



# Abu Dhabi Global Environmental Data Initiative

## Decision-maker Summary

### Ecosystem Services Assessment





## Foreword

Abu Dhabi is rich in natural capital and heritage – and nowhere is this truer than along its spectacular coast. White sand beaches, azure waters, coral reefs, offshore fishing areas, mangroves, seagrass beds replete with the world's most important population of dugongs, salt marsh, sabkha, and other coastal features that characterise Abu Dhabi's marine biodiversity and are testimony to the productivity of these systems. Ecosystem services – the benefits that nature provides humanity – have been identified and preliminarily assessed. This study takes that one step further towards robust quantification of coastal ecosystem services values, focusing on the role that natural capital plays in maintaining water quality and preventing outbreaks of harmful algal blooms.

The Millennium Ecosystem Assessment of 2005 was the first global appraisal of marine and coastal ecosystem services. To the surprise of the 1,300 scientists working on the assessment, the marine services are much more important to the human well-being of the global population (not just coastal communities) than thought, and are also at high risk. Most of the services, deriving from habitats like mangroves and salt marshes, have no realised market value (Blue Carbon markets now beginning to be the exception), and are therefore undervalued.

Marine systems are known for the value of their provisioning services i.e. goods, as is evident in the fisheries resources, however, the regulation and ongoing support of these services may be even more valuable in the marine arena. Taking a holistic look at ecosystem services values is important but challenging, since both the quantity of services coming from any particular habitat, and the actual value of those services must be ascertained on a case-by-case basis.

Abu Dhabi has made great strides in demonstrating methodologies for quantifying not only the Blue Carbon, but also the co-benefits coming from Blue Carbon habitats including the mangroves, salt marsh, seagrass, and others. The difficulty has been that there is no standardised

method for achieving this for most services, beyond carbon sequestration. In the Abu Dhabi Blue Carbon Demonstration project, benefits transfer was used to provide a range of values for coastal ecosystem services, including fisheries production, recreation, shoreline stabilisation, natural hazard mitigation, water quality maintenance, support of biodiversity, disease regulation, and others. However, values specific to Abu Dhabi were not derived until this study.

Habitats are not isolated – usually a chain of intact habitats is needed for ecosystem services to be maintained (shoreline stabilisation may rely on mangrove, rock or shellfish reef, coral reefs, and seagrass beds all working together, for instance). To be able to assess fully, estimates must be made about the services coming from each habitat, and what is required for these habitats to continue to deliver the services. Coastal construction, shoreline armouring, infilling can all interfere with the connections between interconnected habitats. Once values have been ascertained, as they have in this study, then the necessary steps may be taken to safeguard and even enhance those values.

As this study demonstrates, water quality maintenance is particularly valuable to residents and to the tourism industry. The destruction and degradation of coastal habitats that maintain water quality, including natural mangroves, seagrasses, and salt marsh, has in some places upset natural balances and blocked the pollution mitigation potential of natural capital. As this study demonstrates through proven economic assessment methods like Willingness to Pay and Willingness to Accept, the natural capital values of Abu Dhabi's coastal ecosystems are significant – and continued degradation and losses will prove costly to the Emirate if left unchecked.

**Dr Tundi Agardy**

Director

Marine Ecosystem Services (MARES) Program, Forest Trends Association





## Introduction

### Background

Coastal habitats provide a myriad of essential ecosystem services; they support fisheries, protect shorelines, provide opportunities for tourism, and are important for cultural heritage and identity. With Abu Dhabi's rapidly developing growth trajectory derived primarily from its rich oil and gas reserves, it is paramount that Abu Dhabi's ecosystems are protected and valued locally, nationally and globally in terms of their wildlife, natural resources and landscape. And, when it comes to decision-making on land use around Abu Dhabi's coastal and marine habitats, a range of factors needs to be considered to ensure that protective directives are enforced.

To this end, in April 2014, the Abu Dhabi Global Environmental Data Initiative (AGEDI) released the results of Phase I of the Abu Dhabi Blue Carbon Demonstration Project bundled with the Ecosystem

Services programme. The report provided a first understanding of the full potential of these ecosystems for carbon storage and a wide range of the other benefits they provide.

Following this insightful introduction to these marine ecosystems and their blue carbon storage patterns, AGEDI conducted Phase II of the programme, which comprises further localised contingent valuation of associated blue carbon ecosystems services. The contingent valuation helps identify the Total Economic Value (TEV) of these services, based on the two main categories of use values (meaning actual use of the environment, such as fishing) and non-use values (which are not associated with actual use, such as an ecosystem or its services). AGEDI's efforts focused on non-use values, with project findings helping to determine compensation fees for associated environmental damage and in highlighting the need for continued protection of these invaluable habitats.





## Project Overview

Ecosystem services are the natural by-products of healthy, well-functioning environments – they include provisioning for food and water resources, as well as regulating and supporting functions such as flood control, waste management, water balance, climate regulation, and other processes. The oceans and coasts provide many of these critical yet undervalued services, supporting not only coastal inhabitants but all life on the planet. With such significant human reliance on these services, it is essential to recognise their value before they are lost.

The coastal and marine resources are working hard to provide a range of services to all the visitors, residents and citizens of Abu Dhabi.

While it is clear that stakeholders are willing to pay for non-use environmental benefits, these benefits are likely to be implicitly treated as zero unless their dollar value is somehow estimated. The contingent valuation method involves directly asking people, via a survey, how much they would be willing to pay for specific environmental services – one of the only ways to monetise non-use values of the environment.

The Ecosystem Services Assessment for Abu Dhabi is a strategic initiative that measured the value of these services, which will help influence the behaviour of regional leaders. Through education about the environment in coastal marine habitats, and with the understanding that financial compensation may one day be required, these leaders will be able to make informed decisions when it comes to complex land-use, that will ultimately lessen negative environmental impact.

In this analysis, the interest is in the amenity values people derive from the coastal and marine resources within the Abu Dhabi Emirate, and specifically for Abu Dhabi City. This has become an important consideration given the rapid rate of economic development, and the fact that the city is being marketed as a destination of choice for the global traveller and business person using amenity values, such as beach and ocean views, recreation and sport opportunities and facilities, as attractions. The consequences of urban growth, however, are an increase in waste, energy and water use. Furthermore, there is active reclamation of the ocean leading to an increase in the canalisation of the coastal area, reducing water flow, and as a result the city has seen an increase in eutrophication and the number of red algae blooms.

An underwater scene with a green horizontal bar across the top. A white diamond shape is on the left side of the bar. The background is a deep blue ocean with some light rays and bubbles.

