Kuwait

State of the Marine Environment Report Summary

Photo: Tomi Tenetz | Dreamstime

Kuwait

The State of Kuwait is situated at the north-western corner of the Arabian Gulf and provides for an unique and valuable marine ecosystem. The marine waters of Kuwait range along a coastline of approximately 500 km and out into the Northern Arabian Gulf. Kuwait's marine environment is characterized by a variety of habitats and wildlife, particularly in the northern part of Kuwait's waters and Kuwait Bay, one of the most prominent features of Kuwait's marine environment.

Kuwait has a diverse marine environment comprising a range of marine and coastal habitats including coral reefs, seagrass beds, salt marshes and nine islands with important coastal habitats.

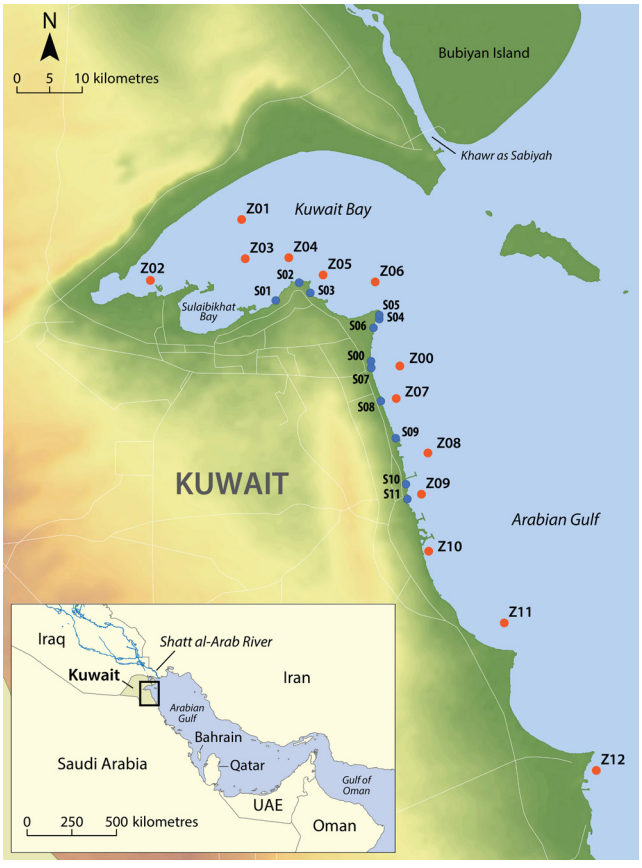


Figure 1: WQ and sediment monitoring sites in Kuwait Bay and the Arabian Gulf

Many of these habitats are critical to the survival of a wide variety of biodiversity but are under threat from anthropogenic activities in the coastal area. Given the environmental extremes of the region many of Kuwait's marine species are functioning close to their physiological limits. It is unknown what the additional role anthropogenic activity may play in further stressing Kuwait's marine ecosystem.

The rapid expansion of Kuwait's industrial and urban sector has mainly occurred around its coastal margins and has significantly changed the coastal areas. The rapid urbanisation and industrialisation has led to a variety of contaminants being discharged directly to the marine environment, including petroleum hydrocarbons, trace metals, nutrients (from domestic sewage), and contaminated brine from desalination plants.

The SOMER presents assessment for the marine area of Kuwait, which ranges from the coastline, intertidal area, Kuwait Bay, the Arabian coast, the coral reefs, seagrass beds and all coastal areas. It stretches outward from the intertidal area into the Bay and out along the Arabian Gulf and north up to the Shatt Al-Arab river.

Reporting overview

A wide variety of different human activities, ranging from fishing, industry, transport and tourism, utilise and depend upon the Kuwait marine environment. Therefore, an integrated ecosystem-based management of this marine environment is required to achieve adequate protection for all users, habitats and species. To achieve this the National Plan will look to provide a framework related to the reporting and protection of the Kuwait marine environment.

