



BIODIVERSITY BASELINE ASSESSMENT REPORT

KINGDOM OF BAHRAIN

Project Title: Bahrain NBSAP (Biodiversity Baseline Assessment Report)

Funding Agency: Global Environment Facility (GEF)

Executing Agency: Supreme Council for Environment, Kingdom of Bahrain

Project Supervisor: Ms. Nouf Al-Wasmi

Project Coordinator: Ms. Reem Al-Mealla

Project Team: Dr. Mohamed Mubarak Bin Daina, Mr. Abdelqader Khamis, Mr. Mohamed Abdulrazzaq Alqassim, Dr. Elsa Sattout, Dr. Jameel Alkhuzai, Ms. Tamera Alhusseini, Ms. Eman Husain

Drafting Committee: Dr. Abdelmawgoud Ragab (Directorate of Agricultural Affairs), Mr. Bassam Al Shuwaikh (Directorate of Fisheries), Dr. Humood Naser (University of Bahrain) and Mrs. Nouf Al Wasmi (Supreme Council for Environment)

Consultant (s): Prof. Jameel Alkhuzai

Number of Pages: 109

Year of Publication: 2015

Version: Final

Acknowledgment

The author would like to thank the Supreme Council for Environment especially Dr. Mohamed Mubarak Bin Daina and the NBSAP Project Team that includes Ms. Reem Al Mealla, Ms. Eman Husain and Ms. Tamera Alhusseini and also the NBSAP commissioned consultants: Dr. Elsa Sattout and Dr. Ameer Abdulla for their valuable and constructive comments throughout the project. I would also like to thank the United Nations Environment Programme - Regional Office for West Asia, particularly Ms. Diane Klaimi for her guidance and support, in addition to all the NBSAP workshops participants and their organizations for their valuable participation, feedback, and genuine contributions. Further thanks goes to all the stakeholder that have participated in the various focus groups and consultation meetings thereby aiding the process in accumulating local knowledge that might not otherwise have been documented thereby creating a baseline platform for all future studies and generations. Special thanks to the NBSAP National Reviewing Committee members Dr. Abdelmawgoud Ragab (Directorate of Agricultural Affairs), Mr. Bassam Al Shuwaikh (Directorate of Fisheries), Dr. Humood Naser (University of Bahrain) and Mrs. Nouf Al Wasmi (Supreme Council for Environment).

Government Sector

Bahrain Authority for Culture and Antiquities (BACA)
Central Informatics Organisation (CIO)
Chamber of Commerce and Industry
Economic Development Board
Electricity and Water Authority
National Oil and Gas Authority
Ministry of Education
Ministry of Finance
Ministry of Interior
 Customs
 National Coast Guard
Ministry of Transport
Ministry of Works, Municipality and Urban Planning
 Directorate of Fisheries
Directorate of Agriculture Affairs
Supreme Council for Environment
Supreme Council for Women
Survey and Land Registration Bureau
 Topographic Survey Directorate
 Hydrographic Survey Directorate

Private Sector

Environment Arabia Consultancy Services
Gulf Petrochemical Industries CO. (GPIC)
Mattar Jewelry
The Bahrain Petroleum Company (Bapco)
The National Initiative for Agricultural Development

Academic Sector

Arabian Gulf University
Bahrain Center for Strategic, International and Energy Studies
University of Bahrain

Civil Society & NGO's

Arab Youth Climate Movement, Bahrain Chapter
Bahrain Environment Society
National Institute for Human Rights
Youth and Environment Association

Intergovernmental

United Nations Development Programme (UNDP)
United Nations Environmental Programme – Regional Office of West Asia (UNEP-ROWA)

Executive Summary

"Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Biological diversity provides many services and benefits to humans, nature, and Planet Earth at large. Ecosystem services include food, natural medicine, air quality, disease regulation, recreation, tourism, nutrient cycling, etc. As a result, there is a growing recognition that biological diversity is a global asset of tremendous value to present and future generations. At the same time, the threat to species and ecosystems has never been as great as it is today. Species extinction caused by human activities continues at an alarming rate.

In response, the United Nations Environment Programme (UNEP) convened an Ad Hoc Working Group of Experts on Biological Diversity in November 1988 to explore the need for an international convention on biological diversity. As a result of continuous efforts, the Convention on Biological Diversity (CBD) was developed and then entered into force on 29 December 1993.

Bahrain has recognized the importance of biological and environmental resources and the need to protect them. Since the early 20th Century, Bahrain introduced a number of laws prohibiting the destruction of habitats and the hunting of animals. Acknowledging the importance of this matter, the Kingdom of Bahrain ratified the International Convention on Biological Diversity Convention (CBD) in 1996 based on Decree (18) 1996.

Bahrain is a small country. However, being an archipelago in a subtropical and arid region, it has a relatively rich and varied biodiversity. The main ecosystems include the marine ecosystem, desert ecosystem, and agriculture ecosystem. The ecosystems encompass a number of smaller ecosystems and habitats including the coral reefs, mangrove, mudflats, and seagrass in the marine ecosystem; jabals (small hills), runnels and small valleys, stone pavements in the desert; plantations, and water springs and streams in the agriculture ecosystems.

The ecosystems and habitats of Bahrain are inhabited by a variety of plants and animals. Some of the species are internationally important such as the dugong and the sooty falcon which nests in Hawar Islands. Bahrain is also a wintering and breeding site for many birds. Sawad Island in Hawar is the site of the largest population of Socotra cormorant in the world. In addition, Bahrain is home to some finest breeds of Arabian horses.

This report documents the flora and fauna of Bahrain which accounts to 1425 species. They include 327 vascular plants, 88 algae, 12 fungi species (*Fusarium*), 23 mammals, 329 birds, 20 reptiles, 1 amphibian, 250 fishes, 6 arachnids (spiders and scorpions), 32 insects, 64 crustaceans, 11 echinoderms, 186 shells, 25 coelenterates, and 51 polychaetes.

The biodiversity is under pressure due to human activities at the ecosystem level, the species level, and the genetic level (within the same species). Some of the pressures on marine ecosystem include dredging and reclamation, pollution, overfishing; urbanization and camping on the desert ecosystem, and overuse of ground water on the water springs and streams. These and other pressures have led to negative impacts and deterioration of some ecosystems. The report indicates that the status of the physical, chemical, and biological attributes of the marine ecosystem is within the good-bad condition (85%, 89%, and 81% respectively as indicated by respondents). The status of the freshwater springs and streams are more towards the negative side (bad-very bad) with 96%, 92%, and 92% respectively as indicated by respondents).

Accordingly, there are a number of suggested priorities and actions to be taken to reduce the negative pressures of human activities. They include implementing laws supportive of biodiversity, regulate and control dredging and reclamation, implementing environmental awareness programs at all Levels, creating a balance between urbanization and increase of agriculture area, etc.

Table of Contents

| Section | Page |
|---|-----------|
| 1. INTRODUCTION: | 7 |
| 1.1 Context of the Project | 7 |
| 1.2 Expected Outcomes of the Report | 9 |
| 2. PHYSICAL SETTING AND GEOMORPHOLOGY OF BAHRAIN | 10 |
| 2.1 Geography | 10 |
| 2.2 Geomorphology | 11 |
| 3. METHODOLOGY AND TOOLS | 12 |
| 3.1 Literature Search | 12 |
| 3.2 DPSIR | 12 |
| 3.3 Questionnaire(s) | 13 |
| 3.4 Focus Group | 13 |
| 4. BIODIVERSITY RICHNESS | 13 |
| 4.1 Flora | 14 |
| 4.2 Fauna | 23 |
| 4.3 Genetic Diversity | 46 |
| 4.4 Wild Relative Species | 49 |
| 4.5 Traditional Knowledge | 49 |
| 5. ECOSYSTEMS | 50 |
| 5.1 Marine Ecosystem | 50 |
| 5.1.1 Coastal Habitat | 50 |
| 5.1.2 Mangrove Habitat | 51 |
| 5.1.3 Seagrass Habitat | 52 |
| 5.1.4 Algal Habitat | 52 |
| 5.1.5 Coral Reefs Habitat | 53 |
| 5.1.6 Salt Marsh and Sabkhas Habitat | 53 |
| 5.1.7 Islands | 54 |

| | |
|--|----|
| 5.2 Desert Ecosystem | 55 |
| 5.2.1 Sand Dunes Habitat | 56 |
| 5.2.2 Gravels and Stone pavements | 56 |
| 5.2.3 Runnels and Small Wadis | 57 |
| 5.2.4 Jabals | 57 |
| 5.3 Agricultural Ecosystem | 58 |
| 5.3.1 Plantations and Farms | 58 |
| 5.3.2 Freshwater Springs and Streams | 58 |
| 6. CONSERVATION STATUS | 60 |
| 6.1 Red list | 62 |
| 6.2 Nature Reserves | 61 |
| 6.3 Sites of International Recognition | 63 |
| 7. STATUS OF BIODIVERSITY | 65 |
| 7.1 DPSIR Framework | 65 |
| 7.1.1 Drivers | 66 |
| 7.1.2 Pressures | 67 |
| 7.1.3 State | 68 |
| 7.1.4 Impacts | 72 |
| 7.1.5 Responses | 72 |
| 7.2 Priorities | 76 |
| 8. CONCLUSIONS AND RECOMMENDATIONS | 85 |
| 9. REFERENCES | 87 |
| 10. ANNEXES | 91 |

1. INTRODUCTION

1.1 Context of the Project:

"Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. In other words, biodiversity includes the number of species of plants, animals, and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs. Appropriate conservation and sustainable development strategies attempt to recognize this as being integral to any approach to preserving biodiversity (CBD, 2015).

Biological diversity provides many services and benefits to humans, nature, and Planet Earth at large. Services falls under four main categories: Provisioning, Supporting, Cultural, Regulating (Fig. 1).

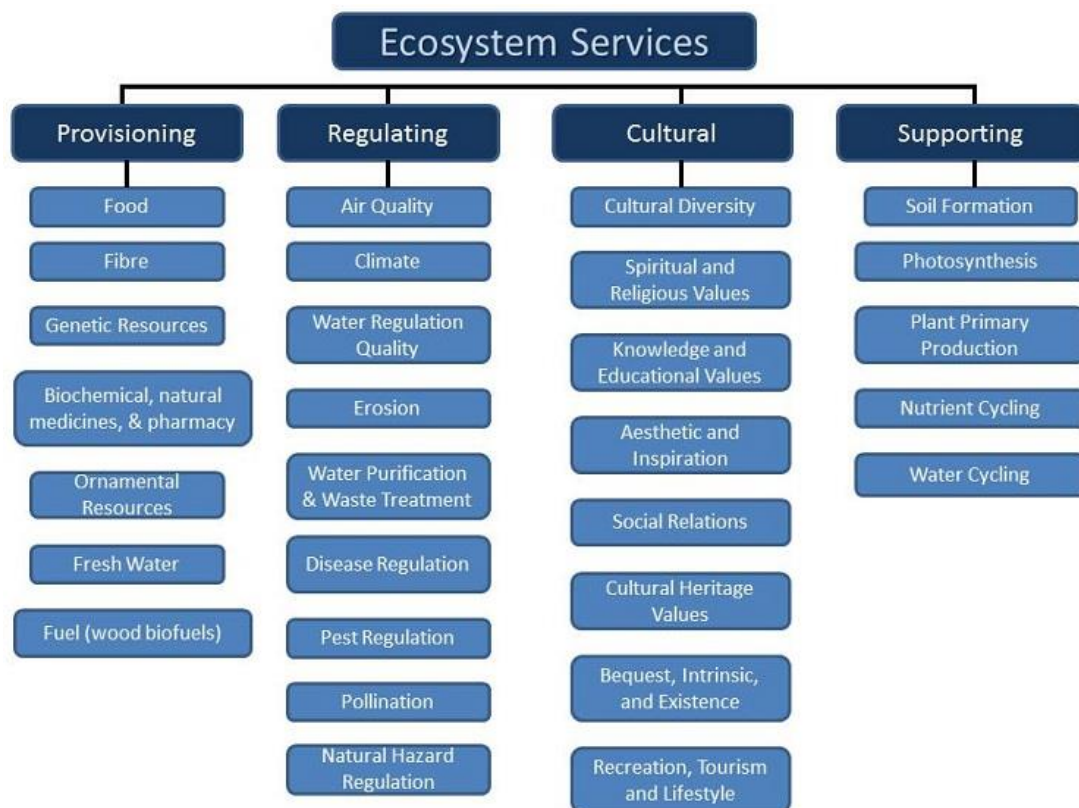


Fig. 1 Ecosystem services

As a result, there is a growing recognition that biological diversity is a global asset of tremendous value to present and future generations. At the same time, the threat to

species and ecosystems has never been as great as it is today. Species extinction caused by human activities continues at an alarming rate.

In response, the United Nations Environment Programme (UNEP) convened an Ad Hoc Working Group of Experts on Biological Diversity in November 1988 to explore the need for an international convention on biological diversity. As a result of continuous efforts, the Convention on Biological Diversity (CBD) was developed and then entered into force on 29 December 1993.

The Convention on Biological Diversity was inspired by the world community's growing commitment to sustainable development. It has 3 main objectives:

1. The conservation of biological diversity
2. The sustainable use of the components of biological diversity
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources

National Biodiversity Strategies and Action Plans (NBSAPs) are the principal instruments for implementing the convention at the national level (Article 6). The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity. The article creates an obligation for national biodiversity planning. A national strategy will reflect how the country intends to fulfil the objectives of the convention in light of specific national circumstances, and the related action plans will constitute the sequence of steps to be taken to meet these goals (CBD, 2015). Bahrain, being aware of the importance of this matter, ratified the International Convention on Biological Diversity Convention (CBD) in 1996 based on Decree (18) 1996.

In 2010, the international community in Nagoya, Japan adopted the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. The plan consists of five strategic goals, including twenty Aichi Biodiversity Targets. The goals and targets comprise both aspirations for achievement at the global level, and a flexible framework for the establishment of national or regional targets. Parties are invited to set their own targets within this flexible framework, taking into account national needs and priorities, while also bearing in mind national contributions to the achievement of the global targets, and report thereon to the eleventh meeting of the Conference of the Parties. Parties are also invited to incorporate this information in their national biodiversity strategy and action plan. As a follow up to the strategy, the Conference of Parties has adopted in 2011 indicators for each of the twenty targets. These are measures on the achievements of targets by the various parties.

1.2 Expected Outcomes of the Biodiversity Baseline Assessment Report:

The 2011-2020 Biodiversity Strategy Goals are:

- Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
- Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use
- Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
- Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services
- Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Strategic Goal B and Strategic Goal C concentrate on efforts to reduce pressure on biodiversity and improve its status. To achieve these goals a number of targets were set to aid in fulfilling them. Therefore, knowing the biological diversity, its components, drivers, status, pressures, and impact is essential to positively respond to requirements of Convention of Biological Diversity and implement the goals of the Biodiversity Strategic Plan 2011-2020.

Accordingly, this biodiversity baseline assessment was carried out with the following expected outcomes (deliverables):

1. An account of biodiversity richness in Bahrain including flora and fauna, wild relative species, and traditional knowledge.
2. An account of ecosystems diversity including habitats and services.
3. Conservation status
4. Status of biodiversity and pressures based on DPSIR (Driver-Pressure-State-Impact-Response) approach.
5. Priorities to reduce the impacts of pressures on ecosystems in Bahrain.

2. GEOGRAPHY AND GEOMORPHOLOGY:

2.1. Geography

Bahrain is an archipelago of 84 natural and artificial islands with a total area of 770.34 km². It is located at the south western coast of Arabian Gulf between Saudi Arabia and Qatar (Fig. 2). It is surrounded by water with a total area of 7549 km². Bahrain falls in the subtropical region within the desert belt extending from North Africa to Central China passing through the Arabian Peninsula. Climate is arid with extremely hot summer

and mild winter. It is characterized by high mean annual temperature and low mean annual rainfall.

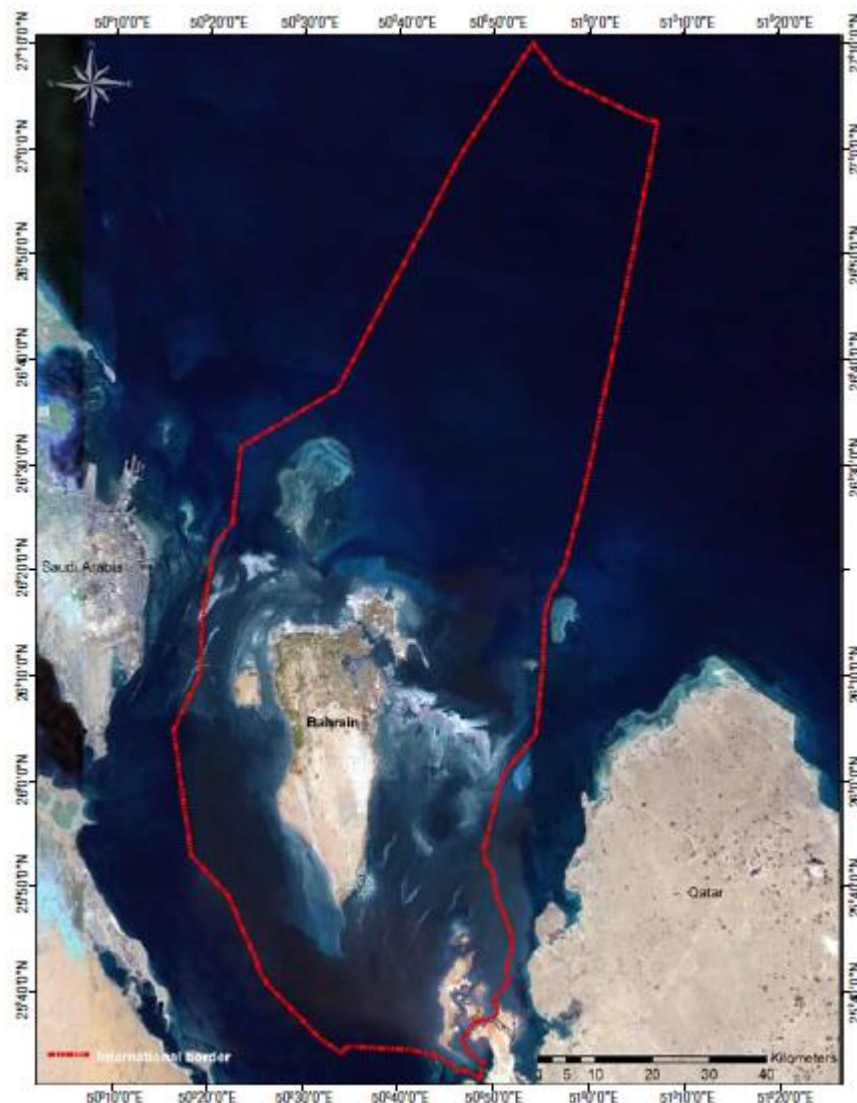


Fig. 2 Location map of Bahrain (Source: Zainal and Loughland, 2009)

2.2. Geomorphology

Bahrain may be divided into five physiographic zones (Doornkamp et al, 1980) as follows:

a. The Central Plateau and Jabals:

This is basically an anticlinal dome occurring in the centre of the island and consisting mostly of sedimentary limestone rocks. The general surface level is 40-66 m, with numbers of steep-sided and flat-topped residual hills, or jabals, rising to a maximum elevation of 122.4 m above sea level at jabal ad Dukhan.

b. The Interior Basin:

Over millions of years, erosion has modified the dome creating an interior basin in the form of an asymmetric ring surrounding the central plateau.

c. The Multiple Escarpments:

Surrounding and overlooking the Interior Basin is a continuous belt of multiple, inward-facing escarpments with a maximum height of 20 m above sea level.

d. The Main Backslope:

Declining away from the crest of the escarpment is an extensive, gently inclined surface (less than 5°).

e. The Coastal Lowlands:

At the base of the backslope, solid geology gives way to a surrounding fringe of young, unconsolidated, superficial deposits laid down by a combination of marine and aeolian processes. This zone represents about 50% of the total area of the main island. The products of erosion of the backslope are washed and deposited in many areas in the coastal lowlands forming sand sheets. Salt flats (Sabkha) occupy much of the coast, especially in the southwestern area. On the other hand, tidal mudflats are mainly located on the eastern coast.

3. METHODOLOGY AND TOOLS:

3.1 Literature Search

Available information on biodiversity in Bahrain was collected from various sources including the following:

1. Published research and studies
2. Books
3. Reports by government departments
4. Reports by Bahrain Natural History Society
5. Information provided by Supreme Council for Environment

3.2 DPSIR:

The Driver- Pressure- State – Impact -Response (DPSIR) scheme is a flexible framework that can be used to assist decision makers in any steps of the decision process. DPSIR was initially developed by the Organisation for Economic Cooperation and Development (OECD 1994) and has been used by the United Nations (UNEP 2007) and European Environmental Agency (EEA 1999) and the United States Environmental Protection Agency (EPA, 2015) to relate human activities to the state of the environment. This framework was used as the base for designing a Delphi-based approach questionnaire (RAND, 2015).

3.3 Questionnaire(s):

A questionnaire was specifically designed based on DPSIR framework (EPA, 2015). This questionnaire included a number of components and questions to stakeholders and experts in order to collect information that will cover the different parts of DPSIR (Annex 1). It was sent by Supreme Council of Environment (SCE) to 70 selected people who are directly or indirectly related to biodiversity in Bahrain. A total of 27 responses were received (38.6%). Delphi technique (RAND, 2015) was adopted to finalize and unify the responses based on DPSIR framework. Accordingly, after receiving the first batch of responses, the questionnaire was redesigned to reflect answers and trends by respondents and was then sent for a second round to all stakeholders and experts including those who responded to the first round.

3.4 Focus Group:

After the first batch of questionnaire responses was received, answers of the questionnaire were analyzed and discussed with a focus group representing experts and stakeholders directly related to biodiversity and environmental management. As a result of the discussion, a second questionnaire including final set of DPSIR components (Drivers, Pressures, Status, Impact, and Response) as well as priorities for the marine ecosystem, desert ecosystem, and agriculture ecosystem was prepared and used for the second round of Delphi technique (Annex 2).

4. BIODIVERSITY RICHNESS

The nature of Bahrain as an archipelago of more than 84 islands and its geographical location in subtropical region of an arid environment has led to the presence of marine and terrestrial ecosystems with various habitats. This variation has resulted in the occurrence of a variety of native plant and animal species. Many of these species are of high biological, ecological, social, economical, or cultural conservation values. For example, pearl oysters have cultural and economic values; corals have ecological and economic values. Many fish species use coral reefs as habitats. Bahraini people depend on fish as food and livelihood of many people. Healthy and protected coral reefs could be used in ecotourism. Mangrove (*Avicennia marina*) channels and tide-inundated mangrove support a variety of fisheries species through provision of nursery habitat (Abdulla, 2015). These fisheries are of cultural and economic importance to the Kingdom of Bahrain. Date palm species (*Phoenix dactylifera*) is a commodity and of cultural value. Many of the desert plants are used in herbal medicine. The following is a brief account of species found in Bahrain. It is by no means comprehensive or accurate because some of the information is based on old reports, incomplete surveys, and general observations by workers in the field of biodiversity. Some species, for example spiders, were given very general common names which are used to represent hundreds of genera and thousands of species. Although some groups such as vascular plants have families and species listing (Annex 3), because of those deficiencies, the tables of

various groups are in the form of species listing without categorizing species under families. The total number of families and genera is given in the introductory paragraph for each group. It is recommended that all groups to be revised, updated, and taxonomically classified by experts in each of the respected field.