“ We cherish our environment because it is an integral part of our country, our history and our heritage. On land and in the sea, our forefathers lived and survived in this environment. They were able to do so only because they recognised the need to conserve it, to take from it only what they needed to live and to preserve it for succeeding generations. We are responsible for taking care of our environment and wildlife, protect it and preserve it not only for the sake of our current generation, but also for the sake of our children and grandchildren. It is our duty to be loyal to our ancestors as well as our successors. With God’s will, we shall continue to work to protect our environment and our wildlife, as did our forefathers before us. It is a duty, and, if we fail, our children, rightly, will reproach us for squandering an essential part of their inheritance, and of our heritage. ”

**The Late Sheikh Zayed bin Sultan Al Nahyan, Founding father of the United Arab Emirates (February 1998, on the occasion of the Annual Environment Day).**



### Acknowledgements

The project team would like to thank all hotel, real estate and commercial property directors and managers who took the time to participate in the interviews; they have provided excellent data and a benchmark of information that has been invaluable for the project. All beach visitors that were interviewed are also acknowledged with thanks.

### Background to Contingent Valuation

Given the fragile, yet highly productive nature of coastal and marine resources, the economic value thereof has been a subject of much debate. Several studies attempted to either value these resources, and/or provided summaries of valuation estimates (Tuya et al. 2014, Vassallo et al. 2013, Carandang et al. 2013, De Groot et al. 2012, Vo et al. 2012, Barbier et al. 2011, Van der Ploeg and De Groot 2010, De Groot et al. 2010 (The Economics of Ecosystems and Biodiversity (TEEB) 2010), Wattage and Mardle 2008, Samonte-Tan et al. 2007). Studies such as these are of great help within the context of assessing broad ranges of the ecosystem goods and services value using what is generally called the benefit transfer method.

The benefit transfer method implies that values derived from other studies are imported into a current study and applied therein. The benefit transfer method is of value when conducting quick assessments. When considering questions of



strategic and long-term importance, the benefit transfer method is weak in providing accurate estimates of the value of local resources. This is, since values have been derived within an unknown context, an unknown country, with an unknown number of beneficiaries and/or service users, and an unknown degree of scarcity and/or abundance of the resource. Context-specific policy questions require context-specific estimates of the value of ecosystem goods and services.

While there is a range of well-documented valuation techniques (Dixon et al. 2004), the method favoured by many when seeking to estimate the direct and indirect value of non-marketed commodities is that of contingent valuation. Contingent valuation studies provide a stated preference by the interviewee as to his/her perceived value of a resource and/or the change in value given a specific scenario. Two types of contingent valuation studies can be identified, namely the Willingness to Pay (WTP) for a service, an improvement in a condition, and/or the avoidance of a deterioration; and/or the Willingness to Accept Compensation (WTA) for the loss and/or deterioration in the service.

The contingent valuation method has also been successfully applied to estimate the economic value of coastal and marine resources in the past within different countries and continents, such as Japan, Mexico, China and the United States (Huang et al. 2013, Petrolia and Kim 2011, Barr and Mourato 2009, and Zhai and Suzuki 2009).

## Project Implementation

The project began in July 2014, when AGEDI commissioned implementing partners Hyder Consulting Middle East Limited (Hyder) to carry out an Ecosystems Services Assessment for coastal and marine resources in Abu Dhabi. Hyder delivered the project with specialist natural resource economists, FutureWorks Sustainability Consulting, based in the Republic of South Africa. The programme for the Ecosystem Services Assessment Project was implemented in a duration of four months. The project stages in Figure 1 are shown consecutively, however some stages were undertaken in parallel in order to streamline the project.

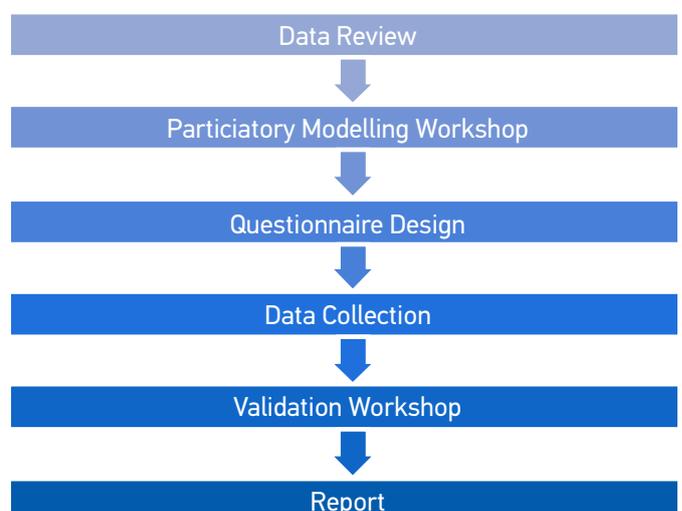


Figure 1: Project stages

# The Assessment



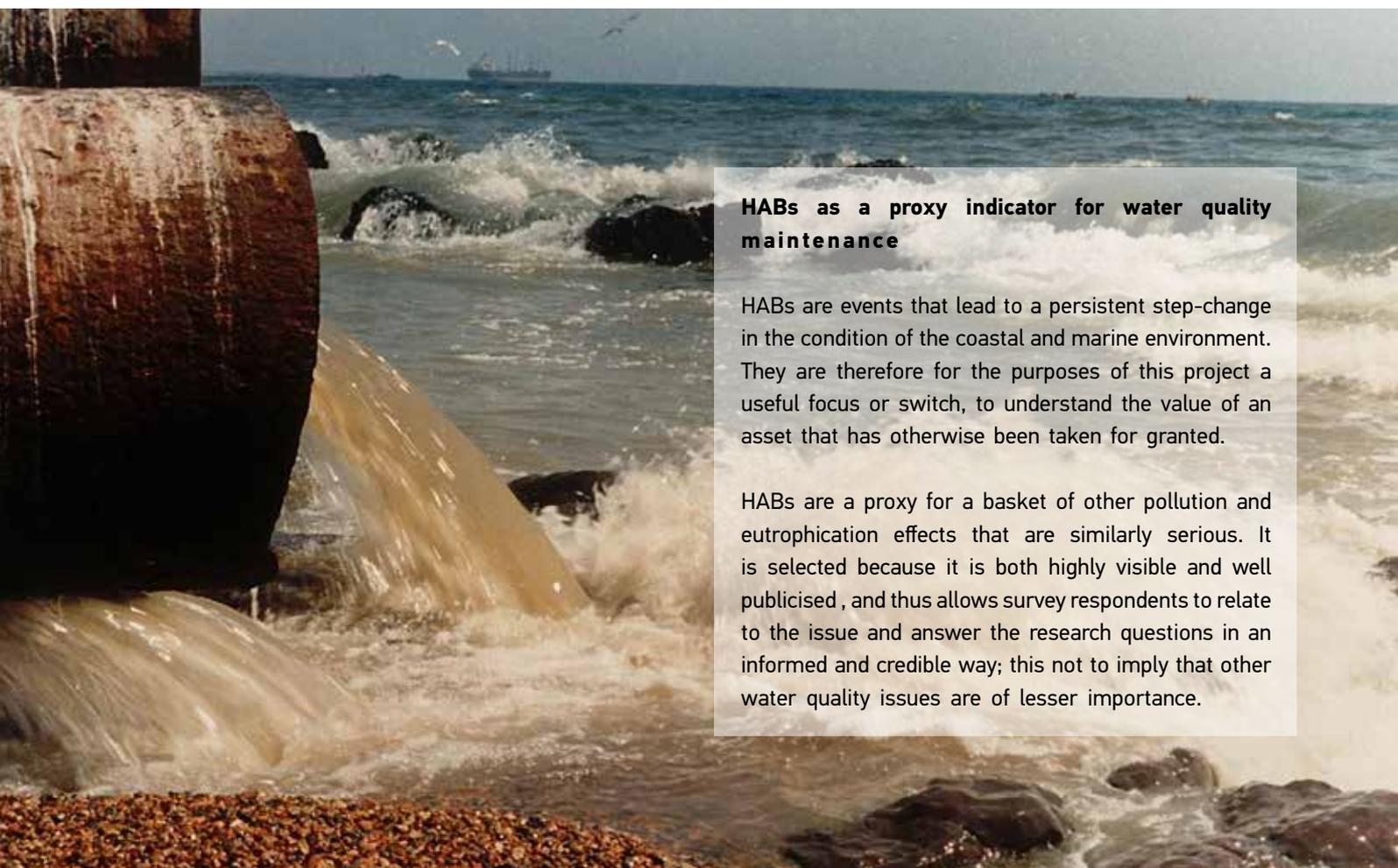
The project incorporated a participatory approach beginning with data review, followed by a participatory modelling workshop, the questionnaire design, data collection, a validation workshop, and finally, a report on findings.

