise - Winter 2006

### III. CONCLUDING REMARKS

**B**ased on the facts and findings presented in the various Chapters of the present “State of the Marine Environment Report” (SOMER 2013), a set of important observations could be highlighted to guide our policy decisions for better, healthier and more sustainable Sea Area for our Region. The following main conclusions are particularly noted:

1. The current trends, practices, and levels of governance and sustainable management of the RSA are still inadequate and if not remedied will lead to its further degradation and the loss of its ecosystem functions and services. This is expected to have dire consequences and negative impacts on the socio-economic development of ROPME Member States.
2. The management of, and the protection policies for the RSA in general, and for the priority application of ROPME protocols, in particular, need to be integrated and mainstreamed into the National social and economic development plans, placing human and environment in the center of the planning process.
3. Regional cooperation between the RSA countries is vital for the sustainable management of the RSA ecosystem. The priority areas of cooperation are mainly in the fields of trans-boundary bio-reserves and protected areas, Regional application of Ecosystem-Based Management (EBM), enforcement of laws and regulations, monitoring and assessment, and data and information exchange.
4. The main obstacle in preparing SOMER 2013, has been the limitation of compatible data available on the impacts of the land and sea-based activities on the marine and coastal ecosystems. The first step to overcome this shortcoming is to consolidate a network for collaboration on relevant issues in this area, promoting, and streamlining data sharing.
5. Member States are to work together, in concerted effort, to gather first-hand information about the land-based sources of marine



degradation, and on the possible impacts of various anthropogenic and climatic sources such as contaminants, overfishing, invasive species, climate change, etc. This effort will be crucial in providing the required solid scientific basis, and hence in guiding the policies and actions aiming towards better coastal and marine management.

6. Member States are encouraged to participate actively in the UNEP Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, especially in the core partnership areas of wastewater, nutrients and marine litter.
7. There is a priority need for heavy Investment in human resources development through education, training, and capacity development programmes, particularly in the fields of environmental management of the coastal and marine ecosystems. Such educational and training programmes are essential elements for the sustainable management of the ROPME Sea Area.

#### IV. TOWARDS SUSTAINABLE ROPME SEA AREA

1. **T**he important choices to achieve environmental sustainability of the ROPME Sea Area, are not necessarily environmental only. The sustainability is a process that relies on a multitude of potential interventions that could positively affect the RSA ecosystem. Some of these interventions are addressed in a large number of sectors and need to be made essentially at the National level. The interventions, most importantly include but are not limited to: the governance approach, the education system, the implementation of technological innovations, and the change of people's attitude and behaviour towards the marine environment.
2. The environment is not compartmentalized and nor should environmental policies be. The RSA protection policies should be integrated and mainstreamed into the National socio-economic development plans and the sound sustainable policies should have human and environment central to planning.



3. A critical review of the current environmental situation in the ROPME Region indicates the following constraints as the most important impediments for the achievement of sustainability of ROPME Sea Area:
- Governance and management of RSA marine ecosystem is fragmented at both the Regional and the National levels.
  - At the Regional level, there is a dire need for closer cooperation among the ROPME Member States sharing the Sea Area, particularly in areas of conflicting social and economic interests and responsibilities.
  - At the National level, decisions continue to be mostly reactive, and not proactive, sectoral or issue-based, with little or no coordination among the concerned authorities for integrated and coordinated management and development of the coastal areas. In the meantime, Integrated Coastal Area Management (ICAM) and/or Integrated Coastal Zone Management (ICZM) planning approach, with a Regional perspective for RSA continue to be largely lacking.
  - Control and management of sea-based and land-based activities, affecting the RSA are not effective as desired, mainly due to lack of enforcement of National laws and regulations as well as the ROPME Protocols. Hence, marine pollution remains to be unabated, and uncontrolled in some coastal areas of the Region.
  - Urban and tourism developments and their associated dredging and land-filling activities continue to be a major threat to the sustainability of RSA, its resources and its services.
  - The destruction of habitats by unsustainable fishing practices, land-filling, sea-filling and urban encroachment is still widely practiced in some countries of the Region, while over-exploitation of living marine resources is also continued.
  - The implementation of ROPME Protocols are still not streamlined as part of the National strategies of the Member States. There is



a general lack of national regulations for the implementation of ROPME Protocols.