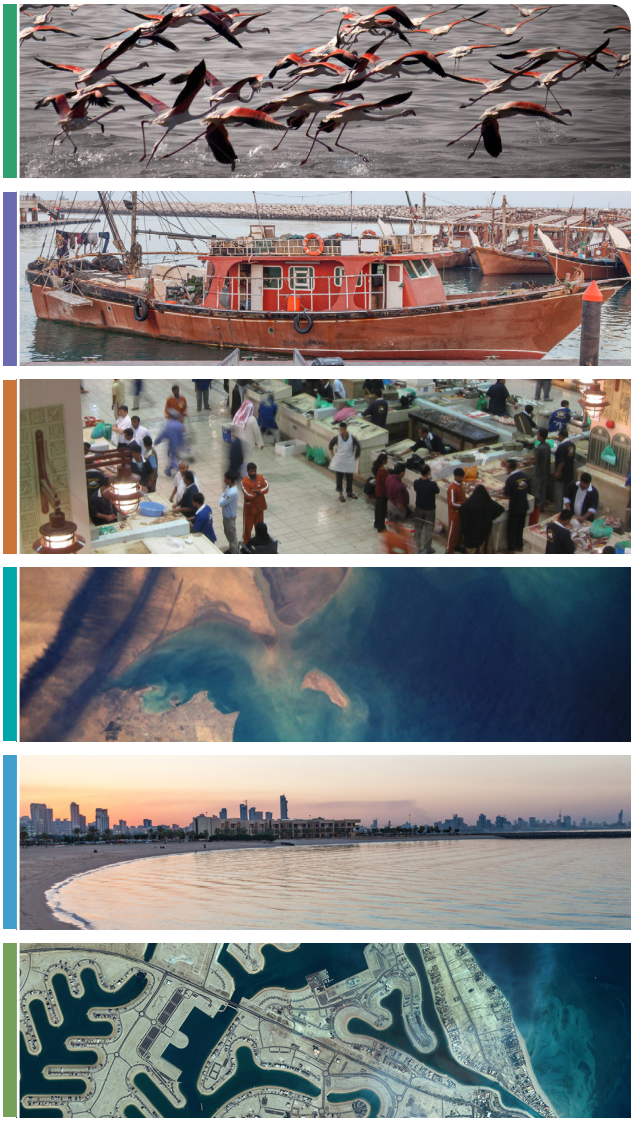
This framework will include a reporting system that provides an assessment of current state and future trajectories for all habitats and species within the Kuwait marine system. This initial summary and assessment of Kuwait's unique marine system will form the basis of the first Kuwait State of the Marine Environment Report.

State of the Marine Environment Report presents an assessment of all available data within six major themes.

- Biodiversity
- Commercial Fisheries
- Food and Water Quality for Human Health
- Environmental Pollution
- Eutrophication and Water Quality
- Coastal processes.

Information within each theme provides the evidence for an assessment of state, an overview of the reporting process, and a detailed summary of the data available for the assessment.

A seventh theme – Human Influences – is also explored and identifies the main pressure and drivers that are influencing the state of the biota, water, ecology and human health that are associated with the other six themes.