The risks to water quality maintenance, waste dilution, recreation and shoreline stabilisation have serious amenity implications for hotel owners, home owners, apartment owners and beach users.

The increasing frequency and duration of large scale red tides and local eutrophication incidents highlights the trend of demand exceeding supply in relation to water quality. Maintenance, which in turn seriously reduces amenity values.

## ECO-FUTURES Participatory Modelling Process

In order to identify critical marine ecosystem services at risk and hence direct a valuation analysis, the ECO-FUTURES participatory modelling process was used in a workshop of invited stakeholders, which included biodiversity and marine policy experts. This populated a systems model using local knowledge and available data, to identify priority services and to simulate future scenarios. The workshop findings indicated that the contingent valuation analysis should focus on the potential decline of amenity values for coastal property owners and beach users, such as hotel owners, apartment owners and beach users, arising from the increasing frequency and duration of large scale harmful algal blooms (HABs) or 'red tides.'



### **HABs as a proxy indicator for water quality maintenance**

HABs are events that lead to a persistent step-change in the condition of the coastal and marine environment. They are therefore for the purposes of this project a useful focus or switch, to understand the value of an asset that has otherwise been taken for granted.

HABs are a proxy for a basket of other pollution and eutrophication effects that are similarly serious. It is selected because it is both highly visible and well publicised, and thus allows survey respondents to relate to the issue and answer the research questions in an informed and credible way; this not to imply that other water quality issues are of lesser importance.



### Key output of ECO-FUTURES workshop

The growing demands for services such as water quality maintenance, waste dilution, recreation and shoreline stabilisation are increasingly constrained by a declining supply of these services as marine habitats shrink or decline in condition. The increasing frequency and duration of large scale red tides and local eutrophication incidents highlights the trend of demand exceeding supply in relation to water quality maintenance, which in turn seriously reduces amenity values.

Comparing ecosystem services supply levels and the demand provides an indication of the risks associated with each service. In this process, risk is measured by dividing demand by supply. The service with the highest risk at present is channel maintenance – which is a function of high demand and a low ecological supply capability. The next cluster of services at risk is water quality, recreation, storm surge reduction, waste dilution, shoreline stabilisation and amenity.

Figure 2 shows that risk will increase in the future as supply declines and demand grows. Water quality and channel maintenance are the services which show the greatest increase in risk in Scenario 1. Scenario

2 shows that even with ecological restoration, the ecological processes are unlikely to remedy the elevated human demands placed on the system, and engineering solutions will need to combine with elevated ecological management and restoration to achieve an acceptable living environment.

The risk analysis also highlights a strategic conflict between dredging to remedy the channel maintenance risk and dredging’s negative ecologic impacts which run down most of the marine assets, thereby decreasing the other key services, which are critical to urban quality of life, property values and the tourism economy.