4.1 FLORA

4.1.1 Vascular Plants:

A brief account on the flora of Bahrain was prepared by Good (1955). Virgo (1980) wrote an introduction to the vegetation of Bahrain. Pictorial books of flowering plants were published by Phillips (1988) and Cornes and Cornes (1989). A checklist of vascular plants and a study on natural flora of Bahrain (El-Oqlah & Abbas, 1992, 1994) reported the presence of 323 species. According to that report, plant species belong to 51 families and 193 genera. The authors found that vascular plants of Bahrain belong to 15 phytogeographic groups. The groups are: Mediterranean; Saharo-Arabian; Irano-Turanian; Euro-Siberian; Sudanian; Tropical; Mediterraneo-Irano-Turano; Saharo-Mediterrano; Saharo-Irano-Turano; Mediterraneo-Euro-Siberian; Saharo-Arabian-Sudanien; Saharo-Arabian-Irano-Mediterrano; Mediterraneo-Irano-Torano-Euro-Siberian; Saharo-Arabian-Tropical; Saharo-Arabian-Mediterrano-Irano-Turano-Tropical. 38% of the species belong to Saharo-Arabian phytogeographic group and annual plants represent 48% of the total. According to the database of the Supreme Council for Environment, 357 plant species are recorded. A review and refinement of this data by the consultant revealed a total of 327 (Table 1).



Photo 1. *Asphodelus tenuifolius* (Source: Jameel Alkhuzai)

Table 1 List of Vascular Plants of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|---|-----|---------------------------------|
| 1 | <i>Acacia Arabica</i> | 35 | <i>Astragalus hauarensis</i> |
| 2 | <i>Acacia tortilis sub sp. Raddiana</i> | 36 | <i>Astragalus schimperi</i> |
| 3 | <i>Adiantum capillus-veneris</i> | 37 | <i>Astragalus tenuirugis</i> |
| 4 | <i>Aeluropus lagopoides</i> | 38 | <i>Astragalus tribuloides</i> |
| 5 | <i>Aeluropus littoralis</i> | 39 | <i>Atracrylis flava</i> |
| 6 | <i>Aerva javanica</i> | 40 | <i>Atriplex halimus</i> |
| 7 | <i>Aizoon canariense</i> | 41 | <i>Atriplex leucoclada</i> |
| 8 | <i>Aizoon hispanicum</i> | 42 | <i>Avena sativa</i> |
| 9 | <i>Alhagi maurorum</i> | 43 | <i>Avicennia marina</i> |
| 10 | <i>Alternanthera sessilis</i> | 44 | <i>Bacopa monnieri</i> |
| 11 | <i>Althaea ludwigii</i> | 45 | <i>Bassia eriophora</i> |
| 12 | <i>Amaranthus graecizans</i> | 46 | <i>Bassia muricata</i> |
| 13 | <i>Amaranthus viridis</i> | 47 | <i>Beta vulgaris</i> |
| 14 | <i>Anabasis articulate</i> | 48 | <i>Bienertia cycloptera</i> |
| 15 | <i>Anabasis setifera</i> | 49 | <i>Brachypodium distachyom</i> |
| 16 | <i>Anagallis arvensis subsp. Arvensis</i> | 50 | <i>Brassica tournefortii</i> |
| 17 | <i>Anagallis arvensis subsp. caerulea</i> | 51 | <i>Bupleurum semicompositum</i> |
| 18 | <i>Anastatica hierochuntica</i> | 52 | <i>Calendula aegyptiaca</i> |
| 19 | <i>Andrachne telephioides</i> | 53 | <i>Calendula arvensis</i> |
| 20 | <i>Anethum graveolens</i> | 54 | <i>Calligonum comosum</i> |
| 21 | <i>Antirrhinum orontium</i> | 55 | <i>Calligonum polygonoides</i> |
| 22 | <i>Apium graveolens</i> | 56 | <i>Calotropis procera</i> |
| 23 | <i>Aristida abnormis</i> | 57 | <i>Capparis spinosa</i> |
| 24 | <i>Aristida adscensionis</i> | 58 | <i>Cassia italica</i> |
| 25 | <i>Arnebia decumbens</i> | 59 | <i>Cenchrus ciliaris</i> |
| 26 | <i>Arnebia hispidissima</i> | 60 | <i>Cenchrus echinatus</i> |
| 27 | <i>Arnebia linearifolia</i> | 61 | <i>Centaurium pulchellum</i> |
| 28 | <i>Arthrocnemum macrostachyum</i> | 62 | <i>Centropodia forskalii</i> |
| 29 | <i>Asphodelus tenuifolius</i> | 63 | <i>Chenopodium glaucum</i> |
| 30 | <i>Asphodelus viscidulus</i> | 64 | <i>Chenopodium murale</i> |
| 31 | <i>Aster squamatus</i> | 65 | <i>Chloris barbata</i> |
| 32 | <i>Astragalus annularis</i> | 66 | <i>Chloris gayana</i> |
| 33 | <i>Astragalus corrugates</i> | 67 | <i>Chrysopogon aucheri</i> |
| 34 | <i>Astragalus hamrinensis</i> | 68 | <i>Chrysopogon gayana</i> |

Table 1 List of Vascular Plants of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|------------------------------------|-----|--------------------------------|
| 69 | <i>Chrysopogon plumulosus</i> | 103 | <i>Digitaria ciliaris</i> |
| 70 | <i>Cistanche phelypaea</i> | 104 | <i>Digitaria sanguinalis</i> |
| 71 | <i>Cistanche tubulosa</i> | 105 | <i>Dipcadi erythraeum</i> |
| 72 | <i>Citrullus colocynthis</i> | 106 | <i>Dipcadi susianum</i> |
| 73 | <i>Cleome quinquenervia</i> | 107 | <i>Diplanthera uninervis</i> |
| 74 | <i>Convolvulus arvensis</i> | 108 | <i>Diploaxis harra</i> |
| 75 | <i>Convolvulus cantabrica</i> | 109 | <i>Echinochloa colona</i> |
| 76 | <i>Convolvulus deserti</i> | 110 | <i>Echiochilon kotschy</i> |
| 77 | <i>Convolvulus fatmensis</i> | 111 | <i>Eclipta alba</i> |
| 78 | <i>Convolvulus lanatus</i> | 112 | <i>Eleusine coracana</i> |
| 79 | <i>Convolvulus pilosellifolius</i> | 113 | <i>Emex spinosus</i> |
| 80 | <i>Convolvulus prostrates</i> | 114 | <i>Ephedra foliata</i> |
| 81 | <i>Corchorus depressus</i> | 115 | <i>Erodium glaucophyllum</i> |
| 82 | <i>cornulaca aucheri</i> | 116 | <i>Erodium laciniatum</i> |
| 83 | <i>Cornulaca monacantha</i> | 117 | <i>Erodium oxyrrhynchum</i> |
| 84 | <i>Cressa cretica</i> | 118 | <i>Eruca sativa</i> |
| 85 | <i>Cuscuta campestris</i> | 119 | <i>Erucaria hispanica</i> |
| 86 | <i>Cuscuta planiflora</i> | 120 | <i>Euphorbia densa</i> |
| 87 | <i>Cutandia dichotoma</i> | 121 | <i>Euphorbia granulata</i> |
| 88 | <i>Cutandia memphitica</i> | 122 | <i>Euphorbia peplus</i> |
| 89 | <i>Cymbopogon commutatus</i> | 123 | <i>Euphorbia serpens</i> |
| 90 | <i>Cymbopogon jwarancusa</i> | 124 | <i>Fagonia bruguieri</i> |
| 91 | <i>Cymbopogon schoenanthus</i> | 125 | <i>Fagonia indica</i> |
| 92 | <i>Cynodon dactylon</i> | 126 | <i>Fagonia kahirina</i> |
| 93 | <i>Cynomorium coccineum</i> | 127 | <i>Fagonia ovalifolia</i> |
| 94 | <i>Cyperus arenarius</i> | 128 | <i>Farsetia heliophila</i> |
| 95 | <i>Cyperus conglomeratus</i> | 129 | <i>Filago desertorum</i> |
| 96 | <i>Cyperus laevigatus</i> | 130 | <i>Fimbristylis ferruginea</i> |
| 97 | <i>Cyperus rotundus</i> | 131 | <i>Fimbristylis sieberana</i> |
| 98 | <i>Dactyloctenium aegyptium</i> | 132 | <i>Flaveria trinervia</i> |
| 99 | <i>Dactyloctenium scindicum</i> | 133 | <i>Frankenia pulverulenta</i> |
| 100 | <i>Datura fastuosa</i> | 134 | <i>Gastrocotyle hispida</i> |
| 101 | <i>Dichanthium annulatum</i> | 135 | <i>Glossonema varians</i> |
| 102 | <i>Dichanthium foveolatum</i> | 136 | <i>Halocnemum strobilaceum</i> |

Table 1 List of Vascular Plants of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|---------------------------------------|-----|------------------------------------|
| 137 | <i>Halodule wrightii</i> | 171 | <i>Launaea capitata</i> |
| 138 | <i>Halopeplis amplexicaulis</i> | 172 | <i>Launaea cassiniana</i> |
| 139 | <i>Halopeplis perfoliata</i> | 173 | <i>Launaea fragiles</i> |
| 140 | <i>Halophila ovalis</i> | 174 | <i>Launaea mucronata</i> |
| 141 | <i>Halophila stipulacea</i> | 175 | <i>Launaea nudicaulis</i> |
| 142 | <i>Halopyrum mucronatum</i> | 176 | <i>Launaea procumbens</i> |
| 143 | <i>Haloxylon persicum</i> | 177 | <i>Leptadenia pyrotechnica</i> |
| 144 | <i>Haloxylon salicornicum</i> | 178 | <i>Limonium axillare</i> |
| 145 | <i>Haplophyllum tuberculatum</i> | 179 | <i>Linum strictum</i> |
| 146 | <i>Helianthemum kahiricum</i> | 180 | <i>Lippia nodiflora</i> |
| 147 | <i>Helianthemum ledifolium</i> | 181 | <i>Lithospermum incrassatum</i> |
| 148 | <i>Helianthemum lippii</i> | 182 | <i>Loeflingia hispanica</i> |
| 149 | <i>Helianthemum salicifolium</i> | 183 | <i>Lolium perenne</i> |
| 150 | <i>Heliotropium crispum</i> | 184 | <i>Lolium rigidum</i> |
| 151 | <i>Heliotropium curassavicum</i> | 185 | <i>Lotus garcinii</i> |
| 152 | <i>Heliotropium europaeum</i> | 186 | <i>Lotus glinoides</i> |
| 153 | <i>Heliotropium kotschy</i> | 187 | <i>Lotus halophilus</i> |
| 154 | <i>Herniaria cinerea</i> | 188 | <i>Lycium shawii</i> |
| 155 | <i>Herniaria hemistemon</i> | 189 | <i>Malva aegyptiaca</i> |
| 156 | <i>Herniaria hirsute</i> | 190 | <i>Malva parviflora</i> |
| 157 | <i>Hippocrepis bicontorta</i> | 191 | <i>Matricaria auriculata</i> |
| 158 | <i>Hippocrepis unisiliquosa</i> | 192 | <i>Medicago laciniata</i> |
| 159 | <i>Hordeum murinum subsp. glaucum</i> | 193 | <i>Melilotus alba</i> |
| 160 | <i>Hordeum vulgare</i> | 194 | <i>Melilotus indica</i> |
| 161 | <i>Hyparrhenia hirta</i> | 195 | <i>Mesembryanthemum forsskalei</i> |
| 162 | <i>Hypocoum pendulum</i> | 196 | <i>Mesembryanthemum nodiflorum</i> |
| 163 | <i>Ifloga spicata</i> | 197 | <i>Misopates orontium</i> |
| 164 | <i>Imperata cylindrical</i> | 198 | <i>Moltkiopsis ciliata</i> |
| 165 | <i>Juncus acutus</i> | 199 | <i>Monosonia nivea</i> |
| 166 | <i>Juncus maritimus</i> | 200 | <i>Morettia parviflora</i> |
| 167 | <i>Juncus rigidus</i> | 201 | <i>Neurada procumbens</i> |
| 168 | <i>Koelpinia linearis</i> | 202 | <i>Ochradenus baccatus</i> |
| 169 | <i>Lactuca serriola</i> | 203 | <i>Ochthochloa compressa</i> |
| 170 | <i>Lasiurus scindicus</i> | 204 | <i>Ogastemma pusillum</i> |

Table 1 List of Vascular Plants of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|---|-----|----------------------------------|
| 205 | <i>Oligomeris linifolia</i> | 239 | <i>Polygonum patulum</i> |
| 206 | <i>Ononis reclinata</i> | 240 | <i>Polypogon monspeliensis</i> |
| 207 | <i>Ononis serrata</i> | 241 | <i>Portulaca oleracea</i> |
| 208 | <i>Ophioglossum aitchisoni</i> | 242 | <i>Portulaca quadrifida</i> |
| 209 | <i>Orobancha cernua</i> | 243 | <i>Prosopis farcta</i> |
| 210 | <i>Orobancha mutelii</i> | 244 | <i>Prosopis juliflora</i> |
| 211 | <i>Pandera pilsa</i> | 245 | <i>Ptergaillonia calycoptera</i> |
| 212 | <i>Panicum maximum</i> | 246 | <i>Pulicaria crispa</i> |
| 213 | <i>Panicum miliaceum</i> | 247 | <i>Pulicaria gnaphalodes</i> |
| 214 | <i>Panicum turgidum</i> | 248 | <i>Pulicaria undulata</i> |
| 215 | <i>Parapholis incurve</i> | 249 | <i>Raphanus raphanistrum</i> |
| 216 | <i>Paronychia Arabica</i> | 250 | <i>Raphanus sativus</i> |
| 217 | <i>Paspalum distichum</i> | 251 | <i>Reichardia tingitana</i> |
| 218 | <i>Paspalum vaginatum</i> | 252 | <i>Reseda muricata</i> |
| 219 | <i>Peganum harmala</i> | 253 | <i>Reseda stenostachya</i> |
| 220 | <i>Pennisetum ciliare</i> | 254 | <i>Rhanterium epapposum</i> |
| 221 | <i>Pennisetum divisum</i> | 255 | <i>Rostraria cristata</i> |
| 222 | <i>Pennisetum glaucum</i> | 256 | <i>Rostraria pumila</i> |
| 223 | <i>Pennisetum orientale</i> | 257 | <i>Rumex vesicarius</i> |
| 224 | <i>Phalaris minor</i> | 258 | <i>Salicornia europaea</i> |
| 225 | <i>Phoenix dactylifera</i> | 259 | <i>Salsola cyclophylla</i> |
| 226 | <i>Phragmites australis subsp. Altissimus</i> | 260 | <i>Salsola imbricata</i> |
| 227 | <i>Plantago albicans</i> | 261 | <i>Salsola vermiculata</i> |
| 228 | <i>Plantago boissieri</i> | 262 | <i>Salsola villosa</i> |
| 229 | <i>Plantago ciliate</i> | 263 | <i>Salvia aegyptiaca</i> |
| 230 | <i>Plantago coronopus</i> | 264 | <i>Samolus valerandi</i> |
| 231 | <i>Plantago notate</i> | 265 | <i>Savigyna parviflora</i> |
| 232 | <i>Plantago ovate</i> | 266 | <i>Schismus arabicus</i> |
| 233 | <i>Pluchea ovalis</i> | 267 | <i>Schismus barbatus</i> |
| 234 | <i>Poa infirma</i> | 268 | <i>Sclerocephalus arabicus</i> |
| 235 | <i>Polycarpaea repens</i> | 269 | <i>Scolymus maculatus</i> |
| 236 | <i>Polycarpaea spicata</i> | 270 | <i>Scrophularia deserti</i> |
| 237 | <i>Polycarpon arabicum</i> | 271 | <i>Sececio glaucus</i> |
| 238 | <i>Polycarpon spicata</i> | 272 | <i>Seetzenia lanata</i> |

Table 1 List of Vascular Plants of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|--------------------------------|-----|-------------------------------|
| 273 | <i>Seidlitzia rosmarinus</i> | 301 | <i>Suaeda maritime</i> |
| 274 | <i>Senecio coronopifolius</i> | 302 | <i>Suaeda vermiculata</i> |
| 275 | <i>Sericostoma persicum</i> | 303 | <i>Tamarix aphylla</i> |
| 276 | <i>Sesbania sesban</i> | 304 | <i>Tamarix senegalensis</i> |
| 277 | <i>Sesuvium sesuvioides</i> | 305 | <i>Tamarix macrocarpa</i> |
| 278 | <i>Sesuvium verrucosum</i> | 306 | <i>Tamarix pycnocarpa</i> |
| 279 | <i>Setaria verticillata</i> | 307 | <i>Taverniera aegyptiaca</i> |
| 280 | <i>Setaria viridis</i> | 308 | <i>Taverniera spartea</i> |
| 281 | <i>Silene Arabica</i> | 309 | <i>Tetrapogon villosus</i> |
| 282 | <i>Silene villosa</i> | 310 | <i>Teucrium polium</i> |
| 283 | <i>Sisymbrium irio</i> | 311 | <i>Trachomitum venetum</i> |
| 284 | <i>Solanum nigrum</i> | 312 | <i>Trachynia distachya</i> |
| 285 | <i>sonchus asper</i> | 313 | <i>Tribulus bimucronatus</i> |
| 286 | <i>Sonchus oleraceus</i> | 314 | <i>Tribulus pentandrus</i> |
| 287 | <i>Spergula fallax</i> | 315 | <i>Tricholaena teneriffae</i> |
| 288 | <i>Spergularia bocconii</i> | 316 | <i>Trigonella anguina</i> |
| 289 | <i>Spergularia diandra</i> | 317 | <i>Trigonella hamosa</i> |
| 290 | <i>Spergularia marina</i> | 318 | <i>Trigonella stellata</i> |
| 291 | <i>Spergularia salina</i> | 319 | <i>Typha domingensis</i> |
| 292 | <i>Sphaerocoma aucheri</i> | 320 | <i>Urospermum picroides</i> |
| 293 | <i>Sphenopus divaricatus</i> | 321 | <i>Vicia monantha</i> |
| 294 | <i>Sporobolus ioclados</i> | 322 | <i>Vicoa pentanema</i> |
| 295 | <i>Sporobolus spicatus</i> | 323 | <i>Withania somnifera</i> |
| 296 | <i>Stenotaphrum secundatum</i> | 324 | <i>Ziziphus nummularia</i> |
| 297 | <i>Stipa capensis</i> | 325 | <i>Ziziphus spina-christi</i> |
| 298 | <i>Stipagrostis plumose</i> | 326 | <i>Zygophyllum qatarense</i> |
| 299 | <i>Stipagrostis sokotrana</i> | 327 | <i>Zygophyllum simplex</i> |
| 300 | <i>Suaeda aegyptiaca</i> | | |

4.1.2 Algae:

A checklist of benthic marine algae of Bahrain (Basson et al., 1989) reported the presence of 88 species, 57 genera, and 31 families. At the time when the checklist was prepared, the authors found that 13 species were new records for the Arabian Gulf. These are marked with (*) in Table 2.

Table 2 List of Benthic Marine Algae of Bahrain.

| No. | Scientific Name | No. | Scientific Name |
|-----|---|-----|----------------------------------|
| 1 | <i>Acanthophora spicifera</i> | 26 | <i>Ceramium cruciatum</i> |
| 2 | <i>Anotrichium tenue</i> | 27 | <i>Ceramium fastigatum</i> |
| 3 | <i>Avrainvillea amadelpha</i> | 28 | <i>Ceramium luetzelbergii</i> |
| 4 | <i>Avarinvillea riukuensis</i> * | 29 | <i>Ceramium transversale</i> |
| 5 | <i>Acetabularia calyculus</i> | 30 | <i>Crounia attenuata</i> * |
| 6 | <i>Anacystis aeruginosa</i> * | 31 | <i>Chondria cornuta</i> * |
| 7 | <i>Anabaina oscillarioides</i> * | 32 | <i>Chondria dasyphylla</i> |
| 8 | <i>Achrochaetium bahreinii</i> | 33 | <i>Dictyota divaricata</i> |
| 9 | <i>Chaetomorpha aerea</i> | 34 | <i>Dictyosphaeria cavernosa</i> |
| 10 | <i>Chaetomorpha capillaries</i> | 35 | <i>Dasya pedicellata</i> |
| 11 | <i>Chaetomorpha linum</i> | 36 | <i>Digneia simplex</i> |
| 12 | <i>Cladophora koiei</i> | 37 | <i>Enteromorpha clathrata</i> |
| 13 | <i>Cladophora nitellopsis</i> | 38 | <i>Enteromorpha flexuosa</i> |
| 14 | <i>Cladophora sericioides</i> | 39 | <i>Enteromorpha intesinalis</i> |
| 15 | <i>Cladophoopsis zollingeri</i> | 40 | <i>Ectocarpus cryptophilus</i> |
| 16 | <i>Caulerpa sertularioides</i> | 41 | <i>Entophysalis conferta</i> |
| 17 | <i>Caulerpa sertularioides</i> forma farlowii | 42 | <i>Erythrocladia irregularis</i> |
| 18 | <i>Colpomenia sinuosa</i> | 43 | <i>Erythrotrichia carnea</i> |
| 19 | <i>Cystoseira myrica</i> | 44 | <i>Eupogodon pilosus</i> |
| 20 | <i>Cystoseira trinodis</i> | 45 | <i>Fosliella farinose</i> |
| 21 | <i>Calothrix crustacean</i> | 46 | <i>Gomphosphaeria aponina</i> * |
| 22 | <i>Chroodactylon ornatum</i> | 47 | <i>Gelidiella acerosa</i> |
| 23 | <i>Champia globulifera</i> | 48 | <i>Hydroclathrus clathratus</i> |
| 24 | <i>Centrocerus clavulatum</i> | 49 | <i>Hormophysa cueniformis</i> |
| 25 | <i>Ceramium codii</i> * | 50 | <i>Hypnea cornuta</i> |

Table 2 List of Benthic Marine Algae of Bahrain.

| No. | Scientific Name | No. | Scientific Name |
|-----|--------------------------------------|-----|---|
| 51 | <i>Hypnea valentiae</i> | 70 | <i>Padina gymnospora</i> |
| 52 | <i>Herposiphonia secunda</i> | 71 | <i>Rhizoclonium kernerii</i> |
| 53 | <i>Johannesbaptistia pellucida</i> * | 72 | <i>Rhizoclonium kochianum</i> |
| 54 | <i>Jania pumila</i> | 73 | <i>Sphacelaria furcigera</i> |
| 55 | <i>Jania rubens</i> | 74 | <i>Sphacelaria tribuloides</i> |
| 56 | <i>Lobophora variegata</i> | 75 | <i>Sarconema filiforme</i> * |
| 57 | <i>Liagora ceranoides</i> * | 76 | <i>Sargassum boveanum</i> |
| 58 | <i>Laurencia glandulifera</i> | 77 | <i>Sargassum cervicorne</i> |
| 59 | <i>Laurentia papillosa</i> | 78 | <i>Sargassum heteromorphum</i> |
| 60 | <i>Leveillea jungermannoides</i> | 79 | <i>Sargassum latifolium</i> |
| 61 | <i>Myriactula Arabica</i> | 80 | <i>Schizothrix calcicola</i> |
| 62 | <i>Microcoleus lyngbyacus</i> | 81 | <i>Schizothrix Mexicana</i> * |
| 63 | <i>Microcoleus vaginatus</i> * | 82 | <i>Schizothrix tenerrima</i> |
| 64 | <i>Nemacystus decipiens</i> | 83 | <i>Spirulina subsala</i> |
| 65 | <i>Porphyrosiphon notarisii</i> | 84 | <i>Spyridia filamentosa</i> |
| 66 | <i>Polysiphonia crassicollis</i> | 85 | <i>Spyridia filamentosa</i> forma gracile |
| 67 | <i>Polysiphonia kampsaxii</i> | 86 | <i>Ulva lactuca</i> |
| 68 | <i>Poysiphonia scopulorum</i> | 87 | <i>Ulva reticulata</i> * |
| 69 | <i>Polysiphonia variegata</i> | 88 | <i>Valonia utricularis</i> |

4.1.3. Fungi:

The only preliminary list of fungi in Bahrain was prepared by Mandeel et al. (1995) and it was focused on the genus *Fusarium*. A total of 12 species were reported (Table 3).