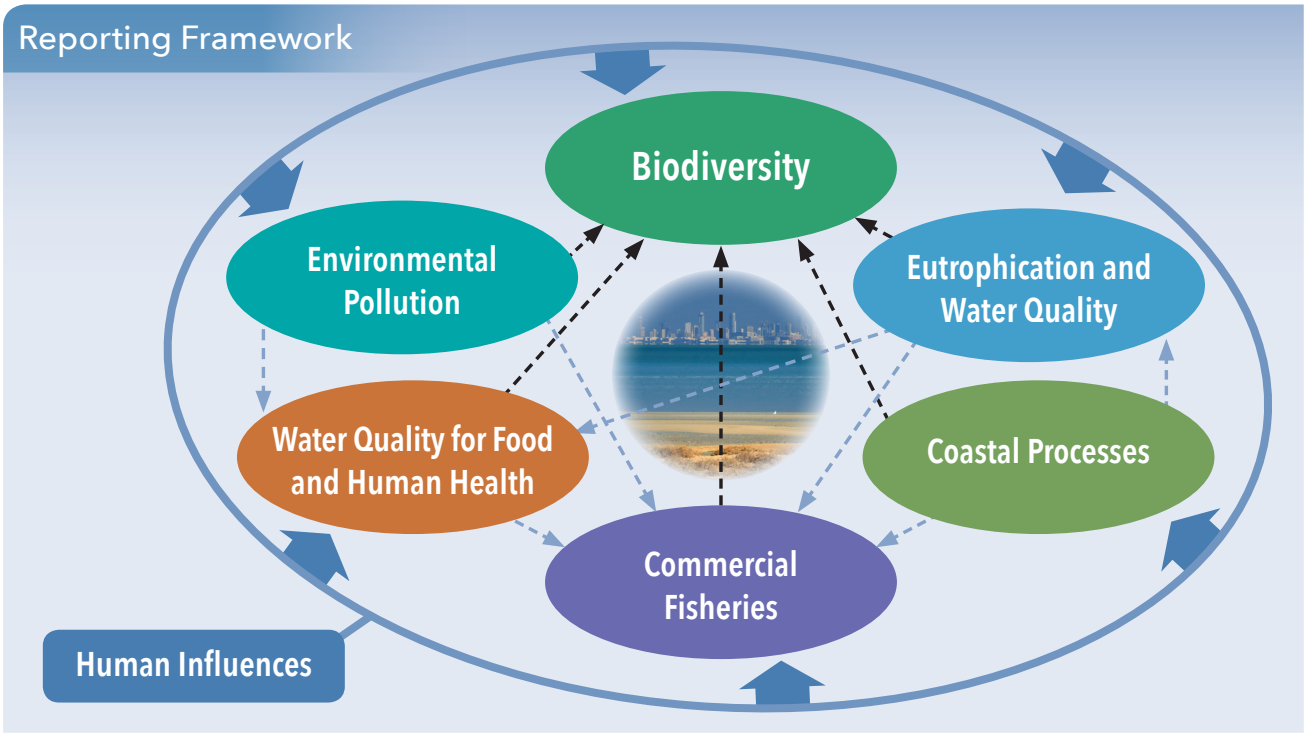


Figure 2: Summary of the six main themes to be presented in the SOMER report, and the main linkages between each theme. Human activities is presented around all themes, as the impacts of human activities is attributed as the main driver of negative change within each theme.

Human influences on the marine environment

Photo: Dr Abdullah Al-Zaidan

This theme identifies the main pressure and drivers that are influencing the state of the biota, water, ecology and human health that are associated with the other six themes. The following table summarises the impacts of climate change and rising sea temperatures, industrial and urban pollution, chronic and diffuse sources of pollution, coastal change, sediment supply and marine litter.

Human activity	Long term trends	Main Causes
		Human influences
Climate change and rising sea temperatures.	Sea water temperature in the Kuwait Bay is increasing at a rate three times higher than global estimates (0.6 (±0.3)°C/decade).	Increasing temperatures are related to global climate change However additional 17% increase due to regional activities. For example, power and desalinisation plants generating thermal plumes and urban storm drain runoff.
Environmental pollution - industrial	Increases in contaminants detected in long term monitoring data, but concentrations are generally below limits of concern. However, new and emerging industrial contaminants are of concern.	Rapid expansion of Kuwait's industrial sector has mainly occurred around its coasts. Industrial pollutants are discharged directly into the marine environment, including petroleum hydrocarbons, trace metals, PAHs, PCBS.
Environmental pollution — urban	Sewage contamination is widespread in coastal areas. Multiple breaches of microbial water quality guidelinesare occurring and have been indicated in failures of food guidelines.	The sewage treatment network, despite recent upgrades, is still running above design capacity, leading to frequent discharges of raw or partially treated effluent into the marine environment. Sewage contains a complex mixture of chemical contaminants that can be toxic to marine species.
Chronic and diffuse sources of pollution	Long term increases in nutrient concentrations driven by diffuse sources such as the Shatt Al Arab River and chronic sources such as persistent sewage discharges.	Coastal waters are being affected by the increased nutrient inputs in Kuwait Bay and the Southern Gulf region, coupled with decreasing river flow and changing salinities in Northern Kuwait waters.
Coastal change	Coastal development may negatively impact natural sediment transport processes by alteration of coastal dynamics, tidal currents and waves.	Dredging, land reclamation and construction of sea walls, jetties and concrete outfalls may affect the natural flux of longshore sediment by altering hydrodynamic processes, waves and currents and changing natural morphology and patterns of erosion and accretion.
Marine litter	Gross urban waste generation from Middle East countries exceeds 150 million tons/yr.	Middle East is responsible for about 8 percent of the global plastic production. Infrastructural roadblocks, lack of awareness and low level of community participation are major factors behind increasing generation of plastic wastes.