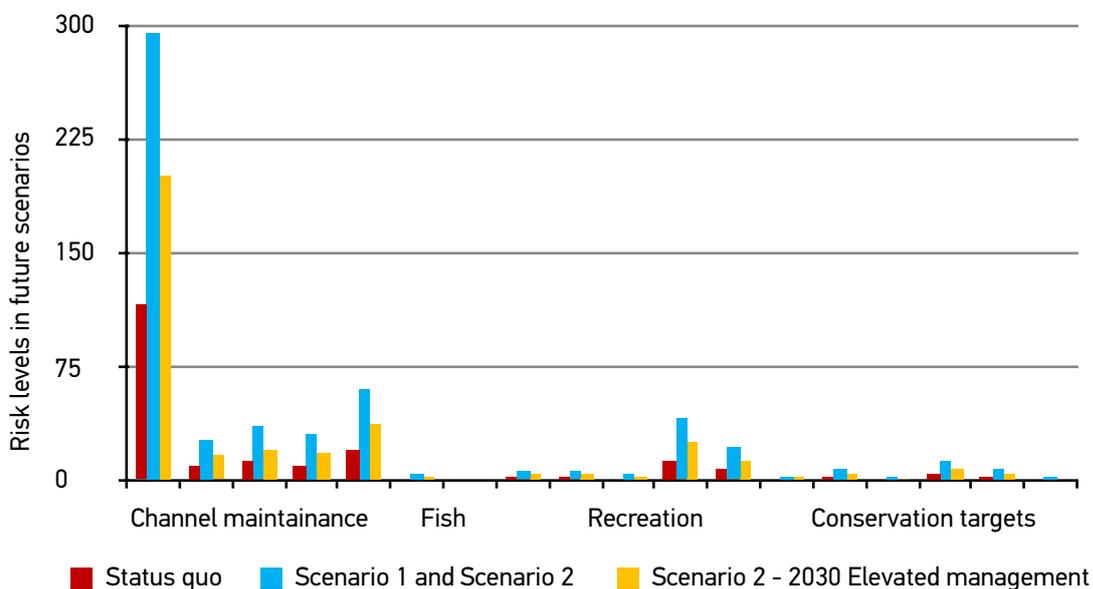


Figure 2: Risk Profile of Services Supply in Current and Future Scenarios

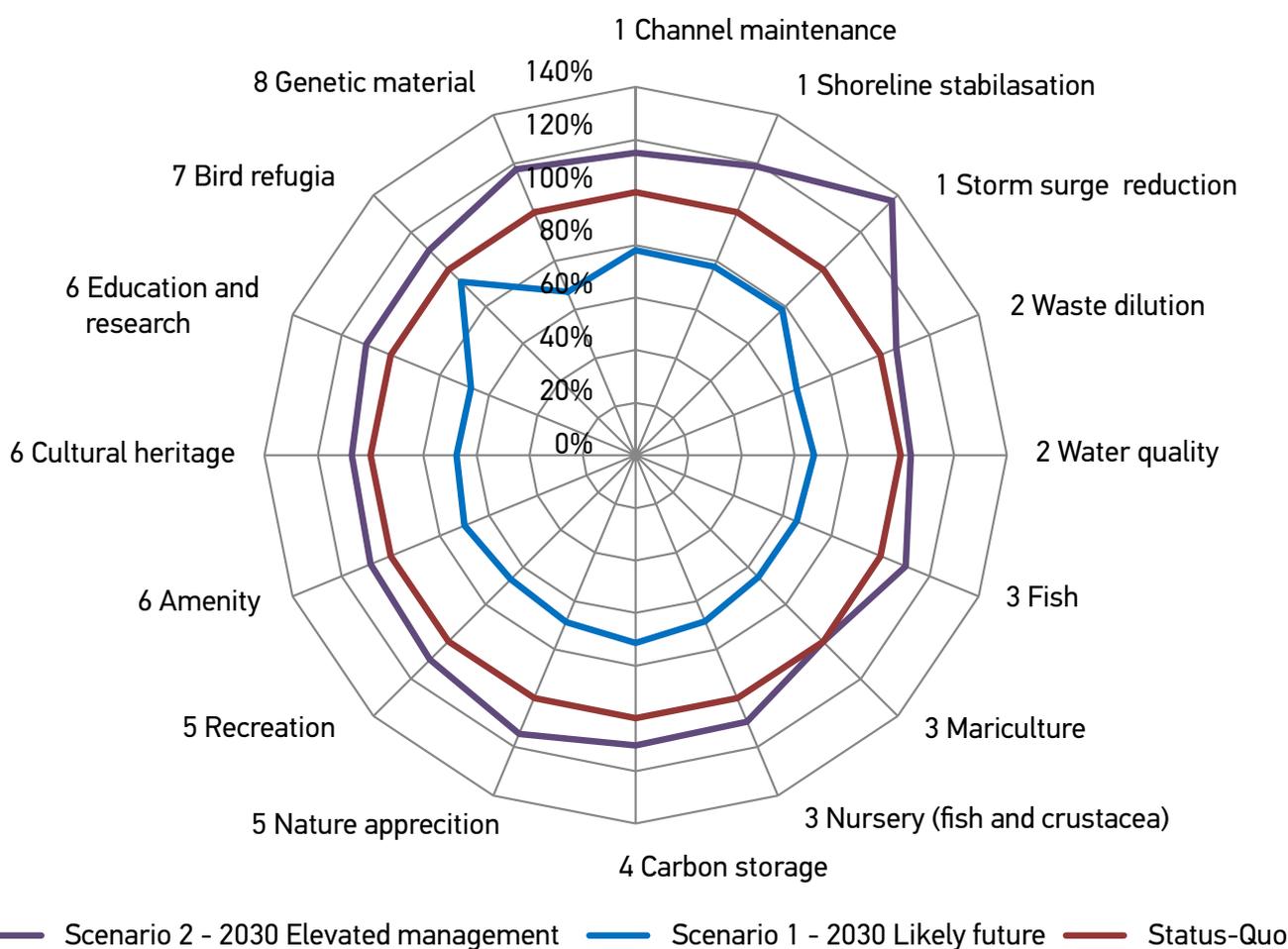


Figure 3: Percentage Change in Service Levels in Two Future Scenarios

### Survey Design and Implementation

The workshop provided the basis to develop targeted questionnaires to collect primary data to provide the basis for a contingent valuation analysis. The project therefore sought to quantify the value of a pristine or

high quality coastline to commercial operations that relied on a beach front component to their commercial offering. These were either hotels, with beach fronts or close to the beach, or those that sold or managed beach front property to residents, for which they charged a premium for the location.



### What is the ECO-FUTURES participatory modelling process?

ECOFUTURES is a proprietary process that enables a group of stakeholders to populate a systems model using their local knowledge and available data, to simulate future scenarios and to interpret the outcomes for management and policy purposes. The process uses a series of structured discussions, providing the space for participants to interact in a synergistic manner, sharing expert knowledge of the system and generating new insights. Importantly, the model assesses a range of future scenarios by the team changing the ecological functionality and demand variables in response to various future development scenarios. The model, in turn, simulates the likely changes in ecosystem services supply levels, which can be compared to ecosystem services demands, highlighting those services at risk and hence can be used to inform decision making.

While separate questionnaires were prepared for real estate managers, owners and the beach visitors, the overall structure of the questionnaires was identical. Both questionnaires commenced with a general introduction about the current state of the coastal and marine resources, marketing material, the government’s vision, and examples of real and recent pollution in the form of HAB - all supported with photos.

The general introduction was followed by a section of questions enquiring about either the current level of operation (in the case of the real estate survey), or demographics (the beach visitor survey). This

was followed, in both cases, with a referendum style double-bound continuous choice contingent valuation survey (respondents are presented with a “follow up” question in addition to the “yes-no” options) seeking to determine the willingness to accept (WTA) compensation for a loss in amenity services. Interviewees were showed voting cards in an increasing order.

A distinct questionnaire was prepared for each of the two stakeholder groups.

Following the determination of the willingness to accept compensation, a hypothetical restoration

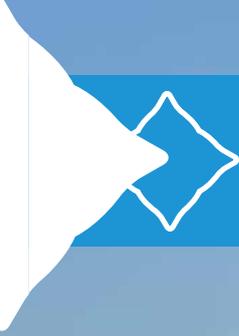
Stakeholder Group	Research Focus
Hotel or real estate managers	To evaluate what the expected change in revenue was due to prevalence of red tides, within the property’s beach, due to the existence of excessive number of HAB (as a proxy for any dis-amenity of service)
Beach visitors	What is the expected amenity loss due to prevalence of red tides due to the existence of excessive number of harmful algal blooms.

Table 1: Questionnaire for the two stakeholder groups.



scenario was sketched and the interviewees asked whether they would be willing to pay an annual fee to a restoration fund that would mitigate the pollution and ensure a constant supply of amenity services:

- A total of 31 hotel and real estate questionnaires were completed and included 25 hotels (27% of total number of Abu Dhabi hotels, and 96% of Abu Dhabi's beach hotels within the study area), 5 real estate managers (approx. 10% of total) and 1 commercial property manager (2% of total)
- A total of 103 beach visitor questionnaires were completed from four principle beaches: Al Bateen, Corniche, Saadiyat and Yas beaches
- The beach visitors surveyed, both tourists and residents, came from a diversity of countries. 86 of the 103 questionnaires were completed by residents, 70 of the 86 by the three middle-income categories varying from AED3,000-60,054 per month (US\$817-16,350 per month). People between 20 and 40 years of age dominated the sample at all of the beaches
- There is a high intensity of beach use with an average of between 50 and 105 visits per year among the residents and between five and 20 visits a year among the tourists. The average travel time varies between about 20 to 60 minutes, but it could be as low as five and 10 minutes



The data from the surveys represents primary data collected through interviews and contains no secondary and/or estimated (modelled) data. Assumptions as listed herein have been made in the up-scaling of some of the numbers to reflect Abu Dhabi-wide impacts. This is the highest form of quality data available. As such it has been attempted to honour the integrity of the data as far as possible and deduct the assessment in such a way as to not infer results onto the data itself, but rather use the data as principal point of departure and to deduct the analysis from that vantage point.