Table 3 List of Fungi species Mammals of Bahrain

| |
|--------------------------|
| Family: Nectriaceae |
| Genus: <i>Fusarium</i> |
| <i>F. oxysporum</i> |
| <i>F. solani</i> |
| <i>F. tricinctum</i> |
| <i>F. equiseti</i> |
| <i>F. sambucinum</i> |
| <i>F. pallidroseum</i> |
| <i>F. chlamydosporum</i> |
| <i>F. compactum</i> |
| <i>F. reticulatum</i> |
| <i>F. nivale</i> |
| <i>F. lateritium</i> |
| <i>F. moniliforme</i> |

4.2 FAUNA

4.2.1 Mammals:

In comparison to mainland Arabia, there are only 23 mammalian species in Bahrain belonging to 19 genera and 15 families (Ghallager and Harisson, 1974), 4 of which are marine species including the important dugong (Table 4).



Photo 2. Dugong grazing on seagrass (Source: <https://blogozoic.wordpress.com/>)

Table 4 List of Mammals of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|------------------------------------|-----|-----------------------------------|
| 1 | <i>Gazella subgutturosa</i> | 13 | <i>Meriones crassus crassus</i> |
| 2 | <i>Gazella subgutturosa marica</i> | 14 | <i>Jaculus jaculus</i> |
| 3 | <i>Oryx leucoryx</i> | 15 | <i>Pipistrellus kuhlii</i> |
| 4 | <i>Lepus capensis arabicus</i> | 16 | <i>Pipistrellus rueppelli</i> |
| 5 | <i>Lepus capensis atallahi</i> | 17 | <i>Taphozous nudiventris</i> |
| 6 | <i>Hemiechinus auritus</i> | 18 | <i>Asellia tridens</i> |
| 7 | <i>Paraechinus aethiopicus</i> | 19 | <i>Camelus dromedarius</i> |
| 8 | <i>Herpestes edwardsi</i> | 20 | <i>Megaptera novaeangliae</i> |
| 9 | <i>Suncus murinus</i> | 21 | <i>Delphinus delphis</i> |
| 10 | <i>Rattus rattus</i> | 22 | <i>Tursiops truncatus aduncus</i> |
| 11 | <i>Rattus norvegicus</i> | 23 | <i>Dugong dugon</i> |
| 12 | <i>Mus musculus</i> | | |

4.2.2 Birds:

There are 329 bird species reported in Bahrain (Nightingale and Hill, 1993; Abdulla, 2008; Kavangh (2014). belonging to 149 genera and 63 families (Table 5). They are categorized into 5 groups (Abdulla, 2008):

- Resident birds, examples: white-cheeked bulbul (*Pycnonotus leucogeny*), crested lark (*Galerida cristata*).
- Passing birds, examples: *Merops apiaster*, *Coracias garrulous*.
- Wintering birds, examples: *Bubulcus ibis*, *Anas acuta*.
- Breeding birds, examples: *Falco concolor*, *Phalacrocorax nigrogularis*.
- Introduced birds, examples: *Acridotheres tristis*, *Corvus splendens*.



Photo 3. White-cheeked bulbul (Source: Jameel Alkhuzai)

Table 5 List of Birds of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|-----------------------------------|-----|----------------------------------|
| 1 | <i>Accipiter nisus</i> | 35 | <i>Apus melba</i> |
| 2 | <i>Acridotheres tristis</i> | 36 | <i>Apus pallidus</i> |
| 3 | <i>Acrocephalus Agricola</i> | 37 | <i>Aquila clanga</i> |
| 4 | <i>Acrocephalus arundinaceus</i> | 38 | <i>Aquila nipalensis</i> |
| 5 | <i>Acrocephalus dumetorum</i> | 39 | <i>Ardea cinerea</i> |
| 6 | <i>Acrocephalus melanopogon</i> | 40 | <i>Ardea purpurea</i> |
| 7 | <i>Acrocephalus palustris</i> | 41 | <i>Ardeola ralloides</i> |
| 8 | <i>Acrocephalus schoenobaenus</i> | 42 | <i>Arenaria interpres</i> |
| 9 | <i>Acrocephalus scirpaceus</i> | 43 | <i>Asio flammeus</i> |
| 10 | <i>Acrocephalus stentoreus</i> | 44 | <i>Athene noctua</i> |
| 11 | <i>Actitis hypoleucos</i> | 45 | <i>Aythya farina</i> |
| 12 | <i>Alaemon alaudipes</i> | 46 | <i>Aythya fuligula</i> |
| 13 | <i>Alauda arvensis</i> | 47 | <i>Aythya nyroca</i> |
| 14 | <i>Alauda gulgula</i> | 48 | <i>Botaurus stellaris</i> |
| 15 | <i>Alcedo atthis</i> | 49 | <i>Bubo bubo</i> |
| 16 | <i>Amandava amandava</i> | 50 | <i>Bubulcus ibis</i> |
| 17 | <i>Ammomanes cinctures</i> | 51 | <i>Bucanetes githagineus</i> |
| 18 | <i>Ammomanes deserti</i> | 52 | <i>Bucanetes mongolicus</i> |
| 19 | <i>Anas acuta</i> | 53 | <i>Burhinus oedicnemus</i> |
| 20 | <i>Anas clypeata</i> | 54 | <i>Buteo buteo</i> |
| 21 | <i>Anas crecca</i> | 55 | <i>Buteo rufinus</i> |
| 22 | <i>Anas Penelope</i> | 56 | <i>Butorides striatus</i> |
| 23 | <i>Anas platyrhynchos</i> | 57 | <i>Calandrella brachydactyla</i> |
| 24 | <i>Anas querquedula</i> | 58 | <i>Calandrella rufescens</i> |
| 25 | <i>Anas strepera</i> | 59 | <i>Calidris alba</i> |
| 26 | <i>Anser anser</i> | 60 | <i>Calidris alpina</i> |
| 27 | <i>Anthus campestris</i> | 61 | <i>Calidris ferruginea</i> |
| 28 | <i>Anthus cervinus</i> | 62 | <i>Calidris minuta</i> |
| 29 | <i>Anthus novaeseelandiae</i> | 63 | <i>Calidris subminuta</i> |
| 30 | <i>Anthus pratensis</i> | 64 | <i>Calidris temminckii</i> |
| 31 | <i>Anthus spinoletta</i> | 65 | <i>Calidris tenuirostris</i> |
| 32 | <i>Anthus trivialis</i> | 66 | <i>Caprimulgus aegyptius</i> |
| 33 | <i>Apus affinis</i> | 67 | <i>Caprimulgus europaeus</i> |
| 34 | <i>Apus apus</i> | 68 | <i>Carduelis carduelis</i> |

Table 5 List of Birds of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|---------------------------------|-----|----------------------------------|
| 69 | <i>Carduelis spinus</i> | 103 | <i>Cuculus canorus</i> |
| 70 | <i>Carpodacus erythrinus</i> | 104 | <i>Cursorius cursor</i> |
| 71 | <i>Carpospiza brachydactyla</i> | 105 | <i>Cygnus columbianus</i> |
| 72 | <i>Cercotrichas galactotes</i> | 106 | <i>Cygnus olor</i> |
| 73 | <i>Cercotrichas podobe</i> | 107 | <i>Delichon urbica</i> |
| 74 | <i>Ceryle rudis</i> | 108 | <i>Dromas ardeola</i> |
| 75 | <i>Charadrius alexandrinus</i> | 109 | <i>Egretta alba</i> |
| 76 | <i>Charadrius asiaticus</i> | 110 | <i>Egretta garzetta</i> |
| 77 | <i>Charadrius dubius</i> | 111 | <i>Egretta gularis</i> |
| 78 | <i>Charadrius hiaticula</i> | 112 | <i>Emberiza aureola</i> |
| 79 | <i>Charadrius leschenaultia</i> | 113 | <i>Emberiza cineracea</i> |
| 80 | <i>Charadrius mongolus</i> | 114 | <i>Emberiza hortulana</i> |
| 81 | <i>Charadrius morinellus</i> | 115 | <i>Emberiza melanocephala</i> |
| 82 | <i>Charadrius pecuarius</i> | 116 | <i>Emberiza schoeniclus</i> |
| 83 | <i>Chettusia gregaria</i> | 117 | <i>Eremopterix nigriceps</i> |
| 84 | <i>Chettusia leucura</i> | 118 | <i>Erithacus rubecula</i> |
| 85 | <i>Chlamydotis undulate</i> | 119 | <i>Euodice malabarica</i> |
| 86 | <i>Chlidonias hybridus</i> | 120 | <i>Falco biarmicus</i> |
| 87 | <i>Chlidonias leucopterus</i> | 121 | <i>Falco cherrug</i> |
| 88 | <i>Chlidonias niger</i> | 122 | <i>Falco columbarius</i> |
| 89 | <i>Ciconia ciconia</i> | 123 | <i>Falco concolor</i> |
| 90 | <i>Circaetus gallicus</i> | 124 | <i>Falco naumanni</i> |
| 91 | <i>Circus aeruginosus</i> | 125 | <i>Falco peregrinus</i> |
| 92 | <i>Circus cyaneus</i> | 126 | <i>Falco subbuteo</i> |
| 93 | <i>Circus macrourus</i> | 127 | <i>Falco tinnunculus</i> |
| 94 | <i>Circus pygargus</i> | 128 | <i>Ficedula albicollis</i> |
| 95 | <i>Clamator glandarius</i> | 129 | <i>Ficedula parva</i> |
| 96 | <i>Columba livia</i> | 130 | <i>Ficedula semitorquata</i> |
| 97 | <i>Coracias bengalensis</i> | 131 | <i>Francolinus pondicerianus</i> |
| 98 | <i>Coracias garrulous</i> | 132 | <i>Fringilla coelebs</i> |
| 99 | <i>Corvus ruficollis</i> | 133 | <i>Fringilla montifringilla</i> |
| 100 | <i>Corvus splendens</i> | 134 | <i>Fulica atra</i> |
| 101 | <i>Coturnix coturnix</i> | 135 | <i>Galerida cristata</i> |
| 102 | <i>Crex crex</i> | 136 | <i>Gallinago gallinago</i> |

Table 5 List of Birds of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|--|-----|-------------------------------------|
| 137 | <i>Gallinago media</i> | 171 | <i>Larus genei</i> |
| 138 | <i>Gallinago stenura</i> | 172 | <i>Larus hemprichii</i> |
| 139 | <i>Gallinula chloropus</i> | 173 | <i>Larus ichthyaetus</i> |
| 140 | <i>Gelochelidon nilotica</i> | 174 | <i>Larus minutus</i> |
| 141 | <i>Glareola lacteal</i> | 175 | <i>Larus ridibundus</i> |
| 142 | <i>Glareola pratincola</i> | 176 | <i>Limicola falcinellus</i> |
| 143 | <i>Glareola nordmanni</i> | 177 | <i>Limosa lapponica</i> |
| 144 | <i>Grus grus</i> | 178 | <i>Limosa limosa</i> |
| 145 | <i>Haematopus ostralegus</i> | 179 | <i>Locustella fluviatilis</i> |
| 146 | <i>Hieraaetus pennatus</i> | 180 | <i>Locustella lusciniodes</i> |
| 147 | <i>Himantopus himantopus</i> | 181 | <i>Locustella naevia</i> |
| 148 | <i>Hippolais icterina</i> | 182 | <i>Lonchura(Euodice) malabarica</i> |
| 149 | <i>Hippolais languid</i> | 183 | <i>Lonchura malacca</i> |
| 150 | <i>Hippolais pallid</i> | 184 | <i>Lullula arborea</i> |
| 151 | <i>Hirundo daurica</i> | 185 | <i>Luscinia luscinia</i> |
| 152 | <i>Hirundo rustica</i> | 186 | <i>Luscinia megarhynchos</i> |
| 153 | <i>Hirundo(Ptyonoprogne) rupestris</i> | 187 | <i>Luscinia svecica</i> |
| 154 | <i>Hoplopterus indicus</i> | 188 | <i>Lymnocyptes minimus</i> |
| 155 | <i>Hoplopterus spinosus</i> | 189 | <i>Marmaronetta angustirostris</i> |
| 156 | <i>Hypocolius ampelinus</i> | 190 | <i>Melanocorypha bimaculata</i> |
| 157 | <i>Irania gutturalis</i> | 191 | <i>Melanocorypha calandra</i> |
| 158 | <i>Ixobrychus minutes</i> | 192 | <i>Mergus serrator</i> |
| 159 | <i>Jynx torquilla</i> | 193 | <i>Merops apiaster</i> |
| 160 | <i>Lanius collurio</i> | 194 | <i>Merops orientalis</i> |
| 161 | <i>Lanius excubitor</i> | 195 | <i>Merops superciliosus</i> |
| 162 | <i>Lanius isabellinus</i> | 196 | <i>Miliaria calandra</i> |
| 163 | <i>Lanius minor</i> | 197 | <i>Milvus migrans</i> |
| 164 | <i>Lanius nubicus</i> | 198 | <i>Monticola saxatilis</i> |
| 165 | <i>Lanius senator</i> | 199 | <i>Monticola solitarius</i> |
| 166 | <i>Larus argentatus</i> | 200 | <i>Motacilla alba</i> |
| 167 | <i>Larus armenicus</i> | 201 | <i>Motacilla cinerea</i> |
| 168 | <i>Larus cachinnans</i> | 202 | <i>Motacilla citreola</i> |
| 169 | <i>Larus canus</i> | 203 | <i>Motacilla flava</i> |
| 170 | <i>Larus fuscus</i> | 204 | <i>Muscicapa striata</i> |

Table 5 List of Birds of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|-----------------------------------|-----|----------------------------------|
| 205 | <i>Netta rufina</i> | 239 | <i>Phoenicurus ochruros</i> |
| 206 | <i>Nettapus coromandelianus</i> | 240 | <i>Phoenicurus phoenicurus</i> |
| 207 | <i>Numenius arquata</i> | 241 | <i>Phylloscopus collybita</i> |
| 208 | <i>Numenius phaeopus</i> | 242 | <i>Phylloscopus inornatus</i> |
| 209 | <i>Nycticorax nycticorax</i> | 243 | <i>Phylloscopus neglectus</i> |
| 210 | <i>Oena capensis</i> | 244 | <i>Phylloscopus sibilatrix</i> |
| 211 | <i>Oenanthe alboniger</i> | 245 | <i>Phylloscopus trochiloides</i> |
| 212 | <i>Oenanthe deserti</i> | 246 | <i>Phylloscopus trochilus</i> |
| 213 | <i>Oenanthe finschii</i> | 247 | <i>Platalea leucorodia</i> |
| 214 | <i>Oenanthe hispanica</i> | 248 | <i>Plegadis falcinellus</i> |
| 215 | <i>Oenanthe isabellina</i> | 249 | <i>Ploceus benghalensis</i> |
| 216 | <i>Oenanthe leucopyga</i> | 250 | <i>Ploceus manyar</i> |
| 217 | <i>Oenanthe lugens</i> | 251 | <i>Ploceus philippinus</i> |
| 218 | <i>Oenanthe monacha</i> | 252 | <i>Pluvialis apricaria</i> |
| 219 | <i>Oenanthe oenanthe</i> | 253 | <i>Pluvialis fulva</i> |
| 220 | <i>Oenanthe pleschanka</i> | 254 | <i>Pluvialis squatarola</i> |
| 221 | <i>Oenanthe xanthopyrma</i> | 255 | <i>Podiceps cistatus</i> |
| 222 | <i>Oriolus oriolus</i> | 256 | <i>Podiceps nigricollis</i> |
| 223 | <i>Otus brucei</i> | 257 | <i>Prozana parva</i> |
| 224 | <i>Otus scops</i> | 258 | <i>Prozana prozana</i> |
| 225 | <i>Pandion haliaetus</i> | 259 | <i>Prozana pusilla</i> |
| 226 | <i>Passer domesticus</i> | 260 | <i>Prinia gracilis</i> |
| 227 | <i>Passer hispaniolensis</i> | 261 | <i>Psittacula eupatria</i> |
| 228 | <i>Passer moabiticus</i> | 262 | <i>Psittacula krameri</i> |
| 229 | <i>Pelecanus onocrotalus</i> | 263 | <i>Pterocles orientalis</i> |
| 230 | <i>Pernis apivorus</i> | 264 | <i>Ptyonoprogne rupestris</i> |
| 231 | <i>Petronia brachydactyla</i> | 265 | <i>Pycnonotus cafer</i> |
| 232 | <i>Petronia xanthocollis</i> | 266 | <i>Pycnonotus leucogenys</i> |
| 233 | <i>Phalacrocorax carbo</i> | 267 | <i>Rallus aquaticus</i> |
| 234 | <i>Phalacrocorax nigrogularis</i> | 268 | <i>Recurvirostra avosetta</i> |
| 235 | <i>Phalaropus lobatus</i> | 269 | <i>Remiz pendulinus</i> |
| 236 | <i>Philomachus pugnax</i> | 270 | <i>Bucanetes githagineus</i> |
| 237 | <i>Phoenicopiterus ruber</i> | 271 | <i>Bucanetes mongolicus</i> |
| 238 | <i>Phoenicurus erythronotus</i> | 272 | <i>Riparia riparia</i> |

Table 5 List of Birds of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|----------------------------------|-----|---------------------------------|
| 273 | <i>Saxicola rubetra</i> | 302 | <i>Sylvia minula jaxartica</i> |
| 274 | <i>Saxicola torquata</i> | 303 | <i>Sylvia mystacea</i> |
| 275 | <i>Scolopax rusticola</i> | 304 | <i>Sylvia nana</i> |
| 276 | <i>Stercorarius parasiticus</i> | 305 | <i>Sylvia nisoria</i> |
| 277 | <i>Stercorarius pomarinus</i> | 306 | <i>Tachybaptus ruficollis</i> |
| 278 | <i>Sterna albifrons</i> | 307 | <i>Tachymarptis(Apus) melba</i> |
| 279 | <i>Sterna anaethetus</i> | 308 | <i>Tadorna ferruginea</i> |
| 280 | <i>Sterna bengalensis</i> | 309 | <i>Tadorna tadorna</i> |
| 281 | <i>Sterna bergii</i> | 310 | <i>Tringa erythropus</i> |
| 282 | <i>Sterna caspia</i> | 311 | <i>Tringa glareola</i> |
| 283 | <i>Sterna dougallii</i> | 312 | <i>Actitis hypoleucos</i> |
| 284 | <i>Sterna fuscata</i> | 313 | <i>Tringa nebularia</i> |
| 285 | <i>Sterna hirundo</i> | 314 | <i>Tringa ochropus</i> |
| 286 | <i>Sterna repressa</i> | 315 | <i>Tringa stagnatilis</i> |
| 287 | <i>Sterna sandvicensis</i> | 316 | <i>Tringa totanus</i> |
| 288 | <i>Sterna saundersi</i> | 317 | <i>Turdus iliacus</i> |
| 289 | <i>Sterna nilotica</i> | 318 | <i>Turdus merula</i> |
| 290 | <i>Streptopelia decaocto</i> | 319 | <i>Turdus philomelos</i> |
| 291 | <i>Streptopelia roseogrisea</i> | 320 | <i>Turdus pilaris</i> |
| 292 | <i>Streptopelia senegalensis</i> | 321 | <i>Turdus ruficollis</i> |
| 293 | <i>Streptopelia turtur</i> | 322 | <i>Turdus torquatus</i> |
| 294 | <i>Sturnus roseus</i> | 323 | <i>Turdus viscivorus</i> |
| 295 | <i>Sturnus vulgaris</i> | 324 | <i>Tyto alba</i> |
| 296 | <i>Sylvia althaea</i> | 325 | <i>Upupa epops</i> |
| 297 | <i>Sylvia atricapilla</i> | 326 | <i>Chettusia gregaria</i> |
| 298 | <i>Sylvia borin</i> | 327 | <i>Chettusia leucura</i> |
| 299 | <i>Sylvia communis</i> | 328 | <i>Vanellus vanellus</i> |
| 300 | <i>Sylvia curruca</i> | 329 | <i>Xenus cinereus</i> |
| 301 | <i>Sylvia hortensis</i> | | |

4.2.3 Reptiles:

A total of 20 reptile species belonging to 19 genera and 12 families are reported from Bahrain (BNHS, 1990; Abdulla, 2008). Most are living in the desert. They belong to snakes, lizards, and turtles (Table 6). The main desert reptiles in Bahrain are the spiny tailed lizard (*Uromastyx microlepis*) and sand snake (*Psammophis schokari*). Agricultural

habitat species include garden lizard (*Mabuya aurata*) and the Caspian turtle (*Mauremys caspia*). The latter is the only freshwater reptile in Bahrain and it is probably distinct.