Photo: iStock | Egypix

Status

- High
- Good
- Moderate
- Poor
- Unknown

Future trajectory

- Improving
- Stable
- Declining
- Unknown

Confidence in assessment

- High confidence: quantitative data, environmental standards, significant temporal trends
- Medium confidence: quantitative to qualitative data, less information on temporal and spatial trends
- Low confidence: limited or qualitative data, no environmental standards and lack of trend

Current State (Status) = High or Good = good ecological quality

Current State (Status) = Moderate or Poor = poor ecological quality, suggests management actions are required.

Biodiversity

Photo: Dr Abdullah Al-Zaidan

Strategic goals

- To prevent extinction of threatened and vulnerable species, and where possible maintain abundant populations of all species.
- To prevent the introduction and spread of priority invasive alien species.
- To maintain the condition and extent of threatened and vulnerable habitats, and critical habitats that support threatened or vulnerable species; and to maintain all habitats in a condition to support key ecosystem functions dependent on them.

Key findings

Status = MODERATE | Trajectory = DECLINE | Confidence = LOW

- **Status assessment** is MODERATE
- **Future trajectory** of status for seabirds, turtles, coral reefs, seagrass areas, and all coastal habitats, is predicted to decline.
- Low **confidence** in all other indicators due to paucity of data

Indicator outcomes

Attribute	Component	OUTCOMES		
		Status	Future trajectory	Confidence of assessment
				Biodiversity
Rare and vulnerable fish	Population abundance	●	↓	■
Cetaceans (Whales and Dolphins)	Population abundance	?	?	■
Marine Turtles	Occurrence of nesting	?	?	■
Seabirds	Population abundance	●	↓	■■■
Impacts from alien species	Frequency of occurrence	?	?	■
Coral Reefs	% cover	●	↓	■■
Seagrass	Area and condition	?	↓	■
Coastal habitats	Area and condition	●	↓	■■

- The moderate status is due to issues that have been identified with turtles, seabirds, coral reefs and coastal habitats and recognises that all of these components of biodiversity, even if current status is unknown, are considered important for the protection of Kuwait's unique biodiversity and are currently being impacted by coastal development, sewage inputs and other human activities.
- Much of the work presented or inferred in the biodiversity narrative identifies many concerns for the sustainability and protection of Kuwait iconic species and vulnerable habitats.
- Future trajectories of coral reefs, seagrass beds, all coastal habitats, turtles and seabirds are likely to decline in status based on current projections and knowledge.
- Confidence in the assessment and prediction of trajectories for sharks, rays, marine mammals, dugongs and impacts from alien species is low, reflecting a lack of knowledge on current state and impacts of future pressures.
- What this assessment does show is that Kuwait is home to many iconic species which are ecologically, commercially and socially important and require significant conservation measures.
- There are major concerns for turtles due to destruction of nesting beaches.
- The occurrence of alien species is increasing and many alien species, which have impacted in other areas, have been identified in Kuwait marine waters.
- Seabirds are facing local habitat destruction and international pressures that are affecting migratory numbers.
- Coral reefs are facing regional and global pressures that are severely impacting on their long term viability.
- Seagrasses and all coastal habitats are under threat from continued coastal expansion
- There is an urgent need for improved monitoring programs to increase knowledge around state and trajectory of many of the biodiversity measures.
- Development of management objectives with environmental standards are required that recognise the importance of these biodiversity indicators and provide guidance for management actions.
- In conclusion, based on the current information and extrapolation out to many of the trends currently occurring in the Arabian Gulf, there is considerable concern that the state of many aspects of biodiversity will continue to decline. There are particular concerns for the state and trajectory for seabirds, turtles, coral reefs and coastal habitats given the importance of these components to biodiversity conservation and their vulnerability to coastal development.

Photo: Wikimedia Commons | Photo: FT Short / IUCN | Photo: Kirsten Dahlen | Marine Photobank | Photo: Wikimedia Commons

Commercial Fisheries

Photo: philipus | Fotolia

Strategic goals

- To ensure all stocks of commercially exploited species are at levels that enable high-long term yield sustainable yield consistent with the concept of maximum sustainable yield.

Key findings

Status = MODERATE | Trajectory = DECLINE | Confidence = LOW

- **Status assessment** is MODERATE
- **Future trajectory** of statu. for commercial fisheries and prawn fisheries is predicted to decline
- Information on cephalopods is limited and difficult to infer state or trajectory.