The combined WTA of the hotel and beach visitors was estimated to be US\$824 million per year.

## Findings



For the hotels/real estate survey, the discounted Net Present Value (NPV) of the expected financial losses associated with a change in amenity services has been estimated using varying discounting rates at -2%, 2% and 5%. It was assumed that, in the case of the beach visitor survey, that the demographic profile of the respondents in terms of age, income level, and whether they are residents or tourists, etc., is an adequate reflection of the profile of the Abu Dhabi population. This assumption allows for extrapolation.

The total willingness to accept compensation in the event of reduced water quality that would lead to HABs for 15 affected hotels was estimated to be US\$113 million/year. Elevated by 25%, to make provision for the hotels indicating that they will require compensation for lowered water quality but which did not provide financial information, this number was estimated to be US\$141 million/year, or 35% of average turnover. This was 9% of the total revenue for all of Abu Dhabi's hotels in 2013, estimated to be some US\$1.5 billion.

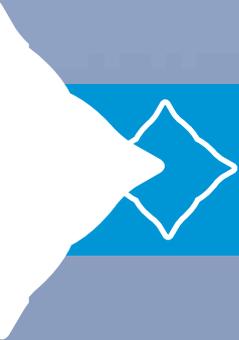
The results suggest that the prevalence of a HAB event would lead to a decline in individual hotel revenue, which required compensation of approximately 30%-35% of turnover. The sector-wide impact could include a short-term decline in sector revenue, resulting in a contraction of the hospitality and related economic sectors as well as impacts on the credibility of the marketing image of Abu Dhabi as a destination of choice. Long-term, the anticipated growth of the city could be inhibited.

The beach visitors surveyed, both tourists and residents, came from a diversity of countries. 86 of the 103 questionnaires were completed by residents, 70 of the 86 by the three middle-income categories varying from US\$817 -US\$16,350/month. People between 20 and 40 years of age dominated the sample at all of the beaches. Seventy eight per cent (67 of 86) of the beach visitor residents indicated that they would be willing to accept an offset cost to go to an alternative beach in the event of their preferred beach not being available for recreation purposes due to HAB. A very

similar number of the tourists sampled, 76% (13 out of 17), indicated the same. Those willing to go would have required compensation to offset their cost between, on average, AED60 and AED250/visit for the residents, with the poorer households indicated that they will require more compensation, indicating their higher inability to cover the additional travel expense. The comparable number for the tourists was AED80 - AED280, which was marginally higher, and the poorer households again required the higher values. In the event of a complete loss of services, those among the residents who would have been willing to travel to an alternative beach would have required compensation between AED550 and AED3,125/ visit, this time the more affluent households demanded higher compensation, indicating that the sense of the value of money being quite different among the income groups. Among the tourists this number was, on average, AED1,150 and AED5,300/visit – considerably higher than that of the residents. Those who would not consider going to an alternative beach estimated their loss much lower, between about AED30 and AED300/visit.

This analysis estimated that the amenity, which the coastal and marine resources supply in Abu Dhabi, was worth some US\$141 million to only 15 Abu Dhabi hotels/year, equalling an NPV of between US\$1.3 billion and US\$2.1 billion over 13 years, the average period before major refurbishment is expected. In addition, the coastal and marine resources supplied a value of US\$683 million to beach users/year. This conservative number, assuming only 4.2% of the residents of Abu Dhabi visit the beaches, is almost five-fold the effect on the hotels.

The combined WTA of the hotel and beach visitors was estimated to be US\$824 million/year. The residential estate market and commercial properties could also experience significant losses, but these could not be estimated because of the small sample sizes in both cases. Additional impacts might also include the loss in other economic activities and a slowdown in the economic development of the city escalating this number even further.



Beach users anticipate a significant loss in wellbeing, reaching values up to 190% of their annual income for the poorer residents, should beach amenity services be lost.



## Beach Goers

### Willingness to Accept Compensation

In order to up-scale the value of the plausible loss in amenity value, and hence loss in household utility, to the city-wide level, it is necessary to determine the total number of beach visits a year. After apportioning the estimated number of beach visits of 2,359,855 according to the profile of the survey respondents, i.e. allowing for a differentiation between being a resident of tourist as well as income levels, the city-wide losses in utility to households due to HAB can be estimated.

- The loss in the total amenity value as a result of all the beaches being affected with HAB is noteworthy. This ranges between US\$461 million and US\$770 million for residents and US\$50.5 million and US\$84 million for tourists, with a total estimated impact of about US\$682.9 million. This does not include the impact of any possible knock-on effect due to a reduction in visitor numbers and/or level of economic activity.

- This translates to a value for the beaches, 55,7ha in size, offering the resident beach user an amenity service of between US\$8.3 million/ha and US\$13.8 million/ha.

The potential implication of these findings can include:

- The magnitude of the loss of complete access is between 14 and 19 times higher than the offset requirement for tourists and between nine and 12 times higher for residents
- A system-wide impact is perceived to have severe well-being implications
- A quality beach is an expectation
- The impact on poorer households is higher and require more compensation for offsetting their costs
- Affluent households are impacted more by the total loss of access

	Offset costs			Cost of algal bloom		
	-25%	Estimated value	+25%	-25%	Estimated value	+25%
<b>Residents</b>						
- AED	339,493,911	452,658,548	565,823,185	1,694,456,669	2,259,275,559	2,824,094,448
- US \$	92,505,153	123,340,204	154,175,255	461,704,814	615,606,419	769,508,024
- US \$/ha	1,660,775	2,214,366	2,767,958	8,289,135	11,052,180	13,815,225
<b>Tourists</b>						
- AED	7,576,377	10,101,835	12,627,294	185,436,333	247,248,444	309,060,555
- US \$	2,064,408	2,752,544	3,440,680	50,527,611	67,370,148	84,212,685
- US \$/ha	37,063	49,417	61,772	907,138	1,209,518	1,511,897
<b>Total</b>						
- AED	347,070,287	462,760,383	578,450,479	1,879,893,002	2,506,524,003	3,133,155,004
- US \$	94,569,561	126,092,747	157,615,934	512,232,426	682,976,568	853,720,709
- US \$/ha	1,697,838	2,263,784	2,829,730	9,196,273	12,261,698	15,327,122



- The willingness to contribute to restoration is low for residents but higher than tourists
- Residents see beach recreation as a critical element of their well-being

#### Willingness to Accept Compensation: Tourists

Offset costs to go to beach B:

- Range AED80 – 280 per visit
- Poorer households requiring the higher amount
- Aggregate for the total economy = AED10.1 million pa (US\$49,400/ha)

With total loss of access:

- Range AED1,150 – 5,300 per visit
- Poorer households requiring the higher amount
- Aggregate for the total economy = AED247.3 million pa (US\$1.2 million/ha)

#### Willingness to Accept Compensation: Residents

Offset costs to go to beach B:

- Range AED60 – 250 per visit
- Poorer households requiring the higher amount
- Aggregate for the total economy = AED452.7 million pa (US\$2.2 million/ha)

With total loss of access:

- Range AED550 – 3,125 per visit
- Affluent households requiring the higher amount
- Aggregate for the total economy = AED2.3billion pa (US\$11 million/ha)

It should be noted that amenity services offered by the marine and coastal ecosystems are highly treasured, as also shown by the percentage compensation required relative to annual income received. The offset cost requirement for the poorer households equates to 62% of their annual income, which is the compensation required to visit Beach B in the event of red tide at their favourite beach. This number declines as the annual income increases.