Photo 4. Spiny-tailed lizard (Source: <http://www.hawar-islands.com/>)

Table 6 List of Reptiles and Amphibians of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|----------------------------------|-----|------------------------------------|
| 1 | <i>Uromastyx microlepis</i> | 12 | <i>Eryx jayakari</i> |
| 2 | <i>Hemidactylus flaviviridis</i> | 13 | <i>Mabuya aurata septemaeniata</i> |
| 3 | <i>Hemidactylus persicus</i> | 14 | <i>Sincus conirostris</i> |
| 4 | <i>Bunopus spatulurus</i> | 15 | <i>Chelonia mydas</i> |
| 5 | <i>Cyrodactylus scaber</i> | 16 | <i>Caretta caretta</i> |
| 6 | <i>Pristurus rupestris</i> | 17 | <i>Eretmochelys imbricata</i> |
| 7 | <i>Stenodactylus arabicus</i> | 18 | <i>Hydrophis cyanocinctus</i> |
| 8 | <i>Psammophis schokari</i> | 19 | <i>Pelamis platurus</i> |
| 9 | <i>Eremias brevisrostris</i> | 20 | <i>Mauremys caspia</i> |
| 10 | <i>Coluber ventromaculata</i> | 21 | <i>Rana ridibunda</i> |
| 11 | <i>Agama jayakari</i> | | |

4.2.4 Amphibians:

There is one record of amphibians in Bahrain (BNHS, 1990), the freshwater frog (*Rana ridibunda*). The number of this species is declining sharply. This is found in the water

channels and streams in the agricultural habitats which are exposed to a very high level of degradation.



Photo 5. Freshwater frog: *Rana ridibunda* (Source: Jameel Alkhuzai).

4.2.5 Fishes:

Bahrain has a rich fish life. There are more than 250 species of fishes in the waters of Bahrain (Al-Baharna, 1986; Moore and Perice, 2013 Moore and Pierce, 2013) belonging to 176 genera and 78 families (Table 7). Some of which have not been seen for a number of years in the market (e.g. the streaked rabbit fish, *Siganus javus*). Possible reasons for their disappearance could be the loss of their habitats due to dredging and construction of development projects.



Fig. 6 Streaked rabbit fish (Source: www.mbahrain.net/)

Table 7 List of Fishes of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|----------------------------------|-----|-----------------------------------|
| 1 | <i>Abalistes stellaris</i> | 35 | <i>Bothus pantherinus</i> |
| 2 | <i>Ablennes hians</i> | 36 | <i>Caesio sp</i> |
| 3 | <i>Abudefduf saxatilis</i> | 37 | <i>Callionymus persicus</i> |
| 4 | <i>Acanthopagrus berda</i> | 38 | <i>Carangoides bajad</i> |
| 5 | <i>Acanthopagrus bifasciatus</i> | 39 | <i>Carangoides chrysophrys</i> |
| 6 | <i>Acanthurus sohal</i> | 40 | <i>Carangoides ferdau</i> |
| 7 | <i>Acropoma japonicum</i> | 41 | <i>Carangoides malabaricus</i> |
| 8 | <i>Aesopia cornuta</i> | 42 | <i>Caranx sexfasciatus</i> |
| 9 | <i>Aethaloperca rogaa</i> | 43 | <i>carcharhinus amblyrhynchos</i> |
| 10 | <i>Aetobatus narinari</i> | 44 | <i>Carcharhinus amboinensis</i> |
| 11 | <i>Aetomylaeus cf. milvus</i> | 45 | <i>Carcharhinus brevipinna</i> |
| 12 | <i>Aetomyleus nichofii</i> | 46 | <i>Carcharhinus dussumieri</i> |
| 13 | <i>Alectis indicus</i> | 47 | <i>Carcharhinus limbatus</i> |
| 14 | <i>Alepes djedaba</i> | 48 | <i>Carcharhinus macloti</i> |
| 15 | <i>Alepes melanoptera</i> | 49 | <i>Carcharhinus melanopterus</i> |
| 16 | <i>Alutera monoceros</i> | 50 | <i>Carcharhinus sorrah</i> |
| 17 | <i>Amblygobius albimaculatus</i> | 51 | <i>Centriscus scutatus</i> |
| 18 | <i>Amphiprion clarkia</i> | 52 | <i>Cephalopholis hemistiktos</i> |
| 19 | <i>Anthias conspicuous</i> | 53 | <i>Chaetodon melapterus</i> |
| 20 | <i>Aphanius dispar</i> | 54 | <i>Chaetodon nigropunctatus</i> |
| 21 | <i>Apistus carinatus</i> | 55 | <i>Chanos chanos</i> |
| 22 | <i>Apogon aureus</i> | 56 | <i>Chaenogaleus macrostoma</i> |
| 23 | <i>Apogon bifasciatus</i> | 57 | <i>Cheilinus lunulatus</i> |
| 24 | <i>Apogon cyanosoma</i> | 58 | <i>Cheilodipterus arabicus</i> |
| 25 | <i>Apogon quadrifasciatus</i> | 59 | <i>Cheimerius nufar</i> |
| 26 | <i>Apogon taeniatus</i> | 60 | <i>Chelonodon patoca</i> |
| 27 | <i>Argyrops spinifer</i> | 61 | <i>Chilomycterus orbicularis</i> |
| 28 | <i>Ariomma indica</i> | 62 | <i>Chiloscyllium arabicum</i> |
| 29 | <i>Arius thalassinus</i> | 63 | <i>Chirocentrus nudus</i> |
| 30 | <i>Arothron stellatus</i> | 64 | <i>Choerodon robustus</i> |
| 31 | <i>Atherinomorus lacunosus</i> | 65 | <i>Choridactylus multibarbus</i> |
| 32 | <i>Atropus atropos</i> | 66 | <i>Crenidens crenidens</i> |
| 33 | <i>Atule mate</i> | 67 | <i>Cryptocentrus lutheri</i> |
| 34 | <i>Batrachus grunniens</i> | 68 | <i>Cypselurus oligolepis</i> |

Table 7 List of Fishes of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|--------------------------------------|-----|----------------------------------|
| 69 | <i>Dactyloptena orientalis</i> | 103 | <i>Hemipristis elongata</i> |
| 70 | <i>Dascyllus trimaculatus</i> | 104 | <i>Heniochus acuminatus</i> |
| 71 | <i>Dasyatis sephen</i> | 105 | <i>Himantura uarnak</i> |
| 72 | <i>Diagramma pictum</i> | 106 | <i>Hippocampus kuda</i> |
| 73 | <i>Diplodus sargus kotschyi</i> | 107 | <i>Ilisha melastoma</i> |
| 74 | <i>Drepane punctata</i> | 108 | <i>Istigobius ornatus</i> |
| 75 | <i>Dussumieria acuta</i> | 109 | <i>Istiophorus platypterus</i> |
| 76 | <i>Echeneis naucrates</i> | 110 | <i>Labroides dimidiatus</i> |
| 77 | <i>Ecsenius pulcher</i> | 111 | <i>Leiognathus bindus</i> |
| 78 | <i>Ephippus orbis</i> | 112 | <i>Leiognathus equulus</i> |
| 79 | <i>Epinephelus areolatus</i> | 113 | <i>Lepidotrigla omanesis</i> |
| 80 | <i>Epinephelus bleekeri</i> | 114 | <i>Lethrinus elongatus</i> |
| 81 | <i>Epinephelus caeruleopunctatus</i> | 115 | <i>Lethrinus lentjan</i> |
| 82 | <i>Epinephelus chlorostigma</i> | 116 | <i>Lethrinus mahsenoides</i> |
| 83 | <i>Epinephelus epistictus</i> | 117 | <i>Lethrinus nebulosus</i> |
| 84 | <i>Epinephelus latifasciatus</i> | 118 | <i>Liza alata</i> |
| 85 | <i>Epinephelus multinotatus</i> | 119 | <i>Liza carinata</i> |
| 86 | <i>Epinephelus suillus</i> | 120 | <i>Liza subviridis</i> |
| 87 | <i>Euryglossa orientalis</i> | 121 | <i>Lobotes surinamensis</i> |
| 88 | <i>Euthynnus affinis</i> | 122 | <i>Loxodon macrorhinus</i> |
| 89 | <i>Fistularia petimba</i> | 123 | <i>Lutjanus argentimaculatus</i> |
| 90 | <i>Fowleria variegata</i> | 124 | <i>Lutjanus ehrenbergi</i> |
| 91 | <i>Gastrophysus lunaris</i> | 125 | <i>Lutjanus fulviflammus</i> |
| 92 | <i>Gazza minuta</i> | 126 | <i>Lutjanus johni</i> |
| 93 | <i>Gerres argyreus</i> | 127 | <i>Lutjanus lutjanus</i> |
| 94 | <i>Gerres filamentosus</i> | 128 | <i>Lutjanus malabaricus</i> |
| 95 | <i>Gerres oyena</i> | 129 | <i>Lutjanus quinquelineatus</i> |
| 96 | <i>Gnathanodon speciosus</i> | 130 | <i>Lutjanus russelli</i> |
| 97 | <i>Grammolites suppositus</i> | 131 | <i>Megalaspis cordyla</i> |
| 98 | <i>Gymnothorax undulates</i> | 132 | <i>Mene maculata</i> |
| 99 | <i>Gymnura poecilura</i> | 133 | <i>Minous monodactylus</i> |
| 100 | <i>Halichoeres stigmaticus</i> | 134 | <i>Muraenesox cinereus</i> |
| 101 | <i>Halichoeres zeylonicus</i> | 135 | <i>Mustelus mosis</i> |
| 102 | <i>Hemiramphus far</i> | 136 | <i>Nematalosa nasus</i> |

Table 7 List of Fishes of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|---------------------------------------|-----|--------------------------------------|
| 137 | <i>Nemipterus bleekeri</i> | 171 | <i>Pseudochromis persicus</i> |
| 138 | <i>Nemipterus japonicus</i> | 172 | <i>Pseudorhombus arsius</i> |
| 139 | <i>Nemipterus peronii</i> | 173 | <i>Pseudosynanceia melanostigma</i> |
| 140 | <i>Neopomacentrus sindensis</i> | 174 | <i>Pseudotriacanthus strigilifer</i> |
| 141 | <i>Ostracion cyanurus</i> | 175 | <i>Pterois volitans</i> |
| 142 | <i>Pagellus affinis</i> | 176 | <i>Rachycentron canadus</i> |
| 143 | <i>Paramonacanthus choirocephalus</i> | 177 | <i>Rastrelliger kanagurta</i> |
| 144 | <i>Paramonacanthus oblongus</i> | 178 | <i>Rhabdosargus haffara</i> |
| 145 | <i>Parapercis alboguttata</i> | 179 | <i>Rhina ancylostoma</i> |
| 146 | <i>Parapercis robinsoni</i> | 180 | <i>Rhinecanthus assasi</i> |
| 147 | <i>Parastromateus niger</i> | 181 | <i>Rhinobatos halavi</i> |
| 148 | <i>Pardachirus magmorattus</i> | 182 | <i>Rhinoptera sp.</i> |
| 149 | <i>Parupeneus heptacanthus</i> | 183 | <i>Rhizoprionodon acutus</i> |
| 150 | <i>Pastinachus sephen</i> | 184 | <i>Rhynchobatus djiddensis</i> |
| 151 | <i>Pegasus natans</i> | 185 | <i>Rhizoprionodon oligolinx</i> |
| 152 | <i>Pelates quadrilineatus</i> | 186 | <i>Rhinobatos cf. punctifer</i> |
| 153 | <i>Pentaprion longimanus</i> | 187 | <i>Sardinella albella</i> |
| 154 | <i>Petroscirtes ancyllodon</i> | 188 | <i>Sardinella gibbosa</i> |
| 155 | <i>Pinjalo pinjalo</i> | 189 | <i>Sardinella longiceps</i> |
| 156 | <i>Platax tiera</i> | 190 | <i>Sardinella sirm</i> |
| 157 | <i>Platycephalus indicus</i> | 191 | <i>Saurida tumbil</i> |
| 158 | <i>Plectorhinchus gaterinus</i> | 192 | <i>Saurida undosquamis</i> |
| 159 | <i>Plectorhinchus pictus</i> | 193 | <i>Scarus ghobban</i> |
| 160 | <i>Plectorhinchus sordidus</i> | 194 | <i>Scarus persicus</i> |
| 161 | <i>Plotosus lineatus</i> | 195 | <i>Scarus psittacus</i> |
| 162 | <i>Pomacanthus maculosus</i> | 196 | <i>Scarus sordidus</i> |
| 163 | <i>Pomacentrus tichourus</i> | 197 | <i>Scolopsis bimaculatus</i> |
| 164 | <i>Pomadasys argenteus</i> | 198 | <i>Scolopsis ghanam</i> |
| 165 | <i>Pomadasys stridens</i> | 199 | <i>Scolopsis taeniatus</i> |
| 166 | <i>Priacanthus tayenus</i> | 200 | <i>Scolopsis vosmeri</i> |
| 167 | <i>Pristis zijsron</i> | 201 | <i>Scomberoides commersonianus</i> |
| 168 | <i>Pristotis jerdoni</i> | 202 | <i>Scomberoides tol</i> |
| 169 | <i>Psettodes erumei</i> | 203 | <i>Scomberomorus commerson</i> |
| 170 | <i>Pseudochromis dutoiti</i> | 204 | <i>Scomberomorus guttatus</i> |

Table 7 List of Fishes of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|--------------------------------|-----|-----------------------------------|
| 205 | <i>Scorpaenopsis barbatus</i> | 228 | <i>Terapon puta</i> |
| 206 | <i>Selar crumenophthalmus</i> | 229 | <i>Terapon theraps</i> |
| 207 | <i>Selaroides leptolepis</i> | 230 | <i>Tetrosomus gibbosus</i> |
| 208 | <i>Seriola dumerili</i> | 231 | <i>Thalassoma lunare</i> |
| 209 | <i>Seriolina nigrofasciata</i> | 232 | <i>Thamnaconus modestoides</i> |
| 210 | <i>Siganus canaliculatus</i> | 233 | <i>Torpedo sinuspersci</i> |
| 211 | <i>Siganus javus</i> | 234 | <i>Tosana niwae</i> |
| 212 | <i>Siganus spinus</i> | 235 | <i>Trachinocephalus myops</i> |
| 213 | <i>Sillago maculata</i> | 236 | <i>Trachinotus blochii</i> |
| 214 | <i>Sillago sihama</i> | 237 | <i>Trachurus indicus</i> |
| 215 | <i>Solea bleekeri</i> | 238 | <i>Trachyrhampus bicoarctatus</i> |
| 216 | <i>Sorsogona tuberculata</i> | 239 | <i>Triacanthus biaculeatus</i> |
| 217 | <i>Sparidentex hasta</i> | 240 | <i>Trichiurus lepturus</i> |
| 218 | <i>Sphyrna obtusata</i> | 241 | <i>Trichonotus setigerus</i> |
| 219 | <i>Sphyrna lewini</i> | 242 | <i>Tylosurus crocodilus</i> |
| 220 | <i>Sphyrna mokarran</i> | 243 | <i>Upeneus sulphureus</i> |
| 221 | <i>Stegostoma fasciatum</i> | 244 | <i>Upeneus tragula</i> |
| 222 | <i>Stephonolepis diasporos</i> | 245 | <i>Uranoscopus guttatus</i> |
| 223 | <i>Stolephorus indicus</i> | 246 | <i>Uraspis helvola</i> |
| 224 | <i>Sufflamen albicaudatus</i> | 247 | <i>Valamugil seheli</i> |
| 225 | <i>Synanceia nana</i> | 248 | <i>Xiphasia setifer</i> |
| 226 | <i>Synodus variegatus</i> | 249 | <i>Xyrichthys bimaculatus</i> |
| 227 | <i>Terapon jarbua</i> | 250 | <i>Zebrasoma xanthurum</i> |

4.2.6 Arthropods:

4.2. 6.1 Arachnids:

Only 4 spiders and 2 scorpions were reported (BNHS, 1990). It is certain that there are more than 4 spider species in Bahrain. The common names of spiders and scorpions are listed in Table 8. Each common name represents up to 550 genera including more than 5000 species. Verification is needed by specialists.

Table 8 List of Archnids (Spiders and Scorpions) of Bahrain

| No. | Common Name |
|-----|-----------------|
| 1 | wolf spider |
| 2 | jumping spider |
| 3 | crab spider |
| 4 | camel spider |
| 5 | black scorpion |
| 6 | yellow scorpion |



Photo 7. Yellow scorpion (Source: <http://www.alamy.com/>)

4.2.6.2 Insects:

Despite being the largest group of animals, very little is known about the species of insects in Bahrain. A list of butterflies was prepared by Bahrain Natural History Society (1984, 1987). Table 9 lists a total of 32 insects including butterflies, moths, and grasshoppers. There are 21 butterflies with scientific names belonging to 20 genera and 5 families. The remaining 11 species are listed with their common names which are usually used for many species. Verification is needed by specialists.



Photo 8. Butterfly in northern area of Bahrain (Source: Jameel Alkhuzai)

Table 9 List of Insects (Butterflies and others) of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|-------------------------------|-----|-------------------------------------|
| 1 | <i>Papilio demoleus</i> | 12 | <i>Tarucus balkanicus</i> |
| 2 | <i>Artogeia rapae iranica</i> | 13 | <i>Zizeeria karsandra</i> |
| 3 | <i>Pontia glauconome</i> | 14 | <i>Chilades parrhasius</i> |
| 4 | <i>Euchloe belemia</i> | 15 | <i>Freyeria trochilus trochylus</i> |
| 5 | <i>Anaphaeis aurota</i> | 16 | <i>Danaus chrysippus chrysippus</i> |
| 6 | <i>Madais fausta fausta</i> | 17 | <i>Hypolimnas misippus</i> |
| 7 | <i>Catopsilia florella</i> | 18 | <i>Vanessa cardui</i> |
| 8 | <i>Colias croceus</i> | 19 | <i>Junonia orithya cheesmani</i> |
| 9 | <i>Deudorix livia</i> | 20 | <i>Spialia doris</i> |
| 10 | <i>Lampides boeticus</i> | 21 | <i>Pelopidas thrax</i> |
| 11 | <i>Tarucus rosacea</i> | | |

Insects with common names are: damselfly, yellow and black butterfly, praying mantis, Antlion, death's head hawk moth, stripped hawk moth, convulvulus hawk moth, hummingbird hawk moth, dragonfly, red darter, Grasshopper.

4.2.6.3 Crustaceans:

Crustaceans represent a relatively large group of invertebrate animals that are used as food by Bahrain people. Shrimp, crabs, and some bivalves are part of traditional meals in Bahrain. A list of 64 crustacean species belonging to 56 genera and 39 families is presented in Table 10.



Photo 9. Shrimp (Source: <http://bahrain-history.net/>)

Table 10 List of Crustaceans of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|------------------------------------|-----|------------------------------------|
| 1 | <i>Acanthonyx limbatus</i> | 33 | <i>Lysianassa certain</i> |
| 2 | <i>Actaea savignyi</i> | 34 | <i>Macrophthalmus telescopicus</i> |
| 3 | <i>Alpheus lobidens</i> | 35 | <i>Maera quadrimana</i> |
| 4 | <i>Ammothella indica</i> | 36 | <i>Maera sp.</i> |
| 5 | <i>Ampelisca brevicornis</i> | 37 | <i>Metacirolana rotunda</i> |
| 6 | <i>Ampelisca scabripes</i> | 38 | <i>Metagrespus messor ?</i> |
| 7 | <i>Amphithoe ramondi</i> | 39 | <i>Metapenaeus stebbingi</i> |
| 8 | <i>Anoplodacylus glandulifer</i> | 40 | <i>Metaplax indica</i> |
| 9 | <i>Ceradocus rubromaculatus</i> | 41 | <i>Metopograpsus messor</i> |
| 10 | <i>Ceradocus serratus</i> | 42 | <i>Mlacrophthalmus depressus</i> |
| 11 | <i>Cirolana Parva</i> | 43 | <i>Moera pacifica</i> |
| 12 | <i>Cleistostoma dotilliforme</i> | 44 | <i>Ocypode saratan</i> |
| 13 | <i>Cymadusa filose</i> | 45 | <i>Orchestia platensis</i> |
| 14 | <i>Cymodoce sp</i> | 46 | <i>Pagrus sp.</i> |
| 15 | <i>Cyplocarcinus sp</i> | 47 | <i>Paguristes perspicax</i> |
| 16 | <i>Dardanus tinctor</i> | 48 | <i>Palaemon pacificus?</i> |
| 17 | <i>Deamina spinosa</i> | 49 | <i>Penaeus semisulcatus</i> |
| 18 | <i>Diogenes avarus</i> | 50 | <i>Penaeus sp</i> |
| 19 | <i>Elasmopus rapax</i> | 51 | <i>Petrolisthes carinipes</i> |
| 20 | <i>Eurycarcinus orientalis</i> | 52 | <i>Petrolisthes rufescens</i> |
| 21 | <i>Eurydice peraticus</i> | 53 | <i>Phylira sp.</i> |
| 22 | <i>Gammaropsis atlantica</i> | 54 | <i>Pilumnus Vespertilio</i> |
| 23 | <i>Gonodactylus demani</i> | 55 | <i>Platycheles natalensis</i> |
| 24 | <i>Hippolyte kraussiana</i> | 56 | <i>Rhopalophthalmus sp</i> |
| 25 | <i>Hippolyte sp.</i> | 57 | <i>Squilla sp.</i> |
| 26 | <i>Hippolyte ventricosa</i> | 58 | <i>Stenothoe vlida</i> |
| 27 | <i>Hyale perieri</i> | 59 | <i>Thalamita poissoni</i> |
| 28 | <i>Hyastenus planasius</i> | 60 | <i>Thalamita prymna</i> |
| 29 | <i>Ilyoplax frater</i> | 61 | <i>Triprotella amica</i> |
| 30 | <i>Lanocira gardineri stebbign</i> | 62 | <i>Tylodiplex sp</i> |
| 31 | <i>Leptochelia savignyi</i> | 63 | <i>Upogebia rhadames</i> |
| 32 | <i>Leucothoe spinicarp</i> | 64 | <i>Xantho exaratus</i> |

4.2.7 Echinoderms:

This group is represented by 11 species belonging to 11 genera and 8 families (Table 11).



Photo 10: Star fish from Bahrain (Source: Hani Bader)

Table 11 List of Echinoderms of Bahrain

| No. | Scientific Name |
|-----|--|
| 1 | <i>Amphiplus (lymanella) sp.</i> |
| 2 | <i>Amphiura fasciata</i> |
| 3 | <i>Asterina burtoni</i> |
| 4 | <i>Astropecten polyacanthus phragmus</i> |
| 5 | <i>Clypeaster humilis</i> |
| 6 | <i>Echinometra matheai</i> |
| 7 | <i>Linckia multifora</i> |
| 8 | <i>Ophiothela venusta</i> |
| 9 | <i>Ophiothrix savignyi</i> |
| 10 | <i>Ophiuroidea sp.</i> |
| 11 | <i>Prionocidaris baculosa</i> |

4.2.8 Molluscs:

Shells include pearl oysters (*Pinctada radiata*) which represent a historical and cultural value in Bahrain. A total of 186 species of shells (Table 12) belonging to 130 genera and 67 families were listed by Khmadan (2004) and Naser (2010).