Indicator outcomes

Attribute	Component	OUTCOMES		
		Status	Future trajectory	Confidence of assessment
				Commercial Fisheries
Commercial fishing	Fishing activity	●	↓	■
Prawns	Annual catch estimates	●	?	■
Cephalopods	Annual catch estimates	?	?	■

- The assessment of status is moderate based on the declining catch data that is reported on landings data for commercial fish and prawns.
- The future trajectory for commercial fishing is predicted to continue to decline in status.
- Recreational fishing also has a significant impact on fish resources in Kuwait with recent data suggesting that there are 30 times more recreational fishing boats than commercial in Kuwait.
- Landings data shows a significant decline in local fish populations.
- There has been a reduction in total fishing vessels, which may be related to the reduced national catch. In contrast, the imported fish numbers have increased over time.
- An additional issue for Kuwait is the amount of discarding, particularly in the shrimp fishery where up to 98% of the bycatch is discarded without being recorded in any way. This gives massive uncertainty around stock sizes in the majority of finfish species.

- Approximately half to two thirds of fish caught are reef associated species so that, in addition to issues of overfishing, reef destruction has added additional consequences of habitat loss for fish.
- It is widely believed that catches of prawns have significantly reduced throughout the region in recent years, although an absence of historic 'effort data' makes this hard to confirm.
- Cuttlefish, squid and octopus are targeted, and opportunistically harvested within Kuwait waters. Cuttlefish are the primary commercial species however, insufficient information on the taxonomy, abundance and distribution of cephalopods species prohibits an accurate assessment of the fishery.
- Current data provides only limited information about falling stock sizes for the majority of Kuwait's fish stocks and certainly not with any confidence, with the possible exception of shrimp assessments. Comprehensive programs to record fishing catch and by catch are required to improve methods for reporting.
- In conclusion, from available catch information and extrapolation from additional studies conducted across the Arabian Gulf region, many commercial fish stocks have deteriorated or collapsed. Further decline of the status of Kuwait commercial fish stocks is predicted.

Food and Water Quality for Human Health

Photo: Evan Hemingway | Wikimedia Commons

Strategic goals

- To maintain the quality of seawater to protect human health.
- To ensure environmental contaminants in fish and other seafood for human consumption do not lead to unacceptable risk to human health.

Key findings

Status = POOR | Trajectory = DECLINE | Confidence = LOW

- **Status assessment** is POOR
- **Future trajectory** of status is not thought to be improving from current status of POOR

Indicator outcomes

Attribute	Component	OUTCOMES		
		Status	Future trajectory	Confidence of assessment
Food and Water Quality for Human Health				
Microbial water quality	Microbial counts	●	↓	■■■
Seafood quality	Seafood contamination	●	?	■

- Food and Water Quality for Human Health is at POOR status, and is recognised as one of the major pollution issues facing Kuwait marine waters.
- This assessment is based on the chronic sewage pollution associated with the microbial contamination of many of the coastal sites in Kuwait marine environment.
- A malfunctioning pump station between 2009 and 2012, resulted in discharges of around 150,000 m^3 per day of untreated sewage directly into the sea.
- Continued microbial failures show that raw sewage discharges are a major problem, particularly in local hot spots around industrialised areas. Hot spots based on faecal sterol sediment contamination were identified in Doha Bay and Sulaibikhat Bay in Kuwait Bay and show contaminatio. from raw or partially treated sewage.
- Ongoing sewage pollution continues from illegal connections and discharges from storm drains. and inadequate capacity of the sewage plants.

- Microbial water quality counts regularly breach regional and European water quality guidelines and indicate that raw and partially treated sewage effluent is regularly being discharged from a number of locations around the coast.
- This is attributed to the failure of the sewage treatment network to keep pace with demands for capacity driven by rapid population growth, which has almost trebled over the last 30 years.
- The analysis of faecal sterols in sediments further provides proof that the environment is regularly impacted by sewage discharges with high levels of contamination found along the Gulf coast and Kuwait Bay.
- Poor water quality and its impact on food, with particular emphasis on commercial fisheries, is less obvious, but data that does exist is concerning.
- Evidence from Kuwait market suggesting that fish tissue may just exceed EC maximum concentrations. This information does come with low confidence given the lack of a dedicated monitoring program which makes it difficult to draw a firm conclusion.
- In conclusion, microbial water quality issues are severe and a threat to human health and biodiversity. Given the continued chronic issues associated with sewage discharges, high recreational use of coastal areas around Kuwait City and the potential impact on seafood quality in a country where fish consumption forms an important component of diet this issue is a priory for management.