This declining pattern with an increase in income is repeated when considering the loss in utility when there is no access to the beach, as a result of red tide. The total loss in amenity services will be as high as 190% of annual income for the poorer households, declining to 4% for the most affluent households.

#### Willingness to Pay

- Residents would be willing to contribute AED197,750 (US\$53,900) to a restoration compensation fund. On a city-wide level, assuming 2.3 million visits per year as estimated above, this would imply AED90.8million (US\$24.7 million), or 4% of the loss in total amenity services.
- The tourists would be willing to contribute AED1,630 (US\$450) to a restoration compensation fund. On a city-wide level this would imply AED1.8 million (US\$490,000), or 1% of the loss in total amenity services.

#### Real Estate/Hotel Group

In summary, the results of the assessment are:

- 24 Abu Dhabi City hotels and one Western Region hotel, were surveyed, the latter discarded to protect the hotel's anonymity and due to the vast number of locational differences among the hotels.



Hotels indicated that they will require compensation between about US\$113 million and US\$141 million per year, or 35% of average turnover. This equates to an average NPV of between US\$ 1.3 and US\$2.1 billion assuming a discount rate of 5% and -2% respectively over the expected average life expectancy of 13 years.

- Four of the 24 hotels did not require compensation; all four hotels had no direct access to beach frontage and were not highly dependent on beach leisure customers.
- Five of remaining 20 hotels required compensation without providing an estimate thereof.
- The remaining 15 hotels provided an estimate of the impact and provided the required data.

#### Willingness to Accept Compensation

- Of the 15 hotels that provided data, elevated to 20 to allow for the five that did not provide data but which indicated that they will require compensation:
  - WTA = US\$113 million - US\$141 million per year (required compensation = 30% to 35% of turnover)
  - NPV of WTA over 13 years = US\$1.3 billion – US\$1.6 billion, but could be as high as US\$2.5 billion

#### Willingness to Pay

- Of the 17 hotels indicating that they would be willing to contribute to a restoration fund, nine provided data on WTP per year totalling AED2,984,000 (US\$813,000). This is a clear indicator of the

high premium the hotels are placing on the expectation to the amenity. It should also be seen in the context that Abu Dhabi is a tax free zone for citizens and a low tax environment for companies and there is therefore limited precedent or culture for companies to make financial contributions to the authorities.

- WTP = US\$813,100; or 1.2%-1.9% of WTA

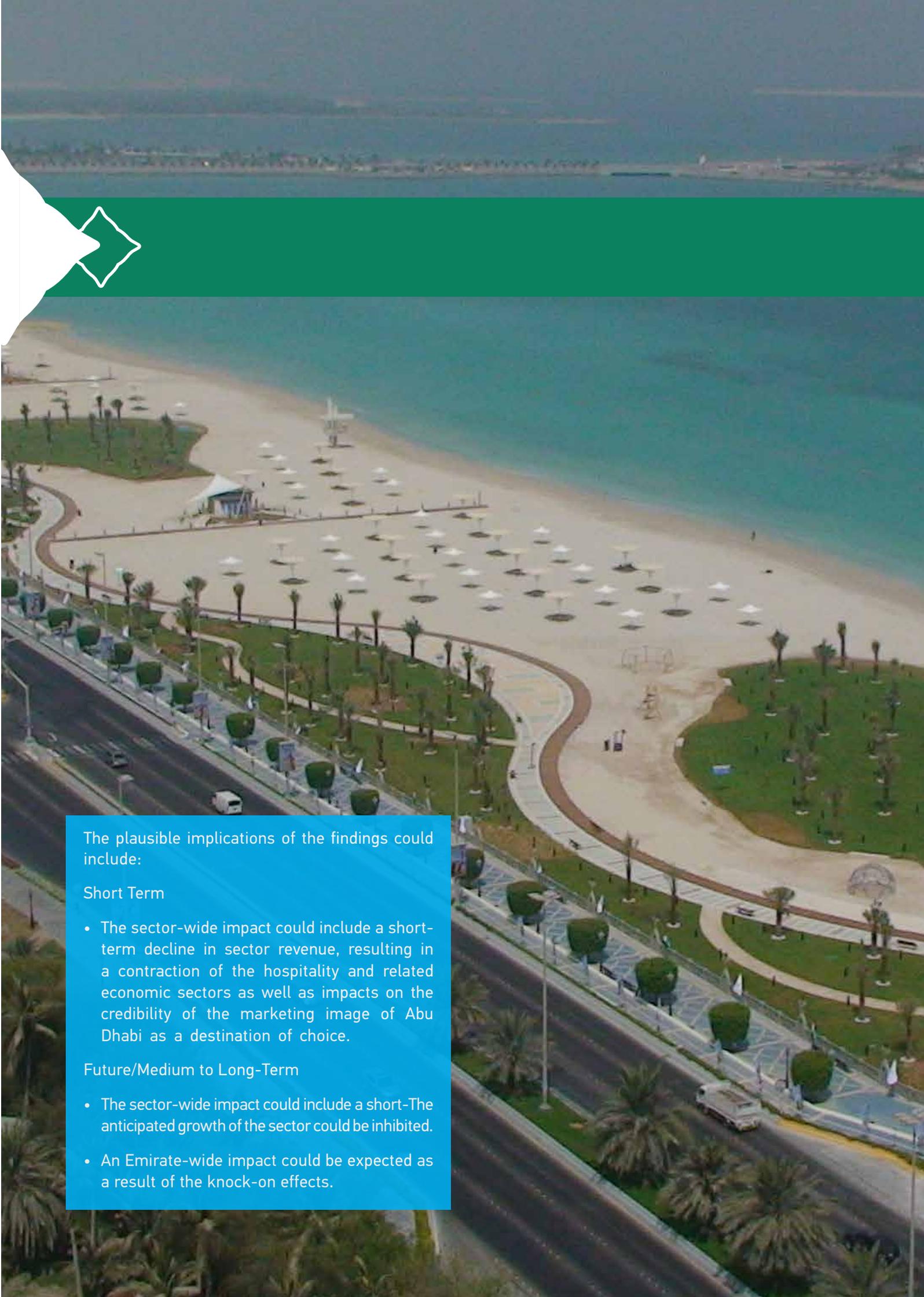
As part of the survey additional comments were raised. An example of these is as follows:

- The impact would be catastrophic, could not sell any properties. Our unique selling point is the beach.
- If tenants couldn't use beaches, why would someone pay a higher rent?
- Nobody would want to live on an unusable coastline, and it will be very smelly and unattractive.
- They would claim compensation since they would be losing billions.