Table 12 List of Shells of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|-------------------------------|-----|--|
| 1 | <i>Acar plicata</i> | 35 | <i>Cerithium scabridum</i> |
| 2 | <i>Acropaginula inflata</i> | 36 | <i>Chama asperella</i> |
| 3 | <i>Acropella isseli</i> | 37 | <i>Chama lazarus</i> |
| 4 | <i>Acteon affinis</i> | 38 | <i>Chama pacifica</i> |
| 5 | <i>Amiantis umbonella</i> | 39 | <i>Chama reflexa</i> |
| 6 | <i>Anadara birleyana</i> | 40 | <i>Cheilea cicatrosa</i> |
| 7 | <i>Anadara ehrenbergi</i> | 41 | <i>Chlamys livida</i> |
| 8 | <i>Anadara uropigimelana</i> | 42 | <i>Chlamys senatorius</i> |
| 9 | <i>Ancilla castenea</i> | 43 | <i>Circe corrugata</i> |
| 10 | <i>Anodontia endentula</i> | 44 | <i>Circe scripta</i> |
| 11 | <i>Anomia achaeus</i> | 45 | <i>Circenita callipyga</i> |
| 12 | <i>Antigona lamellaris</i> | 46 | <i>Clanculus pharaonius</i> |
| 13 | <i>Asaphis deflorata</i> | 47 | <i>Clementia papyracea</i> |
| 14 | <i>Asaphis violascens</i> | 48 | <i>Clypeomorus bifasciatus persica</i> |
| 15 | <i>Atactodea bahreniensis</i> | 49 | <i>Conus dictator</i> |
| 16 | <i>Atactodea glabrata</i> | 50 | <i>Corbula taitensis</i> |
| 17 | <i>Atys cylindrica</i> | 51 | <i>Crassatella radiata</i> |
| 18 | <i>Barbatia foliate</i> | 52 | <i>Cronia konkanensis</i> |
| 19 | <i>Barbatia helblingii</i> | 53 | <i>Ctena divergens</i> |
| 20 | <i>Barbatia lacerate</i> | 54 | <i>Cucullaea cucullata</i> |
| 21 | <i>Barbatia setigera</i> | 55 | <i>Cypraea caurica</i> |
| 22 | <i>Bassina foliacea</i> | 56 | <i>Cypraea lentiginosa</i> |
| 23 | <i>Bellucina semperiana</i> | 57 | <i>Cypraea turdus</i> |
| 24 | <i>Benguina gubernaculum</i> | 58 | <i>Decatopecten plica</i> |
| 25 | <i>Brechites attrahens</i> | 59 | <i>Dendrostrea frons</i> |
| 26 | <i>Bullaria ampulla</i> | 60 | <i>Dentalium longitrorsum</i> |
| 27 | <i>Callista erycina</i> | 61 | <i>Dentalium octangulatum</i> |
| 28 | <i>Callista florida</i> | 62 | <i>Diodora funiculata</i> |
| 29 | <i>Calyptrea pellucid</i> | 63 | <i>Divaricella cumingiana</i> |
| 30 | <i>Cardita ffinchi</i> | 64 | <i>Divaricella sechellensis</i> |
| 31 | <i>Cardites bicolor</i> | 65 | <i>Divaricella sp.</i> |
| 32 | <i>Cardium pseudolima</i> | 66 | <i>Dosinia ceylonica</i> |
| 33 | <i>Cerithidea cingulata</i> | 67 | <i>Dosinia erythraea</i> |
| 34 | <i>Cerithium caeruleum</i> | 68 | <i>Dosinia tumida</i> |

Table 12 List of Shells of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|-------------------------------------|-----|-----------------------------------|
| 69 | <i>Electroma zebra</i> | 103 | <i>Marcia flammea</i> |
| 70 | <i>Engina mendicaria</i> | 104 | <i>Maxacteon (Acteon) flammea</i> |
| 71 | <i>Ensiculus cultellus</i> | 105 | <i>Meropesta nicobarica</i> |
| 72 | <i>Epitonium pallasii</i> | 106 | <i>Mitra bovei</i> |
| 73 | <i>Ervilia pupurea</i> | 107 | <i>Mitra pretiosa</i> |
| 74 | <i>Eunaticina papilla</i> | 108 | <i>Mitrella blanda</i> |
| 75 | <i>Ficus subintermedia</i> | 109 | <i>Moerella rosamunda</i> |
| 76 | <i>Fulvia austral</i> | 110 | <i>Moerella sp.</i> |
| 77 | <i>Fulvia papyracea</i> | 111 | <i>Monodonta vermiculata</i> |
| 78 | <i>Fusinus townsendi</i> | 112 | <i>Murex scolopax</i> |
| 79 | <i>Gafrarium pectinatum</i> | 113 | <i>Natica lineata</i> |
| 80 | <i>Gari amethystus (tripartita)</i> | 114 | <i>Natica vitellus</i> |
| 81 | <i>Gari maculosa</i> | 115 | <i>Neopycnodonte cochlear</i> |
| 82 | <i>Gari occidens</i> | 116 | <i>Oliva bulbosa</i> |
| 83 | <i>Gari ruppelliana</i> | 117 | <i>Paphia undulata</i> |
| 84 | <i>Gari weinkauffi</i> | 118 | <i>Pecten dorotheae</i> |
| 85 | <i>Gibbula declivis</i> | 119 | <i>Phasianella solida</i> |
| 86 | <i>Glycymeris lividus</i> | 120 | <i>Pinctada anomioides</i> |
| 87 | <i>Glycymeris pectunculus</i> | 121 | <i>Pinctada maculata</i> |
| 88 | <i>Glycymeris striatularis</i> | 122 | <i>Pinctada margaritifera</i> |
| 89 | <i>Haminea vitrea</i> | 123 | <i>Pinctada nigra</i> |
| 90 | <i>Herpetopoma (Euchelus) asper</i> | 124 | <i>Pinctada radiata</i> |
| 91 | <i>Hexaplex kuesterianus</i> | 125 | <i>Pinctada rutila</i> |
| 92 | <i>Inquisitor griffithi</i> | 126 | <i>Pinctada sp.</i> |
| 93 | <i>Irus macrophylla</i> | 127 | <i>Pinctada sugillata</i> |
| 94 | <i>Laternula anatine</i> | 128 | <i>Pinna bicolor</i> |
| 95 | <i>Leptomya cochlearis</i> | 129 | <i>Pinna muricata</i> |
| 96 | <i>Limaria fragilis</i> | 130 | <i>Pitar hebraea</i> |
| 97 | <i>Lioconcha ornate</i> | 131 | <i>Pitar yerburyi</i> |
| 98 | <i>Lithophaga robusta</i> | 132 | <i>Plesiothyreus parabica</i> |
| 99 | <i>Loxoglypta rhomboides</i> | 133 | <i>Plicatula australis</i> |
| 100 | <i>Lutraria australis</i> | 134 | <i>Plicatula plicata</i> |
| 101 | <i>Mactra lilacea</i> | 135 | <i>Priotrochus kotschy</i> |
| 102 | <i>Malvifundus regula</i> | 136 | <i>Protapes gallus</i> |

Table 12 List of Shells of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|--|-----|---------------------------------|
| 137 | <i>Protapes sp.</i> | | <i>Tellina prismatica</i> |
| 138 | <i>Pteria penguin</i> | | <i>Tellina rastellum</i> |
| 139 | <i>Pupa alveola</i> | 163 | <i>Tellina wallaceae</i> |
| 140 | <i>Rapana bezoar</i> | 164 | <i>Terebellum terebellum</i> |
| 141 | <i>Rapana bulbosa</i> | 165 | <i>Thais carinifera</i> |
| 142 | <i>Rhinoclavis fasciata</i> | 166 | <i>Thais mutabilis</i> |
| 143 | <i>Scalptia scalarina</i> | 167 | <i>Thais savignyi</i> |
| 144 | <i>Semele sinensis</i> | 168 | <i>Thais tissoti</i> |
| 145 | <i>Semicassis faurotis</i> | 169 | <i>Thracia adenensis</i> |
| 146 | <i>Septifer bilocularis</i> | 170 | <i>Timoclea arakana</i> |
| 147 | <i>Siphonaria laciniosa</i> | 171 | <i>Timoclea sp.</i> |
| 148 | <i>Solecurtus australis</i> | 172 | <i>Trachycardium arenicolum</i> |
| 149 | <i>Solen cylindraceus</i> | 173 | <i>Trachycardium lacunosum</i> |
| 150 | <i>Spondylus exilis</i> | 174 | <i>Trachycardium maculosum</i> |
| 151 | <i>Stomatella elegans</i> | 175 | <i>Trachycardium sp.</i> |
| 152 | <i>Stomatia phymotis</i> | 176 | <i>Trigonostoma costifera</i> |
| 153 | <i>Strombus persicus</i> | 177 | <i>Trisidos tortuosa</i> |
| 154 | <i>Strombus plicatus sabbaldi</i> | 178 | <i>Trochus erythraeus</i> |
| 155 | <i>Sunetta donacina</i> | 179 | <i>Tugonella decurtata</i> |
| 156 | <i>Sunetta effosa</i> | 180 | <i>Turbo coronatus</i> |
| 157 | <i>Tapes sulcarius</i> | 181 | <i>Turbo radiatus</i> |
| 158 | <i>Tellina adamsi</i> | 182 | <i>Turcica stellata</i> |
| 159 | <i>Tellina arsinoensis</i> | 183 | <i>Turritella cochlea</i> |
| 160 | <i>Tellina capsoides</i> | 184 | <i>Vermetus sulcatus</i> |
| 161 | <i>Tellina emarginata</i> | 185 | <i>Vulsella vulsella</i> |
| 162 | <i>Tellina (Pinguicellina) pinguis</i> | 186 | <i>Xenophora corrugate</i> |

4.2.9 Coelenterates:

Coelenterate is a group of animals that include corals, jelly fish, sea anemones and others. The list of corals in Bahrain is shown in Table 13. The listed 24 corals belong to 16 genera and 12 families. There is a record of one jelly fish (*Rhizostoma* jellyfish).

Table 13 List of Corals of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|---------------------------------|-----|-------------------------------|
| 1 | <i>Acanthastrea echinata</i> | 13 | <i>Paracyathus sp.</i> |
| 2 | <i>Acropora Formosa</i> | 14 | <i>Platygyra daedalea</i> |
| 3 | <i>Acropora sp</i> | 15 | <i>Platygyra sinerosis</i> |
| 4 | <i>Anomastrea irregularis</i> | 16 | <i>Plesiastrea versipora</i> |
| 5 | <i>Coscinaraea monile</i> | 17 | <i>Porites compressa</i> |
| 6 | <i>Cyphastrea microphthalma</i> | 18 | <i>Porites lutea</i> |
| 7 | <i>Cyphastrea seralia</i> | 19 | <i>Porites nodifera</i> |
| 8 | <i>Favia pallid</i> | 20 | <i>Psammocora contigua</i> |
| 9 | <i>Favia speciosa</i> | 21 | <i>Siderastrea savignyana</i> |
| 10 | <i>Favites chinesis</i> | 22 | <i>Stylophora pistillata</i> |
| 11 | <i>Favites pentagona</i> | 23 | <i>Turbinaria crater</i> |
| 12 | <i>Leptastrea purpurea</i> | 24 | <i>Turbinaria peltata</i> |

4.2.10 Polychaetes (Sea worms):

The list of sea worms includes 51 species (Naser, 2010) belonging to 41 genera and 32 families (Table 14).

Table 14 List of Sea worms of Bahrain

| No. | Scientific Name | No. | Scientific Name |
|-----|----------------------------------|-----|----------------------------------|
| 1 | <i>Armandia intermedia</i> | 27 | <i>Nephtys hombergii</i> |
| 2 | <i>Armandia leptocirrus</i> | 28 | <i>Nereis cf. Persica</i> |
| 3 | <i>Branchiomma nigromaculata</i> | 29 | <i>Nereis coutieri</i> |
| 4 | <i>Ceratonereis burmensis</i> | 30 | <i>Nereis trifasciata</i> |
| 5 | <i>Ceratonereis erythraensis</i> | 31 | <i>Notomastus latericeus</i> |
| 6 | <i>Ceratonereis mirabilis</i> | 32 | <i>Onuphis emeriti</i> |
| 7 | <i>Cirriformia tentaculata</i> | 33 | <i>Ophiacis savignyi</i> |
| 8 | <i>Chone collsris</i> | 34 | <i>Ophiothrix savignyi</i> |
| 9 | <i>Dorvillea sp.</i> | 35 | <i>Phyllodoce madeirensis</i> |
| 10 | <i>Eulalia viridis</i> | 36 | <i>Perinereis nuntia</i> |
| 11 | <i>Eupolymnia nebulosa</i> | 37 | <i>Perinereis vancaurica</i> |
| 12 | <i>Elasmopus rapax</i> | 38 | <i>Perinereis nigropunctata</i> |
| 13 | <i>Eunice siciliensis</i> | 39 | <i>Pomatoleios Kraussii</i> |
| 14 | <i>Eunice indica</i> | 40 | <i>Pista cristat</i> |
| 15 | <i>Glycinda kamerunina</i> | 41 | <i>Rhizoelonium sp.</i> |
| 16 | <i>Glycera convolute</i> | 42 | <i>Sthenalis boa</i> |
| 17 | <i>Glycera alba</i> | 43 | <i>Syllis gracilis</i> |
| 18 | <i>Harmthoe ampulifera</i> | 44 | <i>Syllis cornuta</i> |
| 19 | <i>Hesione pantherina</i> | 45 | <i>Schistomeringos rudolphi</i> |
| 20 | <i>Hydroides dianthus</i> | 46 | <i>Scoloplos uniramus</i> |
| 21 | <i>Jasmineira elegans</i> | 47 | <i>Streblosoma persica</i> |
| 22 | <i>Lumbrineris latreilli</i> | 48 | <i>Sabella fusca</i> |
| 23 | <i>Loimia medusa</i> | 49 | <i>Terebella ehrenbergi</i> |
| 24 | <i>Lysidice collaris</i> | 50 | <i>Trypanosyllis zebra</i> |
| 25 | <i>Metaprotella sandalensis</i> | 51 | <i>Tylonereis bogoyawlenskyi</i> |
| 26 | <i>Marphysa macintoshi</i> | | |

4.3. Genetic Diversity

4.3.1 Horses:

A unique collection of pure-bred Arabian horses (*Equus ferus caballus*) has been preserved on the island for over 200 years by the rulers of Bahrain, the Al Khalifa family. There are 20 strains in the Royal Arabian Studs of Bahrain. Table 15 shows the 2 strains:

Table 15. Strains in the Royal Arabian Studs of Bahrain

| Strain | Strain | Strain | Strain |
|-----------------|----------------------|--------------|--------------|
| Al-Dahmeh | Kuheila't Aladiyat | Al-Musannah | Al-Shawafah |
| Al Hamdanieh | Kuheila't Jellabieh | Al-Obeyah | Al-Shuwaimeh |
| Al-Kray | Kuheila't Umm Zorayr | Al-Hadhfa | Al-Suwaitieh |
| Al-Krushieh | Ma'anaghieh | Al-Rabda | Al-Tuwaisah |
| Kuheila't Aafas | Al-Mlolesh | Al-Saqlawieh | Al-Wadhnah |



Photo 11: Arabian Studs of Bahrain (Source: <http://www.bahrainroyalstud.com/>)

4.3.2 Camels:

Camels, similar to the Arabian Horse strains, are found and mainly owned by royals in Bahrain. According to Agriculture and Marine Resources Affairs report (AMRA, 2014), camel strains are found in the Royal Farm in Janabya area (Table 16):

Table 16 Camel Strains in Bahrain

| Strain | Strain | Strain | Strain |
|-----------|--------------|-------------|----------|
| Lekhaila | Arja | Erzaylah | Alqalah |
| Leghzaila | Farha | Laskya | Ledwah |
| Sowdeh | Bent Dhebyan | Bent Elwari | Sadwah |
| Dhabya | Samha | Khwarah | Alhareem |
| Alqerdah | Umsayha | Khmesah | Dbaysah |



Photo. 12 Camels grazing south of Bahrain (Source: <http://www.galenfrysinger.com/>)

4.3.3 Date Palm:

Few plant species have developed into an agricultural crop so closely connected with human life as has the date palm. One could go as far as to say that, had the date palm not existed, the expansion of the human race into the hot and barren parts of the "old" world would have been much more restricted. The date palm not only provided a concentrated energy food, which could be easily stored and carried along on long

journeys across the deserts, it also created a more amenable habitat for the people to live in by providing shade and protection from the desert winds (FAO, 2015). There are about 600,000 date palm tree in Bahrain with more than 100 cultivars (SCE, 2015). Fruits of the date palm (*Phoenix dactylifera* L.) are rich in mineral salts and vitamins and are an excellent material for producing refined sugar, concentrated juice, confectionery pastes and fermentation products. Dates contain small amounts of vitamins C, B₁ thiamine, B₂ riboflavin and nicotinic acid, and studies have shown that dates have strong antioxidant, anticancer and antiviral activities (Assirey, 2015). The average annual production per tree in Bahrain varies from 40 to 80 kg (up to 150 kg) depending on the cultivar. Among the most productive cultivars are Bechayra, Khunaizi, Banat Alsayed, Murzeban, and Burhi (Almansoori et al., 2015). Allaith (2008) reported that Khwaja and Khunaizi cultivars have the highest antioxidant activities among 16 tested cultivars. Khulas is the top preferred cultivar by Bharaini people. This could be due to its high content of simple fructose and glucose sugars and its soft texture. Table 17 gives examples of date palm varieties in Bahrain (Agriculture Affairs data).

Table 17. Date Palm Varieties in Bahrain

| Variety | Variety | Variety |
|--------------|---------------|----------------|
| Tayyar | Muwaji | Bechayra |
| Mbasher | Ghirra | Khulas |
| Khunaizi | Shishi | Satrawi |
| Hatmi | Salis | Ammari |
| Rzaiz | Banat Alsayed | Murzeban |
| Banat Alabda | Shbaby | Bresmy |
| Khwaja | Halaw | Burhi |
| Hamri | Fardh | Mdallal |
| Nabtat saif | Ashal | Um Rheem |
| Jabri | Hlali | Salmi |
| Sabo | Shmbri | Khasbat Asfoor |



Photo 13. Dates varieties in Bahrain Market (Source: www.alwasatnews.com)

4.4. Wild Relative Species

The checklists of flora and fauna of Bahrain do not show the presence of wild relatives of domesticated plants (crops) or animals (cattle, etc).

4.5 Traditional Knowledge

Bahrain has a long and rich history which is affiliated to ancient civilizations of the region, from the Sumerian to the Islamic. Alongside this history, there is a rich culture of using plant species particularly in herbal medicine. This use was influenced by the practice of herbal medicine by Bedouins in the Arabian Peninsula in the west, and by Persians and Indians in the East. Nowadays, trade and import is playing a major role in the herbal medicine in Bahrain. Many herbalists' shops can be seen in the small and old markets of Manama and Muharraq. There are families of well known herbalists in which the knowledge has been passed from generation to generation (Abbas & Alsaleh, 2002). Herbalists subscribe treatments for an array of diseases from simple cold to cancer (Alkhuzai et al., 2010). In addition to herbalists, people in Bahrain use herbal medicine in their homes. It is estimated that 94% of people in Bahrain use herbal medicine (Abbas et al., 1992). The medicinal plants of Bahrain represent about 30% of the flora (Abbas & Alsaleh, 2002). However, these are mostly not collected by herbalists. Some people collect plants for medication or as food after rain and the blooming of annual plants. Most of the plants in herbalists' shops are imported from Lebanon, Iran, India, and Pakistan.

5. ECOSYSTEMS DIVERSITY:

The following is a concise and coherent account of the main ecosystems and habitats in Bahrain. The marine ecosystem included coastal habitat, mangrove habitat, seagrass habitat, algal beds habitat, coral reefs habitat, and island habitat. Additionally, the desert and agricultural ecosystems were discussed.

5.1. Marine Ecosystem

5.1.1 Coastal Habitat

This is one of the main marine habitats in Bahrain. It is diverse with heterogeneous types including: rocky shores, mudflats, and rock pools. These types are habitats for diverse groups of plants and animals including algae, invertebrates, and resident and migratory birds such as flamingo. Traditionally, green algae including *Ulva* and *Enteromorpha* are collected from intertidal zone and used as fish bait.



Photo 14. Flamingos feeding on intertidal algae (Source: www.alwasatnews.com/)

5.1.2 Mangrove Habitat

Mangrove is one of the most important marine habitats in Bahrain with *Avicennia marina* as the main plant species. Due to its significant importance, it has been declared as RAMSAR site. It is located on the north- eastern coast of Bahrain in Tubli Bay. Date palm plantations border this bay which is characterized by its mudflats. There is rich diversity of animals in this habitat including shrimps, crabs, bivalves, and birds. This habitat faces lots of pressures including reclamation, siltation from sand washing industry (now under regulation), pollutants, and garbage dumping.



Photo 15. Mangrove Habitat in Ras Sanad. Source: SCE

5.1.3 Seagrass Habitat

The majority of the seagrass habitats in Bahrain territorial waters are located in the eastern subtidal waters, beginning south of Fasht Al-Adham extending to the Hawar Islands (Al Zayani et al., 2009). In a study by Al-Wedaei et al. (2011), differences in structure and composition among the assemblages between two sampling sites in the east and west were detected. Seagrass cover was $95 \pm 3.6\%$ and $78 \pm 7.4\%$ in a 1 km^2 area in the western and eastern sites, respectively. Crustaceans, ploychaetes, and molluscs represented the main assemblages in this habitat. It is the main foraging ground for the endangered marine mammal dugong and are important breeding and foraging areas for the endangered Green Turtle (*Chelonia mydas*), which exhibit continuous decline in populations worldwide (Sheppard et al. 2010).



Photo 16. Seagrass habitat off Hawar Island (Source: Hani Bader)

5.1.4 Algal beds habitat

The algae-dominated habitat is mainly found in the eastern intertidal and subtidal zones of Bahrain (Al Zayani et al., 2009) and around Hawar Islands (Alkhuzai et al., 2009). Where seagrasses are sparse, macroalgal beds are the primary habitat for all organisms requiring plants for shelter (Sheppard et al., 2010).