Environmental Pollution

Photo: NASA

Strategic goals

- To ensure that marine ecosystems are not adversely impacted by contaminants.

Key findings

Status = GOOD | Trajectory = STABLE | Confidence = HIGH

- Status assessment is GOOD
- Future trajectory of status is stable for contamination in water, sediment and biota contamination from many of the environmental pollutants.

Indicator outcomes

Attribute	Component	OUTCOMES		
		Status	Future trajectory	Confidence of assessment
Environmental Pollution				
Water	Total Petroleum Hydrocarbons (TPH)	●	→	■■■
	Heavy metals < thresholds	●	→	■■■
Ecotoxicology	Toxicity/endocrine disrupting chemicals	●	?	■
Sediment	PAH	●	?	■■
	PCB	●	↑	■■
	Metals	●	→	■■
	PBDE	●	?	■
	Faecal sterols	●	↓	■■■
Biota	Chemical contamination	●	?	■
	Fish health	●	?	■

- Pollution in Kuwait has been a chronic issue over many years, with long term records showing persistent contamination of sediment, water and biota.

- However, an assessment of available EPA water contamination data from the national monitoring program demonstrated that no biologically significant change in water contamination was detected over the time series available, indicating that from a perspective of metal and petroleum hydrocarbon contamination the situation has not deteriorated over time.
- As assessment of this data indicates that, in general, metals and TPH in water are below levels thought to pose a toxicological threat. Assessment of the current status is, thus. given as GOOD, with a predicted trajectory of change predicted to be stable with high confidence in these assessments of state and trajectory.
- For sediment contamination by metals, PAHs and PCBs, current levels of contamination posed little toxicological risk to marine biota inhabiting the areas sampled. The levels of contamination detected indicate that, in general, Kuwait's marine environment is relatively unpolluted when compared with other industrialised regions of the world. Where detected, hot spots of PAH and PCB contamination were restricted to locations associated with industry.
- Data indicates that sewage contamination is widespread in coastal areas across the whole of Kuwait. These discharges of sewage are also known to contain a complex mixture of chemical contaminants and these have been shown to be both directly toxic to marine species and also contain endocrine disrupting properties.
- In conclusion, the analysis of chemical contamination in biota along with the levels of contaminant associated disease in fish supports the conclusion of GOOD status with levels generally indicative of unpolluted environment. However, pollution due to sewage discharges continues to be a serious and persistent threat to Kuwait's marine environment. This is an area that requires urgent investigation as continued sewage discharges could impact on the current good status particularly in coastal areas and contamination hotspots.

Eutrophication and Harmful Algal Blooms

Photo: philipus | Fotolia

Strategic goals

- To minimise human-induced eutrophication and its adverse or undesirable effects.
- To reduce the frequency of human-induced harmful algal blooms, and where possible, minimise adverse consequences of HABs.

Key findings

Status = MODERATE | Trajectory = DECLINE | Confidence = LOW

- Status assessment is MODERATE
- Future trajectory of status is predicted to continue to decline.

Indicator outcomes

Attribute	Component	OUTCOMES		
		Status	Future trajectory	Confidence of assessment
		Eutrophication and HABs		
Eutrophication	Dissolved Inorganic Nitrogen (DIN)	●	↓	■■■
	Dissolved Inorganic Phosphorus (DIP)	●	↓	■■■
	Phytoplankton—Chlorophyll-a	●	↓	■■
	Phytoplankton—Community composition	?	?	■
	Dissolved oxygen	●	→	■
	Water quality index	●	↓	■■
HABs	Harmful Algal Blooms	●	?	■

* Water Quality (WQ) index reports nutrients, phytoplankton, turbidity and dissolved oxygen as a single eutrophication index.

- Status assessment is MODERATE. One of the most serious concerns facing Kuwait coastal and marine waters is the continued discharges of raw and untreated sewage from illegal and non-managed drains. This is recognised in the assessment of POOR status for the Food and Water Quality for Human Health and also reflected in a POOR assessment for nutrients.