Two property managers provided an estimate of the financial impact of the change in environmental amenity services.

- A rent reduction between 10% and 25% is foreseen.
- A 10-20 percentage point reduction in occupancy rate is foreseen.

As a result of the small sample size of responses received from estate managers providing financial data, the number was not up-scaled to the full number of real estate properties.



The plausible implications of the findings could include:

#### Short Term

- The sector-wide impact could include a short-term decline in sector revenue, resulting in a contraction of the hospitality and related economic sectors as well as impacts on the credibility of the marketing image of Abu Dhabi as a destination of choice.

#### Future/Medium to Long-Term

- The sector-wide impact could include a short-The anticipated growth of the sector could be inhibited.
- An Emirate-wide impact could be expected as a result of the knock-on effects.



#### Notes and Constraints

1. Data from all interviews were recorded anonymously.
2. One of four hotels within the Western Region was successfully interviewed but it was not possible to obtain an adequate beach visitor sample size over the several survey attempts; Western Region data were therefore excluded from the analysis.
3. For the hotels/real estate survey the discounted NPV of the expected financial losses associated with a change in amenity services has been estimated using varying discounting rates at -2%, 2% and 5%. It was assumed that, in the case of the beach visitor survey, that the demographic profile of the respondents in terms of age, income level, and whether they are residents or tourists, etc., is an adequate reflection of the profile of the Abu Dhabi population. This assumption allows for extrapolation.
4. The residential estate market and commercial properties could also experience significant losses, but these could not be estimated because of the small sample sizes in both cases. Additional impacts might also include the loss in other economic activities and a slowdown in the economic development of the city, escalating this number even further.



## Future Considerations

As part of the Project, a final feedback workshop was held to present the results to participants. The workshop asked the two principal stakeholder groups present (public sector policy specialists and private sector hotel managers) questions relating to:

- What were the lessons learned?
- What are the priority actions for the future?
- What can you do to help the process?

Key recommendations as a result of the assessment and the workshop include the following:

- Delivering projects at a local through to regional level within the following phased programme:
  - Risk assessment
  - Valuation to set a baseline
  - Analysis of options
  - Monitor implementation

To move forward, the following three-stage approach is recommended:

- Stage 1
  - Assess the priority services that deliver the Western Region's food security and biodiversity assets through a participatory modelling workshop

- Use Priority Focus Areas from the Regional Biodiversity Assessment project (AGEDI 2013) as a basis to run ECO-FUTURES participatory modelling workshops at a national level and develop priority contingent valuation research projects

- Stage 2

- Follow up to further determine national values of natural capital assets to inform and guide future management

- Stage 3

- Develop a better understanding of the revenue loss in relation to likely mitigation and restoration costs
- Replicate the amenity valuation research, in particular for Dubai and other Emirates and possibly within the wider Arabian Gulf region
- Inform an options analysis based on a review by coastal biodiversity experts of current habitat resources and habitat condition within the Abu Dhabi area, coupled with a better understanding of the drivers of habitat loss and deterioration, and the likely costs of an implementation programme

All next steps will be facilitated by enhanced cross-sector working between biodiversity, policy, and planning experts.



## Conclusion: The US\$824 Million Question



What can and should be done to prevent the frequent occurrence of HAB?

For the last four to five decades, urban development in Abu Dhabi has taken place in close proximity to the coast. This is largely due to the accessibility to a wide range of marine-based ecosystem services, such as water supply, recreation, visual amenity, sense of place, waste dilution and assimilation, marine food sources, and water-based transport. The abundance and quality of the ecosystem services supplied have generated high levels of coastal amenity services, such as visual aesthetics, and the ability to market the city as a destination of choice.

Much of the hospitality industry and high value residential property has been located immediately adjacent or close to the ocean to access the amenity generated by high levels of ecosystem services supplied by the marine environment. These facilities have been marketed as seaside facilities, offering numerous opportunities to interact or recreate with the marine ecosystem, and attracting a price premium. Given the vision of Abu Dhabi to protect its environment and to continue to offer a quality natural environmental and associated amenity services, there is a perceived entitlement to access a quality marine environment for recreation and other amenity services by the resident, investor and visitor alike.

The Abu Dhabi 2030 Plan (Abu Dhabi Urban Planning Council 2014) articulates strategies for the city with

twice the current population and with a quality coastal environment. Furthermore, the iconic Saadiyat Island, with its cultural precinct including the Louvre, the Guggenheim Abu Dhabi, Zayed National Museum and other top-end facilities are planned to be intimately connected to the ocean, facilitating a high degree of human-marine interaction. These plans and their marketing have built and continue to build a perceived expectation of a high quality near-shore marine environment.

This analysis estimates that the amenity which the coastal and marine resources supply in Abu Dhabi are worth some US\$141 million to only 15 Abu Dhabi hotels per year equalling a net present value of between US\$1.3 billion and US\$21 billion over 13 years, the average period before major refurbishment is expected. In addition, the coastal and marine resources were calculated to supply a value of US\$683 million to beach users per year. This conservative number, assuming only 4.2% of the residents of Abu Dhabi visit the beaches, is almost five-fold the effect on the hotels. The total impact is estimated to be US\$824 million per year. The residential estate market and commercial properties could also experience significant losses, but these could not be estimated.

The amenity services that the marine ecosystems supply is, however, not assured. The increasing incidence of HAB points to declining marine ecological functionality, paralleled with the shrinking coral reefs and sea grass beds. Should the current trend in marine degradation



continue, large scale losses of coastal amenity could be experienced. Beach-front hotels anticipate a 30% to 35% decline in turn over, and beach users anticipate a significant loss in wellbeing, reaching values up to 190% of their annual income for the poorer residents, should beach amenity services be lost. Understanding the implications of red tides has helped to understand the implications of losing the functional marine ecosystems associated with Abu Dhabi. The effects of red tides are a proxy for the loss of ecosystem services which generate recreational and general coastal amenity. By measuring the costs of red tides, we are able to show the value of marine ecosystems and their services.

Importantly, a decline in coastal amenity, due to a declining marine ecology, would not only have costs to the current users and hospitality industry, but could potentially constrain the future growth of the hospitality industry and the attractiveness of the iconic developments. These likely losses could negatively affect Abu Dhabi's global image and tourist economy, and urgent remedial action would be prudent. The anticipated increases in water, brine and thermal pollution as the city grows imply a further decline in coastal amenity, combined with a doubling in demand for the same services, with a serious decline in services per capita.