Photo 17. Algal bed showing *Hormophysa cueniformis* (Source: Hani Bader)

5.1.5 Coral Reefs Habitat

Coral reef habitats (known as fasht in the local Arabic dialect) have been restricted primarily to the east and north of Bahrain. They occupy a total area larger than Bahrain itself (Alkhuzai et al., 2009). The main coral habitats include the 200 km² Fasht Al-Adhm immediately to the east of Bahrain, Khawr Fasht and Fasht Al-Jarim 20 km to the north, and Bulthama 70 km northeast; various other smaller reef habitats are interspersed around eastern Bahrain (Vousden, 1988). Associated with coral reefs are oyster beds which provide ecosystem services such as fisheries, aquaculture, coastal protection, wave energy conservation, recreation and water purification (Al Mealla, 2014). A number of oyster beds (*Hayrat*) were declared as UNESCO Heritage Sites as part of the pearling project.



Photo 18. Coral Reef in Bahrain. Source: Mohammad Alsabab (<http://flickrhivemind.net/Tags/bahrain,underwater/Interesting>)

5.1.6 Salt Marsh and Coastal Sabkha Habitat

Salt marsh is small and fragmented. Some pockets are found on the western and eastern shores of Bahrain Island (near Askar), and Hawar Islands. It is dominated by the plant *Phragmites australis*, *Arthrocnemum macrostachyum*, and *Sueda spp.* This is a habitat for birds such as reef heron and some terrestrial birds. Coastal sabkhas are characterized by high salinity with salt crusts. Many sabkha occur in the southern areas, near Ras El Bar, and also in Hawar Islands (Al Zayani et al., 2009).



Photo 19. Saltmarsh near east coast of Bahrain (Source: Marine Atlas of Bahrain)



Photo 20. Coastal Sabkha near Ras El Bar south of Bahrain (Source: Jameel Alkhuzai)

5.1.7 Islands

There are a number of islands which are exposed to little anthropogenic activities, mainly represented by Hawar Islands. Some of these islands are of different geomorphological formations, such as cliffs, dead corals, or sand. Hawar Islands represent the main group of islands in Bahrain. These islands contain diverse coastal and terrestrial habitats. Well-established vegetation provides shelter for many species, particularly birds. The birds include the internationally important Socotra cormorant and Osprey. Suwad Island is the main breeding site for the largest population of Socotra cormorant in the world, which is estimated to be around 25,000 pairs. Other islands,

such as Nabih Saleh, have been exposed to major anthropogenic activities and destruction of its habitats and biodiversity.



Photo 21. Island Cliffs in Hawar with Sooty Falcon Nest (Source: Jameel Alkhuzai)



Photo 22. Socotra cormorant on Hawar Island (Source: Juhani Kyyro, 2006)

5.2 Desert Ecosystem

Bahrain falls in a desert belt extending from North Africa to Central Asia. It is part of Arabian Peninsula which is mostly arid and dominated by deserts. Away from the coasts, the inland part of Bahrain is characterized by desert features. The plants are mainly xerophytic and the animals are mainly of desert types.

5.2.1 Sand Dunes Habitat

Sand dunes in Bahrain are of small size. They occur mainly on the western coastal lowland of the island. Many of these are in the form of phytogenic mounds that are formed due to accumulation of sand by plants such as *Zygophyllum qatarense*, *Panicum turgidum*, and *Pennisetum divisum*.



Photo 23. Phytogenic Mounds near Tree of Life (Source: [tps://tahira007.wordpress.com](https://tahira007.wordpress.com))

5.2.2 Gravels and Stone Pavements

Gravels and stone pavements are usually found on elevated areas and slopes of hills in the backslope and middle dome. Vegetation includes *Lycium shawii*, *Zygophyllum qatarense*, and *Stipagrostis* spp. Surrounding areas in the central basin faces anthropogenic pressures from camping and waste landfills.



Photo 24. Gravel and stone pavements in the desert of Bahrain.
(Source: www.flickr.com/photos/alamhari/3117159400)

5.2.3 Runnels and Small Wadis

Runnels and small wadis are usually found where rain water runoffs are formed throughout the years. These are mainly found in the central basin of the main Bahrain Island in areas such as Heniniya near Riffa. Here, more dense vegetation is found compared to other areas, particularly annual plants.



Photo 25. Runnel in Sakhir area (Source: Jameel Akhuzai)

5.2.4 Jabals (small mountains)

The main elevated formation in Bahrain is represented by Jabal Aldukhan (Smoke Mountain) and the surrounded plateau. The highest point is 122.4 m above sea level. This rocky and hard surface habitat is inhabited by xerophytic plants such as *Lycium shawii*, *Zygophyllum qatarense*, and *Calligonum polygonoides*.



Photo 26. Residual hills with perennial vegetation. (Source: Jameel Alkhuzai)

5.3. Agriculture Ecosystem

5.3.1 Plantations and Farms

Plantations and farms have been part of Bahraini people culture and living throughout history. They are mainly located along the northern, eastern, and north western coastal strips. Date palm is the main crop. In addition, trees of plants locally known as *Terminalia catapa* (Looze Bahraini), *Ziziphus spina-christi* (Knar), and *Cordia myxa* (Bamber) are also planted. In these sites, naturally occurring plants such as *Alhagi maurorum*, *Capparis spinosa*, and *Convolvulus arvensis* are found. Date palm plantations are the natural nesting sites for the white cheek bulbul.



Photo 27. Date palms (Source: Jameel Alkhuzai)

5.3.2 Freshwater Springs and Streams

Bahrain has been known for its villages and agriculture. This was mainly due to the presence of natural water springs and wells. Reports and people of have recognized a number of water springs most of which, if not all, have degraded. The most famous of these springs was Ain Adhari. This was one of the biggest natural springs in Bahrain. It had channels that extended for relatively long distances passing through agricultural areas forming riparian vegetation alongside the banks. Other springs included Abu Zaidan, Um Shuoom, and many others. Fresh water fish including *Aphanius dispar* (Arabian killifish) were found in these springs. In addition, turtles and frogs were also found. Nowadays, only remnants of these springs are found. Recently, a small spring called the Eskharah (Rocks) Spring located on government-owned land between Saddam

and Shahrakan villages has been recognized by the Bahrain Authority for Culture and Antiquities as a site of historical significance based on a submission by the Northern Municipal Council (Trade Arabia, 2014). Small water streams can still be seen in agricultural areas as part of flood irrigation network in plantations and farms. These spot are the only sites were few individuals of the freshwater frog can be seen.

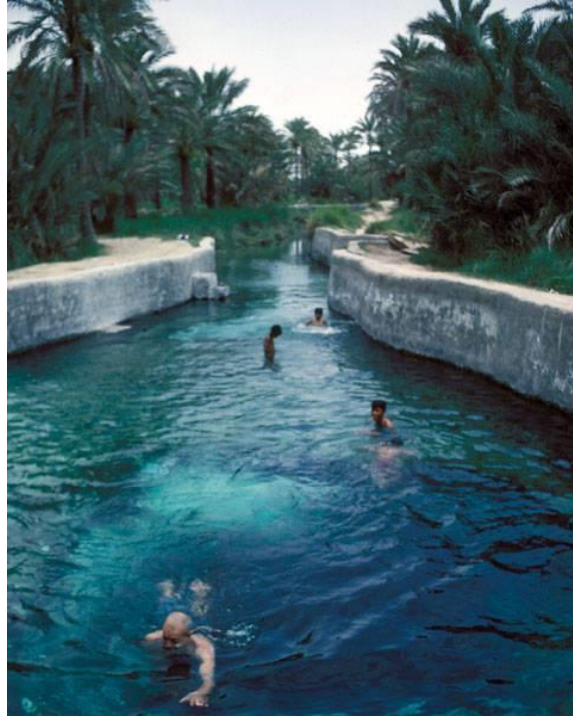


Photo 28. The main channel of Adhari (Source: bahrainforum.com)



Photo 29. Water stream in a plantation near Bahrain Fort (Source: Jameel Alkhuzai)

6 CONSERVATION STATUS

This report provides a summary of biodiversity conservation efforts in Bahrain. These include initial steps for the establishment of red list, nature reserves, and sites of international recognition.

6.1 Red list

Very little is known about threatened species in Bahrain. A recent effort was made by the SCE (Directorate of Biodiversity) in collaboration with the Arab Center for World Heritage and IUCN to start the process of establishing a red list for Bahrain based on the IUCN procedure for preparing red lists. The initial list includes few species. In addition, as a result of questionnaire sent to 70 stakeholders as part of NBSAP development, a list of threatened species and habitats as perceived by the stakeholders based on their knowledge and observation was prepared (Table 18).



Photo 30. Little Egret (Source: <http://www.hawar-islands.com/blog/index.php/2010/>)

Table. 18 List of species believed to be endangered according to respondents of an NBSAP development questionnaire

| No. | Species | Common Name | Local Name |
|-----|----------------------------------|---------------------------------|-----------------|
| 1 | <i>Epinephelus coioides</i> | Orange spotted grouper | Hamoor |
| 2 | <i>Dugong dugon</i> | Dugong | Sea Cow |
| 3 | <i>Pycnonotus leucogenys</i> | White-cheeked Bulbul | Bulbul |
| 4 | <i>Eretmochelys imbricate</i> | Hawksbill Turtle | |
| 5 | <i>Chelonia mydas</i> | Green Turtle | |
| 6 | <i>Siganus javus</i> | streaked rabbit fish | Safi Senayfi |
| 7 | <i>Avicenna marina</i> | Black Mangrove | Garm |
| 8 | <i>Rana ridibunda</i> | Freshwater frog | Dhifdaa |
| 9 | <i>Tirmania nivea</i> | Truffle | Zubaidi |
| 10 | <i>Delphinus delphis</i> | Short-beaked common dolphin | Dolphin |
| 11 | <i>Mauremys caspica</i> | Caspian turtle | |
| 12 | <i>Epinephelus multinotatus</i> | White-blotched Grouper | Bertam |
| 13 | <i>Pavona cactus</i> | Cactus or Lettuce Coral | Murjan |
| 14 | <i>Phoenix dactylifera</i> | Date palm | Nakheel |
| 15 | <i>Penaeus semisulcatus</i> | Shrimp | Rubyaan |
| 16 | <i>Pristis zijsron</i> | Green Sawfish, Longcomb Sawfish | Bu Sayyaf |
| 17 | <i>Lepus capensis</i> | Desert rabbit | Arnab Barri |
| 18 | <i>Lethrinus elongatus</i> | Longnose Emperor | She'ri |
| 19 | <i>Phoenicopterus ruber</i> | Greater flamingo | Fenteer |
| 20 | <i>Chlamydotis undulata</i> | Hubara bustard | Hubara |
| 21 | <i>Branchipus shaefferi</i> | Fairy shrimp | Rubyaan |
| 22 | <i>Falco concolor</i> | Sooty Falcon | Saqr Al ghuroob |
| 23 | <i>Uromastix microlepis</i> | Spiny-tailed lizard | Dhab |
| 24 | <i>Pinctada radiata</i> | Pearl oyster | Lulu |
| 25 | <i>Portunus pelagicus</i> | Blue swimmer crab | Gobgob |
| 26 | <i>Valamugil seheli</i> | Bluespot Mullet | Maid |
| 27 | <i>Halichoeres stigmaticus</i> | Wrasse | Ghain |
| 28 | <i>Oryx leucoryx</i> | Arabian oryx | Maha Arabi |
| 29 | <i>Sillago maculata</i> | Blotchy Sillago | Hasoom |
| 30 | <i>Lutjanus argentimaculatus</i> | River Snapper | Shagra |
| 31 | <i>Scomberomorus commerson</i> | Narrow-barred Spanish Mackerel | Kana'ad |
| 32 | <i>Teucrium polium</i> | Felty Germander | Etra |
| 33 | <i>Vanessa cardui</i> | Painted Lady | Farasha |

6.2 Nature Reserves

The Kingdom of Bahrain, in its effort to manage its biological resources and protects the biological diversity from human pressures, has declared a number of areas as protected areas. There are a total of 7 protected areas in Bahrain, 6 of which are marine and 1 as terrestrial.

6.2.1: Ras Sanad in Tubli Bay:

Ras Sanad is the main remaining area with mangrove habitat. This area, located in Tubli Bay, was declared as a protected area by Council of Ministers Decision No. 1341/ 1995. A ministerial decision No. 1/ 1995 was issued and it stated that this area is a category (A) protected area and that reclamation and construction is completely prohibited.

6.2.2 Tubli Bay:

Tubli Bay was classified as category (B) protected area based on Council of Ministers Decision No. 1341/ 1995 and the ministerial decision No. 1/ 1995. Reclamation and construction is controlled under specific regulations. In 2006 it was declared as a completely protected area.

6.2.3: Hawar Islands:

Hawar Islands and regional waters were declared as protected by Council of Ministers Decision No. 16/ 1996.

6.2.4: Mashtan Island:

Mashtan Island and the surrounding waters were declared as protected by Council of Ministers Decision No. 1/ 2002.

6.2.5: Dohat Arad:

Dohat Arad is a small embayment in Muharraq Island. It is a migratory bird's site. It was declared as a protected area by a decision of the Chairman of the Public Commission for the Protection of Marine Resources, Environment & Wildlife (Decision No. 4/ 2003).

6.2.6: Hayr Bulthama:

This habitat represents oyster beds (locally known as *Hayr*). This area was declared as marine protected area by the environmental authority (Decision No. 8/ 2007). This site, in addition to Hayr Shutaya and Hayr Bu Amamah, were declared as UNESCO Heritage Sites.

6.2.7: Al Areen Wildlife Park and Reserve:

Al Areen Wildlife Park and Reserve was established in 1976 with the main objective to protect endangered Arabian animal species such as the Oryx and the Reem Gazelle in addition to the conservation of natural habitats and its animal and plant components.

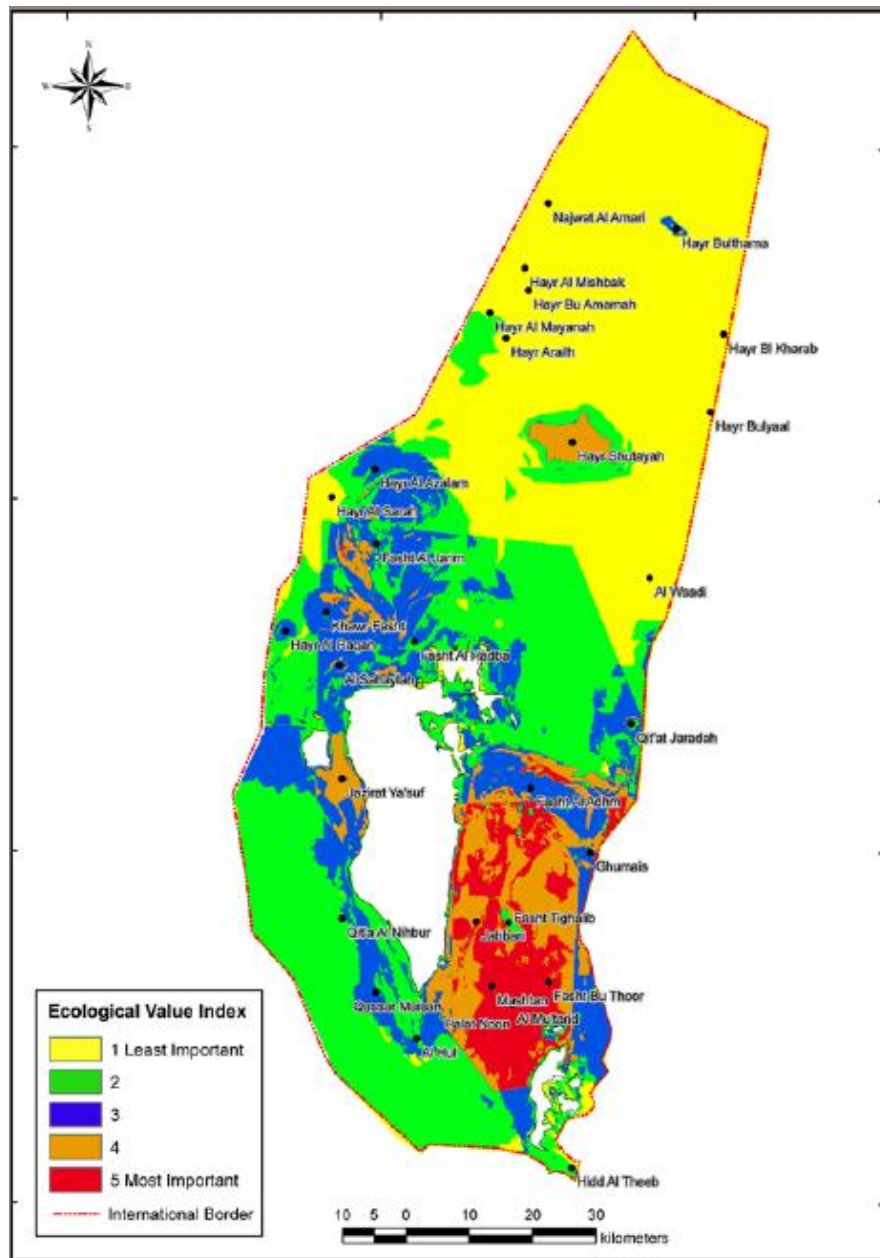
6.3 Sites of International Recognition

Bahrain recognized the significance of identifying and protecting ecologically important sites at the local as well as at the international level. In this line, Bahrain was successful in listing under RAMSAR wetland sites of international significance Hawar Islands and Tubli Bay.

Hawar is an archipelago of 36 small desert islands (of which the largest covers 4.1ha) and islets in the Gulf of Bahrain, surrounded by shallow seas with extensive seagrass beds. The islands are in relatively pristine condition because access is severely restricted by the coast guard and military. The islands support one of the world's largest concentrations of the Socotra Cormorant, and significant numbers of Greater Flamingo and Black-headed Gull. Notable marine species in the surrounding waters include the endangered dugong and several species of marine turtles.

Tubli Bay is a state-owned; natural reserve at Ras Sand. A sheltered bay with extensive intertidal mud/sand flats south of the capital city Manama. The only remaining natural mangrove stand in the country is located at Ras Sand in the southwest corner of the site. This is an important nursery area for commercially-important prawns and fish and an important wintering area for up to 45 species of water birds. Land use within and around the site is limited to small-scale commercial fishing, recreation and cultivation.

In addition to the above sites, traditional pearl oyster beds locally known as Hayr Shutaya, Hayr Bulthama, and Hayr Bu Amamah were included, as part of Pearling, testimony of an island Economy on the UNESCO World Heritage Sites. In addition, Bahrain Fort (Qalat Al Bahrain) and its surrounding area of natural vegetation and date palm groves was also listed on the UNESCO World Heritage Sites. Fig.3 shows a map of territorial waters of Bahrain with the ecological value index of marine habitats including the three pearl oyster beds (Zayani et al, 2009).



7 STATUS OF BIODIVERSITY

7.1 DPSIR FRAMEWORK

The DPSIR framework (Driving Forces-Pressures-State-Impacts-Responses) is used to assess and manage environmental problems. Driving forces are the socio-economic and socio-cultural forces driving human activities, which increase or mitigate pressures on the environment. Pressures are the stresses that human activities place on the environment. State, or state of the environment, is the condition of the environment. Impacts are the effects of environmental degradation. Responses refer to the responses by society to the environmental situation. This graphic explains the DPSIR process (GRID, 2015).

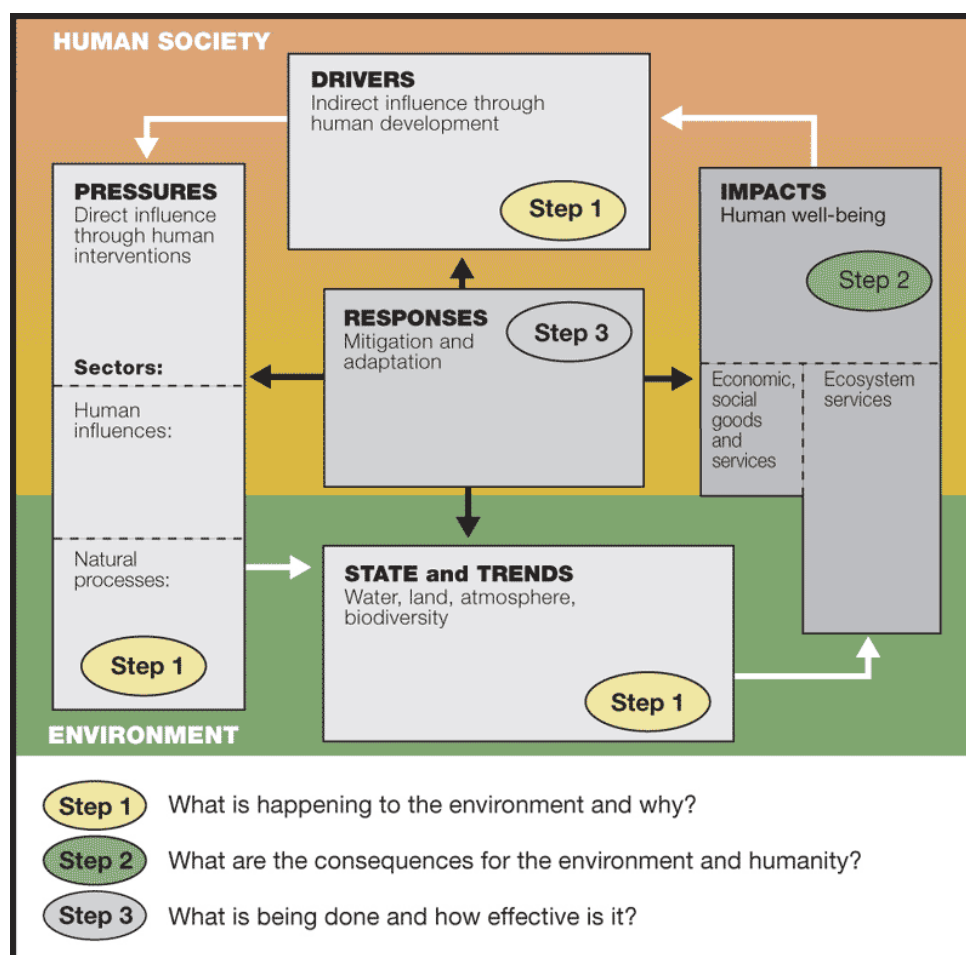


Fig.4 UNEP DPSIR Model (Source: <http://www.unep.org/ieacp/graphic.aspx?f=grb/fig4-8.gif>)

The following tables represent the result of questionnaires structured based on DPSIR components and implemented according to Delphi technique, where questionnaire was sent over 2 rounds to more than 70 experts and stakeholders in the area of environment and biodiversity. Results were analyzed and answers were ranked according to the statistical mode of responses (most frequent answer) or percentage of agreement on certain rubric. In addition to the DPSIR components (Driving Forces-Pressures-State-Impacts-Responses), specialists were asked about priorities and actions that should be taken to protect biodiversity. It is important to mention here that in addition to the main ecosystems covered in this report (marine, desert, and agriculture ecosystem), freshwater springs and stream ecosystem (a small ecosystem/ habitat within agriculture ecosystem) was also included in the questionnaire. This ecosystem was included because very little is known about it and it is believed that it is under severe threat and mostly degraded.