- A combination of chronic and diffuse nutrient loads has had a major impact on the status of the water quality indicators, particularly the concentrations of dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) which have increased significantly over the last 30 years. There has also been an rapid increase in ammonium concentrations between 2009 and 2012. This is linked to a malfunctioning pump station between 2009 and 2012, with discharges of around 150,000 m^3 per day of untreated sewage directly into the sea.
- The long term EPA monitoring data also shows the influence of the diffuse pollution, evident in increasing nitrate concentrations from the Shatt Al-Arab River from the early 1990's.
- However, the hydrodynamic regime of the northern Kuwait waters has been altered through the reduction in freshwater flow due to dam construction in the Tigris, Euphrates, and Karoon drainage basins. These dams have virtually eliminated seasonal flood events, which are extremely important for nutrient input, lowering salinities, and triggering certain biological events such as migration or spawning. Salinities have increased from ~36 in 1981-1982 to an average of ~ 44 in recent years.
- The long term chlorophyll-a data shows a significant reduction in the phytoplankton biomass associated with seasonal blooms particularly around the period of the extended contamination associated with sewage discharges after 2007. This may relate to a shift in the phytoplankton community responding to the elevated nutrient concentrations.
- The impact of the long term enrichment on phytoplankton community is less clear, and the limited data availability on phytoplankton data has made this difficult to fully resolve.
- Whilst the dissolved oxygen concentrations are generally stable, there have been low dissolved oxygen events occurring more frequently in areas around Kuwait City and Kuwait Bay. On occasions the oxygen concentrations drop below ecological thresholds.
- The marine system is being affected by the increasing nutrient inputs in Kuwait Bay and the Southern Gulf region, coupled with a decreasing river discharge and changing salinity in Northern Kuwait waters. These pressures can result in changes in plankton species composition, diversity and biomass, which have had knock-on effects for higher trophic levels. Further investigation of the coupled impacts from the cumulative pressures is required.
- HABS outbreaks have not been recorded in recent times, however the suite of conditions which were responsible for the previous recorded HABS outbreaks are still occurring and thus the estimates of future trajectories must consider that the re-occurrence of HABS outbreaks is still likely.
- In conclusion, combining the different water quality indicators for a coordinated assessment indicates MODERATE status for eutrophication. Confidence attached to this assessment is moderate due to a lack of appropriate environmental standards for the water quality indicators. This is driven by nutrient inputs to Kuwait Bay and around Kuwait City. This may have knock-on effects for higher trophic levels. HABS have not occurred in high numbers in recent years, however conditions that are linked to HABS outbreaks are present.

Coastal Processes

Strategic goals

- To minimise changes in sediment transport caused by coastal developments and offshore structures that may lead to undesirable changes in the shoreline or increased flood risk.

Key findings

Status = GOOD | Trajectory = DECLINE | Confidence = LOW

- Status assessment is MODERATE
- Future trajectory of status is predicted to decline based on proposed coastal developments.