The results suggest that the economic value of the current, ongoing and planned levels of development could face risk and be potentially vulnerable to changes

in the quality of marine and coastal amenity services. Such changes can be brought about by the increase in the frequency and intensity of red tide and harmful algal blooms. Historic evidence (Burt 2014, Al Shehhi et al. 2014, Zhao and Ghedira 2014, Foster and Foster 2013, Ghaffour et al. 2013, Grandcourt et al. 2011, Cheung et al. 2012, Burt et al. 2011, Sheppard et al. 2010, AGEDI 2008) as well as ongoing economic activities suggest that the prevalence HAB is likely to increase.

A well-managed coastline that would provide quality marine and coastal resources around Abu Dhabi and would act as a safeguard against the prevalence of red tide or harmful algal blooms is therefore important to protect both the economic revenues from tourism and beach leisure activities, as well as to secure the image of Abu Dhabi. The latter is especially important given the drive to position Abu Dhabi as a global destination of choice for international and predominantly high value visitors. Abu Dhabi has therefore become iconic, leading to rapid expansion and top-end development, such as the ongoing developments.

# What is AGEDI?



Under the guidance and patronage of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the United Arab Emirates, the Abu Dhabi Global Environmental Data Initiative (AGEDI) was formed in 2002 to address responses to the critical need for readily accessible accurate environmental data and information for all those who need it.

With the Arab region as a priority area of focus, AGEDI facilitates access to quality environmental data that equips policy-makers with actionable, timely information to inform and guide critical decisions towards a sustainable future.

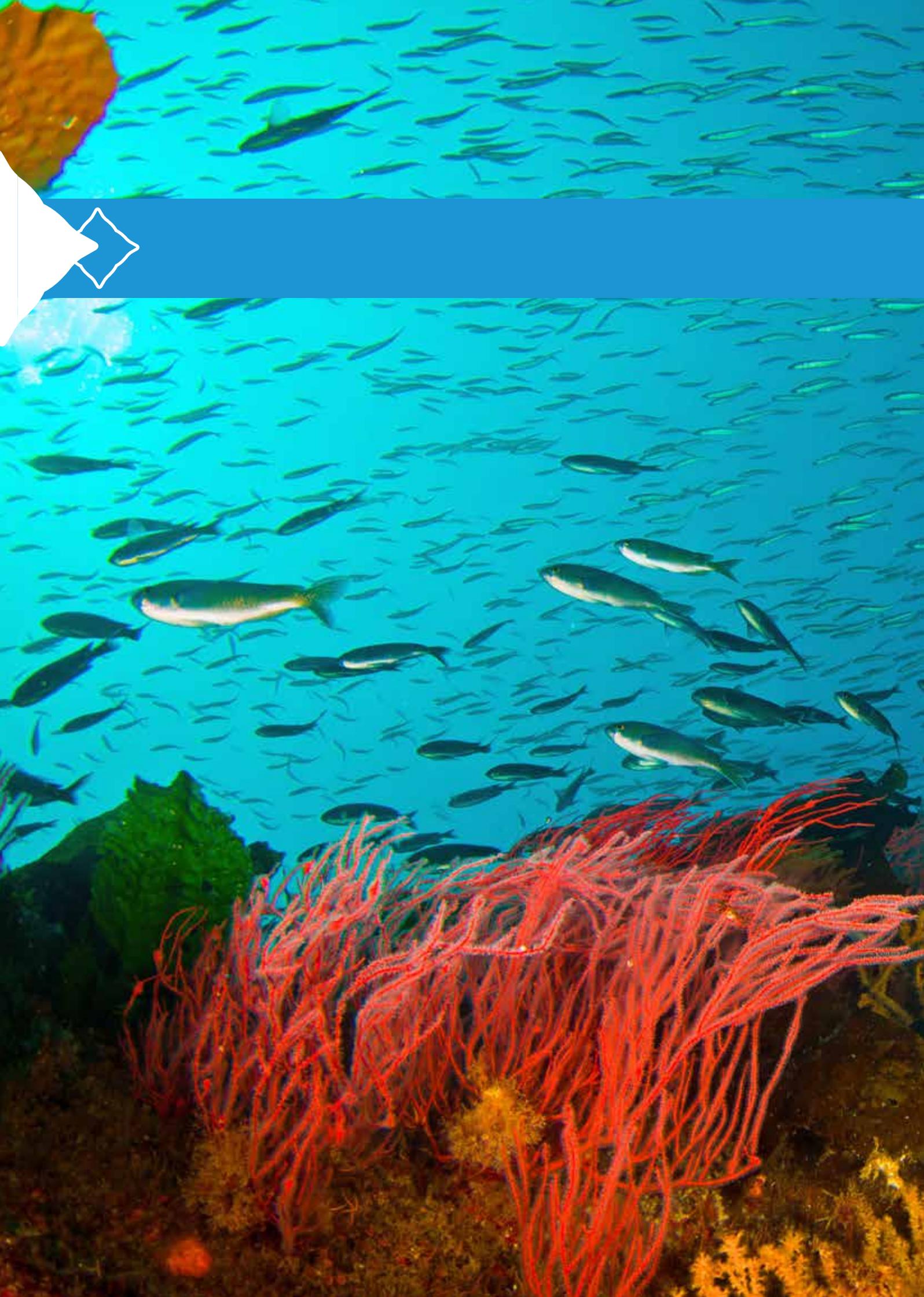
AGEDI is supported by Environment Agency - Abu Dhabi (EAD) on a local level, and supported by the United Nations Environment Programme (UNEP), regional and internationally.

For more information or to view the full technical report, visit [www.AGEDI.ae](http://www.AGEDI.ae), or contact:

[BlueCarbon-EcosystemServices@ead.ae](mailto:BlueCarbon-EcosystemServices@ead.ae)

## ABBREVIATIONS

<b>AGEDI</b>	Abu Dhabi Global Environmental Data Initiative
<b>ADM</b>	Municipality of Abu Dhabi City
<b>AED</b>	United Arab Emirates Dirham
<b>EAD</b>	Environment Agency - Abu Dhabi
<b>GDP</b>	Gross Domestic Product
<b>HAB</b>	Harmful Algal Blooms or Red Tides
<b>Hyder</b>	Hyder Consulting Middle East Ltd.
<b>NPV</b>	Net Present Value
<b>SCAD</b>	Statistics Centre - Abu Dhabi
<b>TEEB</b>	The Economics of Ecosystems and Biodiversity
<b>UPC</b>	Urban Planning Council
<b>US</b>	United State of America Dollar
<b>WTA</b>	Willingness to Accept
<b>WTP</b>	Willingness to Pay



**Abu Dhabi Global Environmental Data Initiative  
(AGEDI)**

P.O Box: 45553  
Al Mamoura Building A, Murour Road  
Abu Dhabi, United Arab Emirates  
Phone: +971 (2) 6934 444  
Email : info@AGEDI.ae



an initiative of



هيئة البيئة - أبوظبي  
Environment Agency - ABU DHABI

**AGEDI.ae**