- Environmental awareness activities are fragmented and need to be strengthened with long-term vision through a coordinated National/Regional framework of action.
  - Public participation and the role of NGOs in the management and planning process are limited and need to be encouraged.
4. The environmental situation of the RSA will be exacerbated by the expected impacts of climate change on marine ecosystems. The employment of policies that are based on integrated approaches and sound scientific evidences for the management of the RSA ecosystem should be pursued with climate change dimension.
  5. ROPME Member States are to work intensively over the next 5 years and beyond to overcome the constraints to sustainability. All Member States are to work individually at the National level, and collectively through ROPME Secretariat, to address the constraints that impede the road to sustainable development of the ROPME Sea Area, as the case may be in each country.
  6. In Sustainable RSA, a more visionary state of affairs is governed where proactive solutions to the challenges of sustainability are provided, and a sustained link between social, economic, and environmental policies is made.
  7. Cooperation and constructive dialogue at the National, Regional, and inter-regional levels could easily resolve tensions to avoid armed conflicts that have been repeatedly experienced with disastrous impacts on the environment of the Region.
  8. The countries of the Region, therefore, are to adapt a long-term integrated strategic planning approach and a Road Map for the sustainable development of RSA, to achieve a healthier environment for a superior quality of life for all the people.



9. Strong emphasis should be placed on human development with the allocation of heavy investment through targeted educational, awareness, training, and capacity building programmes.
10. All the National and Regional environmentally sound and sustainable developments would reflect positively on the RSA. As a result, a shared vision for RSA is achieved, and its governance and management will be more integrated and coordinated among the riparian countries. The implementation of protection strategies and action plans by the ROPME Member States would consequently lead to a sustainable RSA, and to an increased contribution of its functions and services to the economy of Member States.

## V. POLICY RECOMMENDATIONS FOR DECISION-MAKERS

The recommended actions for decision-makers are mainly related to an essential element of sustainable development, namely, “*Compliance with Regional and National Environmental Policies and Regulations*”. In this respect, the following policy recommendations are particularly noted:

1. Enforcing compliance with National and Regional environmental legislation and the National regulations for combating marine pollution and degradation from various land and sea-based sources. This could be most effectively achieved through developing a Regional mechanism to monitor compliance at all governance entities to insure adherence with the regulations, and through strengthening the capacity of National and Regional institutions to fulfill their mandates.
2. Ensuring the sustainability of ROPME Sea Area within the next 10 years. This could best be achieved through addressing a number of policy issues, including: integrated coastal area management and development and sprawling of coastal cities; Abatement of marine pollution by oil and other harmful substances; Controlling, reduction and combating of marine degradation from land-based activities; Prevention, abatement and controlling of marine pollution from sea-based activities; Safeguarding against health risks associated with seafood; Preserving marine and coastal biodiversity; Sustainable



management of fisheries; Control of invasive alien species; Safe disposal of hazardous wastes; Control of eutrophication; and litter management. It is a matter of urgency to develop Regional and National plans and programmes to address these areas.

3. Adopting the Ecosystem-Based Management (EBM) approach as a policy instrument that offers an opportunity for incorporating all priority issues into a formal joint plan that can be executed at the National level, where integrated policy instruments could be aligned and harmonized.
4. Utilizing the Integrated Coastal Zone Management (ICZM) for harmonizing and integrating major development activities in the coastal areas. ICZM is the proper vehicle to incorporate the EBM approach and for streamlining other national policies and translating them into implementable action plans.
5. Developing a new decision-making process to accommodate the EBM, and at the same time, a new evidence-based policy-making process to supersede the old practices and provide for proper evaluation of the achievements of the set objectives.
6. Promoting the concept of “Green Economy”. The “Green Economy” is the future, and the course to be taken to alleviate the driving forces and the pressures, affecting the state and trend of the ROPME Sea Area environment. This obviously requires reformulating National policies in various sectors of the National economies, keeping the environment, in general, and the RSA environment, in particular, in the center of the decision-making process.





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