7.1.1 DRIVERS: HUMAN NEEDS

This represents fundamental processes in society that reflect human needs and services of the environment and ecosystems. Respondents listed marine ecosystem and agriculture ecosystem as the most important service providing ecosystems (Table 20), and seagrass beds, coral reefs, and algal beds as the most important habitats in Bahrain.

Table 20. Ranking of Ecosystems According to Services Importance

| Ecosystem | Ranking |
|--------------------------------|---------|
| Marine Ecosystem | 1 |
| Agricultural Ecosystem | 2 |
| Freshwater Springs and Streams | 3 |
| Desert Ecosystem | 4 |

Table 21. Ranking of Habitats According to Services Importance

| Habitat | Ranking |
|---------------|---------|
| Seagrass beds | 1 |
| Coral Reef | 2 |
| Algal beds | 3 |
| Mangrove | 4 |
| Coasts | 5 |
| Mudflats | 6 |
| Pearl Beds | 7 |

7.1.2. PRESSURES: HUMAN ACTIVITIES

Human interventions or practices cause changes in the state of the ecosystem. Respondents indicated that the main pressures on the marine ecosystem are land reclamation, overfishing, pollution, and dredging (Table 22); pollution, urbanization, and camping (Table 23); pollution, urbanization, and leaving the profession of agriculture on agriculture ecosystem (Table 24); overuse of ground water, and dredging and reclamation on water springs and streams (Table 25).

Table 22. Ranking of Pressures on Marine Ecosystem

| Pressure | Ranking |
|--|---------|
| Land Reclamation | 1 |
| Overfishing | 2 |
| Pollution | 3 |
| Dredging | 4 |
| Industrial Wastes | 5 |
| Fishing without study | 6 |
| Desalination | 7 |
| Climate Change | 8 |
| Ballistic Waters | 9 |
| Domestic Waste | 10 |
| Increase in the consumption of marine products | 11 |

Table 23. Ranking of Pressures on Desert Ecosystem

| Impacts | Ranking |
|------------------------------------|---------|
| Pollution | 1 |
| Urbanization | 2 |
| Camping | 3 |
| Industries and other Constructions | 4 |
| Climate Change | 5 |
| Hunting Desert Animals | 6 |
| Damaging Habitats | 7 |
| Rocks and Sand Excavation | 8 |
| Plant Cutting | 9 |

Table 24. Ranking of Pressures on Agriculture Ecosystem

| Impacts | Ranking |
|---------------------|----------------|
| Urbanization | 1 |
| Pollution | 2 |
| Leaving Agriculture | 3 |
| Climate Change | 4 |
| Introduced Insects | 5 |
| Irrigation Systems | 6 |
| Alien Plants | 7 |

Table 25. Ranking of Pressures on Spring Ecosystem

| Impacts | Ranking |
|------------------------------------|----------------|
| Overuse of ground water | 1 |
| Dredging and Reclamation | 2 |
| Urbanization | 3 |
| Weak Management of Water Resources | 4 |
| Pollution | 5 |
| Conversion to Modern Methods | 6 |
| Digging Private Wells | 7 |

7.1.3 STATE: CONDITION OF ECOSYSTEM

State reflects the condition of the environment or the ecosystem and changes and trends resulting from the pressures. The qualitative interpretation of excellent is that over 90% of the ecosystem is intact, very good is 70-90% intact, good is 50-70% intact, bad is 20-50 intact, and very bad is 0-20% intact. The majority of respondents (Table 26) indicated that the physical state of the marine ecosystem ranges between good and bad (highest is good 55%), the chemical state ranges between good and bad (highest is good 51.8%), the state of species and communities ranges between good and bad (highest is bad 42.3%); physical state of the desert ecosystem ranges between very good and bad (highest is good 48.1%), the chemical state ranges between very good and bad (highest is good 56%), the state of species and communities ranges between good and bad (highest is good 59.2%); physical state of the agriculture ecosystem ranges between very good and bad (highest is good 55.5%), the chemical state ranges between very good and bad (highest is good 52%), the state of species and communities ranges between good and bad (highest is good 52%); physical state of the freshwater springs and streams ecosystem ranges between bad and very bad (highest is very bad 54%), the chemical state ranges between bad and very bad (both at 45.8%), the state of species and communities ranges between very bad and bad (highest is very bad 58.3%).

Table 26. State of Ecosystems Expressed as Percentage of Respondents

| Pressure | Excellent | Very Good | Good | Bad | Very Bad |
|---------------------------------------|-----------|-----------|------|------|----------|
| Marine Ecosystem | | | | | |
| Physical Factors | 3.7 | 7.4 | 55.5 | 29.6 | 3.7 |
| Chemical Factors | 0 | 7.4 | 52 | 37 | 3.7 |
| Species and Communities | 0 | 15.3 | 38.5 | 42.3 | 3.8 |
| Desert Ecosystem | | | | | |
| Physical Factors | 0 | 29.7 | 48.1 | 22.2 | 0 |
| Chemical Factors | 0 | 20 | 56 | 24 | 0 |
| Species and Communities | 0 | 7.4 | 59.2 | 33.3 | 0 |
| Agriculture Ecosystem | | | | | |
| Physical Factors | 3.7 | 14.8 | 55.5 | 22.2 | 3.7 |
| Chemical Factors | 0 | 16 | 52 | 28 | 4 |
| Species and Communities | 0 | 8 | 56 | 32 | 4 |
| Freshwater Springs and Streams | | | | | |
| Physical Factors | 0 | 0 | 4.2 | 41.6 | 54 |
| Chemical Factors | 0 | 0 | 8.3 | 45.8 | 45.8 |
| Species and Communities | 0 | 0 | 8.3 | 33.3 | 58.3 |

Degree of Pressure on Ecosystems:

Table 27 shows the degree of human pressures on the state of each of the ecosystems. Values show that the highest pressure is on the marine ecosystem (96% of respondents); moderate pressure is on desert ecosystem (53.8%); high pressure on agriculture ecosystem (64%), and on freshwater springs and streams (88%).

Table 27. Degree of Human Pressure on State of Ecosystems

| Ecosystem/Habitat | High | Moderate | Low | I don't Know |
|---------------------------------------|-------------|-----------------|------------|---------------------|
| Marine Ecosystem | 96 | 4 | 0 | 0 |
| Desert Ecosystem | 28 | 53.8 | 16 | 3.4 |
| Agriculture Ecosystem | 64 | 32 | 4 | 0 |
| Freshwater Springs and Streams | 88 | 4 | 4 | 4 |

Ranking of Threatened Ecosystems and Habitats:

Table 28 lists ranking of threatened ecosystems and habitats as perceived by the stakeholders.

Table 28. Ranking of threatened ecosystems and habitats

| Ecosystem/Habitat | Ranking |
|---------------------------------------|----------------|
| Freshwater Springs and Streams | 1 |
| Coral Reefs | 2 |
| Seagrass and algal beds | 3 |
| Mangrove | 4 |
| Agriculture habitats | 5 |
| Desert Ecosystem | 6 |
| Salt marshes | 7 |
| Pearl Oyster beds | 8 |
| Migratory birds habitats | 9 |
| Date palm plantations | 10 |
| Temporary pools | 11 |
| Rocky shores | 12 |

Trends of Biodiversity of Ecosystems:

Table 29 shows the trend of the state of biodiversity of ecosystems over the next 5 years as predicted by respondents. The results indicate that the trend in the marine ecosystem and the freshwater springs and streams is negative (48% and 63% of respondents, respectively); trend in desert and agriculture ecosystems is constant (55% and 48%, respectively) and

Table 29. Trends of Biodiversity of Ecosystems over the Next 5 Years
(% of Responses)

| Ecosystem/Habitat | Positive | Constant | Negative | I don't Know |
|--------------------------------|----------|----------|----------|--------------|
| Marine Ecosystem | 11 | 33 | 48 | 7 |
| Desert Ecosystem | 4 | 55 | 18 | 22 |
| Agricultural Ecosystem | 15 | 48 | 26 | 11 |
| Freshwater Springs and Streams | 4 | 18 | 63 | 15 |

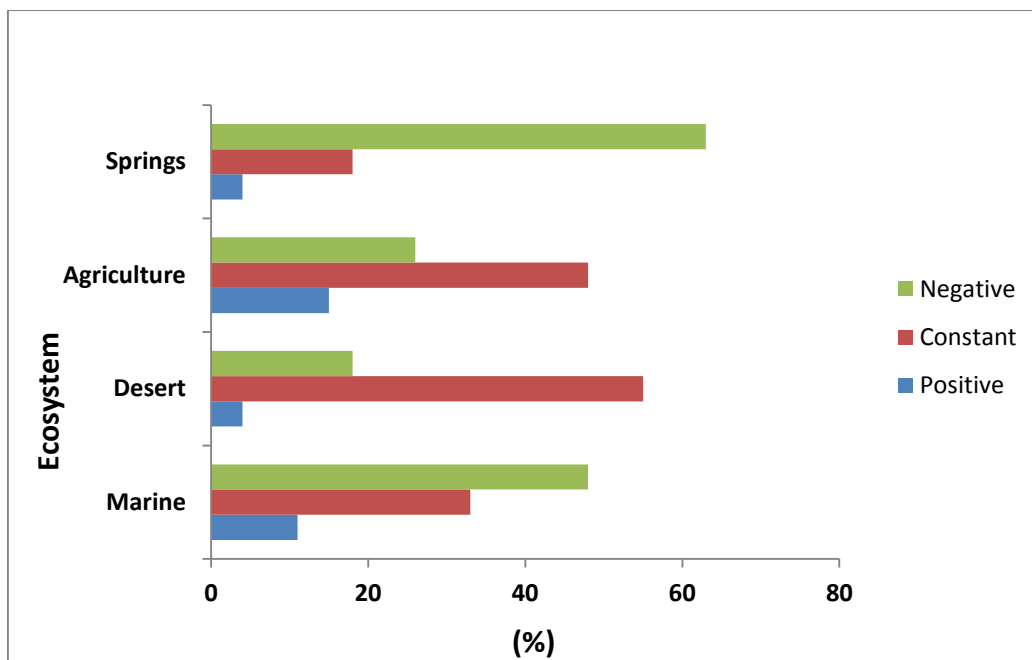


Fig. 5. Trends of Biodiversity of Ecosystems over the Next 5 Years (% of Responses)

7.1.4 IMPACT: The outcome of pressures on ecosystem services

Environmental change due to pressure may positively or negatively influence human well-being through changes in ecological services and environmental stress. The following is an account of the main impacts on the services as listed by the respondents.

A. Marine Ecosystem

1. Increase of land area at the expense of marine area
2. Degradation of marine ecosystems/ habitats
3. Decline in the species abundance and richness
4. Increase in the prices of marine products
5. Decrease in the productivity of marine ecosystems

B. Desert Ecosystem

1. Degradation of ecosystems/ habitats
2. Erosion
3. Decrease of biodiversity

C. Agriculture Ecosystem

1. Salinization of irrigation water
2. Salinization of soil
3. Shortage of freshwater for irrigation
4. Decline in the species abundance and richness
5. Decrease in vegetation cover
6. Decrease in food security
7. Consumption of Resources

D. Freshwater Springs and Streams

1. Decline in water quality

7.1.5 RESPONSE: Decisions (Law/ Policy) in response to impact

Responses consist of elements among the drivers, pressures and impacts which may be used for managing society in order to alter the human – environment interactions. Drivers, pressures and impacts that can be altered by a decision-maker at a given scale are referred to as endogenous factors, while those that can't are referred to as exogenous factors. The following is a list of laws, policies, or actions taken to reduce the impact on ecosystems services and human well-being. These are ranked starting with those that mentioned more frequently than others (Table 30).

Table 30. Laws and Decisions taken to reduce the negative effects on Marine Ecosystem

| No. | Title | Law/ Decision No. |
|-----|---|-----------------------|
| 1 | Banning of fishing or circulate or sell shrimp | Decision No. 1/ 2007 |
| 2 | Considering Tubli Bay as natural protected area | Law No. 53/ 2006 |
| 3 | Regulating the fishing and using and protection of marine resources | Law No. 20/ 2002 |
| 4 | Approval of Kuwait ROPME agreement | Law No. 17/ 1978 |
| 5 | Banning the hunting of all kinds sea cows, sea turtles, and dolphins | Decision No. 3/ 2003 |
| 6 | Ratification of the Convention of Biodiversity | Law No. 18/ 1996 |
| 7 | Joining convention on Wetlands of International Importance, especially as Waterfowl Habitat (RAMSAR) | Law No. 3/ 1997 |
| 8 | Banning reclamation of submerged land by seawater without licence | Decision 16/ 2005 |
| 9 | Joining the International Convention for the Prevention of Pollution from Ships (MARPOL) | Law No. 32/ 2005 |
| 10 | Ratification of Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal | Law No. 11/ 1992 |
| 11 | Establishment and organization of the Supreme Council for Environment | Law No. 47/ 2012 |
| 12 | Domestic waste water and disposal of surface water | Law No. 33/ 2006 |
| 13 | 2015-2018 Government Action Plan | Date 6/1/2015 |
| 14 | Projects Environmental Impact Assessment | Law No. 1/ 1998 |
| 15 | Environmental Law | Law No. 21/ 1996 |
| 16 | Reclamation line in Tubli Bay | Decision No. 70/ 2011 |
| 17 | Establishment of the Directorate of Biodiversity | |
| 18 | Ratification of United Nations Framework Agreement on Climate Change | Law No. 7/ 1994 |
| 19 | Protection of beaches, coasts, and marine entries | Law No. 20/ 2006 |
| 20 | Reorganization of National Commission for the Protection of Marine Resources, Environment and wildlife | Law No. 43/ 2005 |
| 21 | Ratification of Protocol on Marine Pollution arising from Exploration and Exploitation of Continental Drift | Law No. 9/ 1990 |
| 22 | Ratification of Stockholm Convention on Persistent Organic Pollutants | Law No. 39/ 2005 |
| 23 | Stopping of fish and shrimp catchment licence issuance | Decision No. 1/ 2009 |
| 24 | Pearl oysters beds protected areas | Decision No. 8/ 2007 |
| 25 | Regulation of Sea sand excavation | Law No. 47/ 2014 |

Table 31. Laws and Decisions taken to reduce the negative effects on Desert Ecosystem

| No. | Title | Law/ Decision No. |
|-----|--|----------------------|
| 1 | Protection of wildlife | Decision No. 2/ 1995 |
| 2 | Banning of hunting and trade of all species of hubara and Bahraini bubul | Law No. 2/ 2005 |
| 3 | Establishment and organization of the Supreme Council for Environment | Law No. 47/ 2012 |
| 4 | Best camp competition | |
| 5 | Camping requirements | |
| 6 | Urban Planning | Law No. 2/ 1994 |
| 7 | Establishment of the Directorate of Biodiversity | |
| 8 | Environmental Law | Law No. 21/ 1996 |
| 9 | Joining The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa | Law No. 9/ 1997 |
| 10 | Ratification of Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal | Law No. 11/ 1992 |
| 11 | Joining Cartagena Protocol on Biosafety to the Convention on Biological Diversity | Law No. 2/ 2011 |

Table 32. Laws and Decisions taken to reduce the negative effects on Agriculture Ecosystem

| No. | Title | Law/ Decision No. |
|-----|---|-----------------------|
| 1 | Agriculture quarantine | Decision No. 20/ 1983 |
| 2 | Veterinarian quarantine | Law No. 5/ 1982 |
| 3 | Date palm protection | Law No. 21/ 1983 |
| 4 | Establishment and organization of the Supreme Council for Environment | Law No. 47/ 2012 |
| 5 | Urban Planning | Law No. 2/ 1994 |
| 6 | Banning of hunting and trade of all species of hubara and Bahraini bubul | Law No. 2/ 2005 |
| 7 | National Initiative for Agricultural Development | |
| 8 | Environmental Law | Law No. 21/ 1996 |
| 9 | Pesticides | Law No. 11/ 1989 |
| 10 | Establishment of the Directorate of Biodiversity | |
| 11 | Banning date palm and others from countries infested by date palm insects | Decision No. 3/ 2006 |
| 12 | Ratification of the Convention of Biodiversity | Law No. 18/ 1996 |
| 13 | Establishment of National Committee for Biodiversity | Law No. 81/ 2011 |
| 14 | Approval of EIA consultation offices by Environmental Affairs | Decision No. 3/2000 |
| 15 | Approval of Law of fertilizers and agriculture soil amendments in GCC | Law No. 38/ 2005 |

Table 33. Laws and Decisions taken to reduce the negative effects on freshwater springs and streams Ecosystem

| No. | Title | Law/ Decision No. |
|-----|---|---------------------|
| 1 | Regulating the use of ground water | Law No. 12/ 1980 |
| 2 | Establishment and organization of the Supreme Council for Environment | Law No. 47/ 2012 |
| 3 | Tariffs of consumption of ground water | Law No. 4/ 1985 |
| 4 | Establishment of the Directorate of Biodiversity | |
| 5 | Environmental Law | Law No. 21/ 1996 |
| 6 | Approval of EIA consultation offices by Environmental Affairs | Decision No. 3/2000 |
| 7 | Regulation of agriculture drainage | Law No. 4/ 1985 |

7.2 PRIORITIES

The following tables represent the stakeholder's priorities and actions suggested to reduce the negative impacts on ecosystems ranked based on percentage of responses.

Table 34. Ranking of Priorities for Marine Ecosystem

| No. | Priority | Ranking |
|-----|---|---------|
| 1 | Implement Laws Supportive of Biodiversity | 1 |
| 2 | Regulate dredging and reclamation | 2 |
| 3 | Implement environmental awareness programs at all Levels | 3 |
| 4 | Establish and implement an effective policy for the protection of sensitive marine habitats | 4 |
| 5 | Restore coral reefs | 4 |
| 6 | Finance and carryout scientific studies in cooperation with universities and government departments | 5 |
| 7 | Build capacities and carryout programs for the qualifications of workers in this field | 5 |
| 8 | Control fishing and fishermen work | 5 |
| 9 | Monitor commercial and fishing ships | 5 |
| 10 | Join international agreements | 6 |
| 11 | Strengthen executive governmental departments | 6 |
| 12 | Regulate discharge of industrial wastes | 6 |
| 13 | Immediate treatment for all types of pollutants | 6 |
| 14 | Implement sustainable management of environment | 6 |
| 15 | Work towards increasing the abundance of marine organisms | 6 |
| 16 | Establish and manage protected areas | 6 |
| 17 | Safe management of marine stock | 6 |

Table 35. Ranking of Priorities for Desert Ecosystem

| No. | Priority | Ranking |
|------------|--|----------------|
| 1 | Implement environmental awareness programs at all Levels | 1 |
| 2 | Introduce and Implement Laws Supportive of Biodiversity | 1 |
| 3 | Regulate urbanization and human activities | 2 |
| 4 | Establish protected areas | 3 |
| 5 | Finance and carryout scientific studies in cooperation with universities and government departments | 4 |
| 6 | Implement sustainable management of environment | 4 |
| 7 | Seek international support for building capacity | 4 |
| 8 | Join international agreements | 5 |
| 9 | Strengthen executive governmental departments | 5 |
| 10 | Conserve genetic diversity | 5 |
| 11 | Control camping | 5 |

Table 36. Ranking of Priorities for Agriculture Ecosystem

| No. | Priority | Ranking |
|------------|--|----------------|
| 1 | Create a balance between urbanization and increase of agriculture area | 1 |
| 2 | Introduce and Implement Laws Supportive of Biodiversity | 2 |
| 3 | Introduce a plan to increase agricultural activities | 3 |
| 4 | Implement environmental awareness programs at all Levels | 3 |
| 5 | Build the capacity and qualify farmers | 4 |
| 6 | Manage water resources efficiently | 5 |
| 7 | Support efforts to maintain agriculture profession | 6 |
| 8 | Join international agreements | 6 |
| 9 | Strengthen executive governmental departments | 6 |
| 10 | Finance and carryout scientific studies in cooperation with universities and government departments | 6 |
| 11 | Implement sustainable management of environment | 6 |
| 12 | Establish protected areas | 6 |
| 13 | Conserve genetic diversity | 6 |
| 14 | Implement efficient management of pests | 6 |

Table 37. Ranking of Priorities for Freshwater Springs and Streams Ecosystem

| No. | Priority | Ranking |
|------------|--|----------------|
| 1 | Introduce a policy to conserve and maintain springs | 1 |
| 2 | Introduce and Implement Laws Supportive of Biodiversity | 2 |
| 3 | Implement environmental awareness programs at all Levels | 3 |
| 4 | Stop digging for new artesian wells and stop projects or activities harmful to springs | 3 |
| 5 | Carryout field surveys to determine status of springs | 4 |
| 6 | Implement sustainable management of environment | 4 |
| 7 | Establish protected areas | 4 |
| 8 | Build capacities and carryout programs for the qualifications of workers in this field | 4 |
| 9 | Support efforts to maintain agriculture profession | 5 |
| 10 | Join international agreements | 5 |
| 11 | Strengthen executive governmental departments | 5 |
| 12 | Finance and carryout scientific studies in cooperation with universities and government departments | 5 |
| 13 | Organize recreational activities to conserve springs | 5 |
| 14 | Establish desalination plants to conserve springs | 5 |

Many of the priorities listed above by stakeholders are overlapping among the different ecosystems. In addition, some are not in line with the concept of the biodiversity objectives, particularly in the agriculture ecosystem. Therefore, the above priorities were analyzed and refined by the consultant. In addition, consultation with stakeholders including primary and secondary as well as specialists in the field, the following table represents priorities by stakeholders and suggestions by the consultant stated as actions and mapped to Aichi Targets (Table 38) to be in line with the NBSAP objectives and strategy (Table 38).