Indicator outcomes

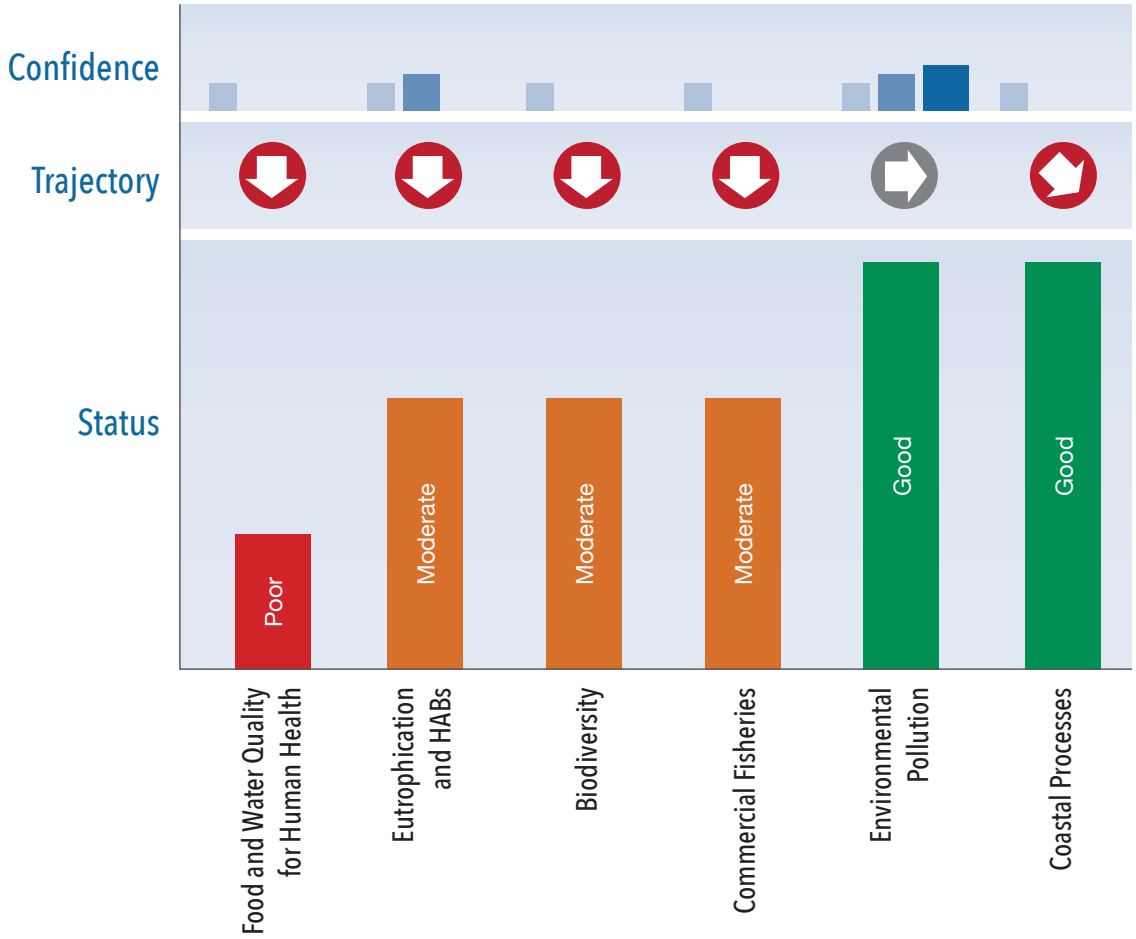
Attribute	Component	OUTCOMES		
		Status	Future trajectory	Confidence of assessment
Coastline stability	Coastal change	●	➡	■
	Changes in sedimentology	●	➡	■
Coastal currents	River flow	●	⬇	■■

- The current assessment of status is GOOD. Kuwait coastal stability is still resilient, with only localised impacts of measured stress, despite rapid coastal development over the past 30 years.
- This assessment is made with low confidence due to a lack of information and concern regarding the impact of the upcoming developments, particularly in relation to vulnerable areas such as the coastal region of Boubiyan Island.
- However, some local hot spots next to major developments have resulted in sediment starvation due to differential sediment transport processes.
- The future coastal development trajectories are predicted to decline from current levels, given the continued modifications of the coastal zone. This is particularly exacerbated by the expansion of the northern residential area and the causeway.
- In conclusion, coastal development has changed the shape of the Kuwait coastline, however, coastal stability is still functioning well. There are concerns for many of the future coastal development plans which could significantly impact on coastal processes and sedimentology.

Conclusion

- This report identifies major concerns around Food and Water Quality for Human Health, Eutrophication, Biodiversity and Commercial Fisheries (Figure 3). Based on current information, the trajectories for future status are predicted to decline for all themes other than environmental pollution.
- Indicators for environmental pollution show low levels of contamination and are not thought to be declining. However, there are concerns with contamination associated with sewage discharge
- In conclusion, there are many significant environmental issues that are occurring in Kuwait marine waters. Continued coastal development, urban runoff and environmental pollution are the most important issues, and with climate change, will continue to impact on the marine environment unless fundamentally addressed through the national plan.

Figure 3: Summary of results for the six SOMER themes.



- A framework for environmental reporting is essential to achieve ecosystem based management. This SOMER is a first attempt at resolving the evidence base around six environmental themes to provide an assessment of status. The outcomes of this report, and the development of objectives and indicators provides guidance to Kuwait's environmental managers on appropriate activities to ensure the predicted trajectories do not decline or continue to decline. The long term EPA monitoring programmes provided a unique insight into the marine environment of the Arabian Gulf and will be an important part of protecting Kuwait's marine resources into the future.