Table 38. Mapping of Actions to Aichi Targets

| Aichi Targets | | Actions | |
|---------------|---|---------|---|
| 1 | By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably. | 1 | Introduce awareness programmes and campaigns at all levels. |
| 2 | By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems. | 2 | Encourage industry and private sectors to participate more effectively in plans directed towards biodiversity protection and sustainable development. |
| | | 3 | Mainstream mandates and efforts for the protection of biodiversity and its sustainability and to introduce the concept of biodiversity protection and sustainable development in all sectors. |
| | | 4 | Ratify the membership in biodiversity-related international agreements conventions. |
| | | 5 | Regulate urbanization and human activities affecting biodiversity through mainstreaming. |
| 3 | By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions. | | |
| 4 | By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits. | 6 | Implement sustainable management of production and consumption of natural resources. |

Table 38. Mapping of Actions to Aichi Targets

| Aichi Targets | | Actions | |
|---------------|--|---------|--|
| 5 | By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. | | |
| 6 | By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits. | 7 | Monitor fishing by fishers and commercial fishing vessels. |
| | | 8 | Safe management of marine resources stock. |
| 7 | By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity. | 9 | Create a balance between urbanization and increasing agricultural areas and use of native species in agriculture |
| | | 10 | Build institutional and human capacities in agriculture ensuring conservation of biodiversity |
| | | 11 | Implement efficient management of pests and invasive species control |
| | | 12 | Carryout field surveys to determine status of fresh water springs and their sustainability |
| 8 | By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity. | 13 | Regulate discharges and efficiently treat industrial and anthropogenic pollutants and wastes into ecosystems |

Table 38. Mapping of Actions to Aichi Targets

| Aichi Targets | | Actions | |
|---------------|--|---------|---|
| 9 | By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment. | 14 | Manage and control the discharge of ballistic waters and other sources of invasive alien species |
| 10 | By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning. | 15 | Strengthen environmental monitoring programmes to reduce the pressures and threats by human activities on the biodiversity of coral reefs, mangroves, and other important ecosystems. |
| | | 16 | Introduce and implement Integrated Coastal Zone Management plan to manage and protect the coastal and marine environment. |
| | | 17 | Regulate and efficiently control dredging and reclamation |
| 11 | By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape. | 18 | Establish and implement an effective policy for the protection of sensitive marine habitats |
| | | 19 | Establish and manage protected areas |
| 12 | By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained. | 20 | Carryout quantitative surveys of species and populations to determine threatened or endangered species. |
| | | 21 | Introduce plans and mechanisms to protect and conserve threatened species and their habitats |

Table 38. Mapping of Actions to Aichi Targets

| Aichi Targets | | Actions | |
|---------------|--|---------|--|
| 13 | By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity. | 22 | Develop a gene bank of date palm cultivars. |
| 14 | By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable. | 23 | Determine the values of marine, desert, and agriculture ecosystems services and consider and integrate these values in the national developmental plans. |
| 15 | By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification. | | |
| 16 | By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation. | | |
| 17 | By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan. | 24 | Adopt a mechanism to monitor, update, and unify information and data related to biodiversity. |
| | | 25 | Introduce a process for the effective implementation of laws and decisions for the protection of environment and biodiversity. |
| | | 26 | Review biodiversity protection policies and decisions to be in line with up to date information about biodiversity |

Table 38. Mapping of Actions to Aichi Targets

| Aichi Targets | | Actions | |
|---------------|--|---------|--|
| 18 | By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels. | | |
| 19 | By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied. | 27 | Carryout surveys and studies to fill gaps in the biodiversity data, particularly of fauna. |
| | | 28 | Carryout surveys and studies to update the available biodiversity data and checklists. |
| 20 | By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resources needs assessments to be developed and reported by Parties. | 29 | Strengthen the role of the Supreme Council for Environment particularly the Directorate of Biodiversity. |
| | | 30 | More emphasis on biodiversity and ecosystem services protection and sustainable use in the plan the Government Action Plan. |
| | | 31 | Finance and carryout scientific studies in cooperation with universities and government departments Strengthen executive governmental departments. |

8 CONCLUSIONS AND RECOMMENDATIONS FOR NATIONAL STRATEGY

The environment in Bahrain is diverse with the main ecosystems including marine, desert, and agriculture ecosystem. Although the area of Bahrain is small, biodiversity at the ecosystem, species, and genetic level is noticeable. The total species of the flora and fauna is around 1425 ranging between those from the marine, to the desert, to the agriculture, and the temporary pools. There are a number of species with regional or international importance. The Kingdom of Bahrain recognized the importance of environment, biodiversity, and ecosystems services. This was reflected in a wide array of laws, decisions, and multilateral environmental agreements such as the ratification of the Convention of Biological Diversity. However, because of the small size of the country and the high population density, pressures on the biodiversity are many and ranging from low impact to high impact on the state of the ecosystems.

The following are some recommendations of prime importance that are derived from priorities proposed by NBSAP workshops participants, discussions with stakeholders and specialists in the field, as well as the consultant own experience. All of these were reflected in the proposed actions listed in Table (38):

1. There are many gaps in the biodiversity data, particularly of fauna, that require bridging. Also, there are available data and checklists of a number of plant and animal groups. However, these checklists are mostly very old and do not represent the up-to-date species lists. There is a need to carryout surveys and studies to update the available biodiversity data and checklists. Therefore, it is recommended to to establish a national biodiversity team of experts to fill the gaps, update the information, and create a database with taxonomic classification of the different speies.
2. There is contradictory information about the availability and status of freshwater springs and streams. Therefore, there is a need to conduct surveys and studies of these ecosystems and habitats.
3. Introduce awareness programmes and campaigns about biodiversity and its role in ecosystem services at all levels.
4. It was noticed that there are many declared laws and decisions for the protection of environment and biodiversity. However, there is a general consensus to introduce a process for the effective implementation of these laws and decisions.
5. Mandates and efforts for the protection of biodiversity and its sustainability are mostly scattered and and hardly coordinated. There is a need to mainstream

these mandates and efforts and to introduce the concept of biodiversity protection and sustainable development in all sectors.

6. Strengthen environmental monitoring programmes to reduce the pressures and threats by human activities on the biodiversity.
7. Bahrain is a small island country. Coasts are very important and provide many services and benefits. There is a need to introduce and implement Integrated Coastal Zone Management plan to manage and protect the coastal and marine environment.
8. There is a need to properly evaluate the value of the marine, desert, and agriculture ecosystems services and consider and integrate these values in the national developmental plans.

9 REFERENCES

- Abbas, J.A., El-Oqlah, A.A. and Mahasneh, A.M. 1992. Herbal plants in the traditional medicine of Bahrain. *Economic Botany*, 46: 158-163.
- Abbas, J.A. and Alsaleh, F.S. 2002. *Medicinal Plants of Bahrain*. University of Bahrain (In Arabic).
- Abdulla, A. 2015. *Ecosystem Services Assessments*. Report to Supreme Council for Environment, Bahrain.
- Abdulla, S. 2008. Desert natural environments in Kingdom of Bahrain. In: *Environment in Kingdom of Bahrain- Reality and Challenges*. Ed.: Musaiger, A. O. and Zayani, K.A. Bahrain Centre for Studies and Research (In Arabic).
- Al-Baharna, W. 1986. *Fishes of Bahrain*. Ministry of Commerce and Agriculture, Directorate of Fisheries; 1st edition
- Alkhuzai, J., Sheppard, C., Abdulqader, E.A., Alkhuzai, S.A., Loughland, R.A. 2009. Subtidal habitats. In: *Marine Atlas of Bahrain*. Ed.: Loughland, R.A and Zainal, A.M. Miracle Publishing, Bahrain.
- Alkhuzai, S. and Zainal, K. 2009. In: *Marine Atlas of Bahrain*. Ed.: Loughland, R.A and Zainal, A.M. Miracle Publishing, Bahrain.
- Alkhuzai, J.A., Mandeel, Q.A. and Al-laith, A.A. 2010. Folk medicine and the use of herbal plants in the Kingdom of Bahrain. *Arabian Gulf Journal of Scientific Research*. 28: 91-105.
- Allaith, A. 2008. Antioxidant activity of Bahrain date palm (*Phoenix dactylifera* L.) of various cultivars. *International Journal of Food Science and Technology*. 43:1033-1040.
- Almadani, I.M. and Elsayed, H.A. 2000. *Bahrain marine environment*. National Commission for the Protection of Wildlife (In Arabic).
- Almansoori, T., Al-Khalifa, M., Mohamed, A. 2015. Date palm status and perspectives in Bahrain. In: *Date Palm Genetic Resources and Utilization*. Vol. 2: Asia and Europe. Al-Khayri, J.M., Jain, S.M., and Johnson, D.V. (Editors). Springer.
- Al Mealla, R. 2014. *Application of Ecosystem Based Approach in the Kingdom of Bahrain: The analysis of various Socio-Economic aspects of the Oyster Beds*. The Supreme Council for Environment.

Al-Sayed, H. and Zainal, K. 2005. The occurrence of Anostracans—Fairy shrimps *Branchipus schaefferi* in vernal pools of Bahrain. *Journal of Arid Environments*, 61: 447–460.

Al-Wedaei, K., Naser, H., Al-Sayed, H. and Khamis, A. 2011. Assemblages of macro-fauna associated with two seagrass beds in Kingdom of Bahrain: Implications for conservation. *Journal of the Association of Arab Universities for Basic and Applied Sciences*, 10: 1-7.

Alzayani, A.K. 2009. Environmental policies and directions in the Kingdom of Bahrain. 2009. In: *Environment in Kingdom of Bahrain- Reality and Challenges*. Ed.: Musaiger, A. O. and Zayani, K.A. Bahrain Centre for Studies and Research (In Arabic).

AMRA (2014). Report on role of agriculture and marine resources in biodiversity. Agriculture and Marine Resources Affairs. Ministry of Municipal Affairs and Urban Planning.

Assiery, E.A. 2015. Nutritional composition of fruit of 10 date palm (*Phoenix dactylifera* L.) cultivars grown in Saudi Arabia. *Journal of Taibah University of Science*, 9: 75-79.

Basson, P.W., Mohamed, S.A. and Arora, D.K. 1989. A survey of the benthic marine algae of Bahrain. *Botanica Marina*, 32: 27-40.

B.N.H.S. 1984. Wildlife in Bahrain. Third Biennial Report of the Bahrain Natural History Society. Ed.: Mike Hill and Tom Nightingale.

B.N.H.S. 1987. Wildlife in Bahrain. Fourth Biennial Report of the Bahrain Natural History Society. Ed.: Tom Nightingale and Martin Overy.

B.N.H.S. 1990. Wildlife in Bahrain. Bahrain Natural History Society. Fifth Edition. Bahrain

CBD (2015). Convention of Biological Diversity.
<https://www.cbd.int/convention/articles/default.shtml?a=cbd-02>

Cornes, M.D. and Cornes, C.D. 1989. The wild flowering plants of Bahrain. Immel Publishing Limited, London.

Doornkamp, J.C., Brunsden, D., Jones, D.K.C. 1980. Geomorphology and Pedology of Bahrain. Geoabstract, Norwich.

EEA (European Environment Agency), 2015. Environment Indicators: Typology and overview. Technical report No. 25. <http://www.eea.europa.eu/publications/TEC25>

El-Oqlah, A.A. and Abbas, J.A. 1992. Preliminary studies on the natural flora and vegetation of Bahrain. *Dirasat*, 19: 123-137.

El-Oqlah, A.A. and Abbas, J.A. 1994. A checklist of vascular plants of Bahrain. Dirasat, 21B: 95-118.

EPA (Environmental Protection Agency), 2015. Tutorials on Systems Thinking using the DPSIR Framework. <http://www.epa.gov/ged/tutorial/>

FAO, 2015. Date Palm Products. <http://www.fao.org/docrep/t0681e/t0681e02.htm>).

Ghallaigher, M. and Harrison, D. 1974. The terrestrial mammals of Bahrain. Journal of the Bombay Natural History Society. Vol. 72: 407-421.

Good, R.D.O. 1955. The flora of Bahrain. In: Dickson, V. (Ed.), The wild flowers of Kuwait and Bahrain. Allen & Unwin, London.

GRID, 2015. DPSIR framework for State of Environment Reporting. http://www.grida.no/graphicslib/detail/dpsir-framework-for-state-of-environment-reporting_379f

Kavanagh, B. 2014. Birds of Delmon. An introduction to the birds of Bahrain. Miracle Publishing Company.

Khamdan, S. 2004. Gulf Encyclopedia in Pearls and Oysters. Bahrain Centre for Studies and Research (In Arabic).

Mandeel, Q.A., Abbas, J.A., Saeed, A.M. 1995. Survey of *Fusarium* species in an arid environment of Bahrain. II. Spectrum of species on five isolation media. Sydowia, 47: 223-239.

Moore, A.B.M. and Pierce, R. 2013. Composition of elasmobranch landings in Bahrain. African Journal of Marine Science. Vol. 35: 593-596.

Naser, H. 2010. Using macrobenthos as a tool in ecological impact assessment: applications in Environmental Impact Assessment (EIA). Lambert Academic Publishing, Saarbrücken,

Nightingale, T., Hill, M. 1993. Birds of Bahrain. IMMEL Publishing.

OECD (Organisation for Economic Co-operation and Development), 1994. Environmental indicators - OECD Core Set, OECD, Paris.

Phillips, D.C. 1988. Wild flowers of Bahrain. Arabian Printing and Publishing House, Bahrain.

RAND, 2015. Delphi Method. <http://www.rand.org/topics/delphi-method.html>

SCE (Supreme Council for Environment), 2015. Bahrain Fifth National Report of Biological Convention of Biodiversity.

Sheppard, C., Al-Husiani, M., Al-Jamali, F., Al-Yamani, F., Baldwin, R., Bishop, J., Benzoni, F., Dutrieux, E., Dulvy, N., Durvasula, S., Jones, D., Loughland, R., Medio, D., Nithyanandan, M., Pilling, G., Polikarpov, I., Price, A., Purkis, S., Riegl, B., Saburova, M., Namin, K., Taylor, O., Wilson, S., Zainal, K., 2010. The Gulf: A young sea in decline. *Marine Pollution Bulletin* 60, 13–38.

UN (United Nations) Division for Sustainable Development, 1997. From theory to practice: Indicators for sustainable development. UN, New York.

Virgo, K.J. 1980. An introduction to the vegetation of Bahrain. In: *Wildlife in Bahrain. Annual Reports for 1978-1979*. Bahrain Natural History Society.

Vousden, D.H. 1988. The Bahrain marine habitat survey. A study of the marine habitats in the waters of Bahrain and their relationship to physical, chemical, biological and anthropogenic influences. Vol.1. The technical report. Environmental Protection Secretariat, Bahrain.

Zainal, A.M. and Loughland, R.A. 2009. Introduction. In: *Marine Atlas of Bahrain*. Ed.: Loughland, R.A and Zainal, A.M. Miracle Publishing, Bahrain.

Zainal, K., Al-Sayed, H., Al-Madany, I., 2008. Coastal pollution in Bahrain and its management. In: Abuzinada, A.H., Barth, H.J., Krupp, F., Boer, B., Al Abdessalam, T.Z. (Eds.), *Protecting the Gulf Ecosystems from Pollution*. Berkhauser Verlag, Switzerland

Zayani, A.K., Zainal, A.M. and Choudhury, P.R. 2009. An overview of the marine habitats of Bahrain. In: *Marine Atlas of Bahrain*. Ed.: Loughland, R.A and Zainal, A.M. Miracle Publishing, Bahrain.

10 ANNEXES

10.1 Annex 1

استبانة حول حالة التنوع البيولوجي في البحرين

(1)

عزيزي الشريك

ضمن جهود المجلس الأعلى للبيئة لدراسة حالة التنوع البيولوجي في البحرين في الوقت الحاضر، تم تجهيز هذه الاستبانة لمعرفة رأيك وجهة نظرك كشريك في حالة التنوع البيولوجي في البحرين في الجوانب التالية:

الدوافع: أي الاستخدامات والاحتياجات البشرية مثل الغذاء، الدواء، السياحة، الماء، وغيرها.

الضغوطات: أي الأنشطة البشرية مثل تغيير طبيعة الأراضي، استهلاك المصادر، التسبب بالتلوث، وغيرها.

الحالة: كيفية ونوعية متغيرات النظام البيئي الفيزيائية، والكيميائية، والبيولوجية (على مستوى الصنف والنوع والمجتمع والنظام البيئي).

التأثير: التأثير الناتج من الضغوطات وتغير حالة ووظيفة النظام البيئي على رفاهية الانسان

الاستجابة: القرارات والتشريعات التي تم وضعها للحد أو للتقليل من التأثيرات.

إن تعاونك معنا في الاستجابة لهذه الاستبانة وما يليها سوف يكون له أبعاد الأثر في صياغة الاستراتيجية الوطنية للتنوع البيولوجي. شاكرين ومقدرين لك تعاونك.

أولاً: معلومات عامة

| | | | | |
|------------------------------------|--------------------------------|------------------------------|-------------------------------------|---|
| الاسم | | | | |
| الوظيفة | | | | |
| الجهة الوظيفية | | | | |
| العلاقة بالتنوع البيولوجي (القطاع) | <input type="checkbox"/> حكومة | <input type="checkbox"/> خاص | <input type="checkbox"/> مجتمع مدني | <input type="checkbox"/> تعليم <input type="checkbox"/> أخرى <input type="checkbox"/> |

ثانياً: خدمات الأنظمة البيئية

1. ما هي أهم الأنظمة البيئية الخدماتية في البحرين من وجهة نظرك (مثال: الثروة السمكية، الزراعة، النباتات الطبية، الشعاب المرجانية، وغيرها)؟.

| التسلسل حسب الأهمية | النظام البيئي أو الخدمة |
|---------------------|-------------------------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |

2. ما هي أهم الضغوطات (راجع التعريف أعلاه) التي تؤثر على الأنظمة البيئية في البحرين؟

| التسلسل حسب الأهمية | الضغط |
|---------------------|-------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |

3. ما هي حسب معلوماتك أو اعتقادك حالة الأنظمة البيئية التالية في البحرين؟

| ممتازة | جيدة جداً | جيدة | سيئة | سيئة جداً | |
|--------|-----------|------|------|-----------|-----------------------------------|
| | | | | | أ. الأنظمة البيئية البحرية |
| | | | | | 1. العوامل الفيزيائية |
| | | | | | 2. العوامل الكيميائية |
| | | | | | 3. الأنواع والمجتمعات |
| | | | | | ب. الأنظمة البيئية البرية |
| | | | | | 1. العوامل الفيزيائية |
| | | | | | 2. العوامل الكيميائية |
| | | | | | 3. الأنواع والمجتمعات |
| | | | | | ج. الأنظمة البيئية الزراعية |
| | | | | | 1. العوامل الفيزيائية |
| | | | | | 2. العوامل الكيميائية |
| | | | | | 3. الأنواع والمجتمعات |
| | | | | | د. أنظمة العيون الطبيعية والجداول |
| | | | | | 1. العوامل الفيزيائية |
| | | | | | 2. العوامل الكيميائية |
| | | | | | 3. الأنواع والمجتمعات |

4. ما هي حسب معرفتك أو اعتقادك درجة التأثيرات السلبية للضغوط البشرية على النظم البيئية في البحرين؟

| عالية | متوسطة | متدنية | |
|-------|--------|--------|-----------------------------------|
| | | | أ. الأنظمة البيئية البحرية |
| | | | ب. الأنظمة البيئية البرية |
| | | | ج. الأنظمة البيئية الزراعية |
| | | | د. أنظمة العيون الطبيعية والجداول |

5. ما هي حسب معلوماتك أو اعتقادك أهم التأثيرات السلبية التي تؤثر على الأنظمة البيئية التالية في البحرين؟

| النظام البيئي | المؤثر السلبي |
|-----------------------------------|---------------|
| أ. الأنظمة البيئية البحرية | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| ب. الأنظمة البيئية البرية | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| ج. الأنظمة البيئية الزراعية | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| د. أنظمة العيون الطبيعية والجداول | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

6. ما هي حسب معلوماتك أهم القرارات أو التشريعات أو الخطط التي تم وضعها لتقليل التأثيرات السلبية التي تؤثر على الأنظمة البيئية التالية في البحرين؟

| النظام البيئي | القرارات أو التشريعات أو الخطط |
|-----------------------------------|--------------------------------|
| أ. الأنظمة البيئية البحرية | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| ب. الأنظمة البيئية البرية | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| ج. الأنظمة البيئية الزراعية | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| د. أنظمة العيون الطبيعية والجداول | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

7. ما هو حسب معلوماتك أو اعتقادك اتجاه التنوع البيولوجي للأنظمة البيئية التالية في البحرين؟

| النظام البيئي | اتجاه إيجابي | ثابت | إتجاه سلبي |
|-----------------------------------|--------------|------|------------|
| أ. الأنظمة البيئية البحرية | | | |
| ب. الأنظمة البيئية البرية | | | |
| ج. الأنظمة البيئية الزراعية | | | |
| د. أنظمة العيون الطبيعية والجداول | | | |

8. ما هي، حسب معلوماتك أو اعتقادك، أهم الأنواع المهددة بالانقراض في البحرين ؟ تستطيع أن تستخدم الاسم العلمي أو الاسم المتداول محلياً.

| النوع المهدد بالانقراض |
|------------------------|
| |
| |
| |
| |
| |

9. ما هي، حسب معلوماتك أو اعتقادك، أهم النظم البيئية أو الموائل المهددة بالزوال في البحرين ؟

| النظام البيئي أو الموئل المهدد بالزوال |
|--|
| |
| |
| |
| |
| |

شكراً على تعاونكم،،،،،

Annex. 2

إستبانة حول وضع التنوع البيولوجي في البحرين (المرحلة الثانية)

عزيزي الشريك

ضمن جهود المجلس الأعلى للبيئة لدراسة حالة التنوع البيولوجي في البحرين في الوقت الحاضر من أجل إعداد الإستراتيجية الوطنية للتنوع الحيوي وخطة العمل (NBSAP)، تم في مرحلة سابقة تجهيز وتوزيع إستبانة لمعرفة رأي ووجهة نظر الشركاء في وضع التنوع البيولوجي للأنظمة البيئية في البحرين من خلال الجوانب التالية:

الدوافع: أي الاستخدامات والاحتياجات البشرية مثل الغذاء، الدواء، السياحة، الماء، المحافظة على التنوع الجيني، وغيرها.

الضغوطات: أي الأنشطة البشرية المؤثرة في النظم البيئية مثل تغيير طبيعة الأراضي، التسبب بالتلوث، الصيد الجائر، وغيرها.

الحالة: حالة العوامل الفيزيائية (مثل: التضاريس، المساحة، تماسك التربة أو القاع، العمق، الضوء)، والكيميائية (مثل: الملوحة، العناصر الكيميائية، ثاني أكسيد الكربون)، والبيولوجية (على مستوى الصنف والنوع والمجتمع والنظام البيئي مثل: عدد الأنواع، وفرة الأنواع، الغطاء النباتي، المونل، الإنتاجية).

التأثير: نتيجة أو محصلة الضغوطات مثل: نقص الأنواع، قلة الغذاء، إزدياد الأمراض، نقص المياه، زيادة أسعار المنتجات.

الاستجابة: القرارات والتشريعات والاجراءات التي تم وضعها للحد أو للتقليل من التأثيرات السلبية.

وقد استجاب للاستبانة الأولى حوالي 40% من الذين أرسلت لهم، مما ساعدنا في التعرف على وجهة نظر المختصين والمستفيدين في وضع التنوع الحيوي في الأنظمة البيئية المختلفة، فلهم منا جزيل الشكر والتقدير.

وبناء على المعلومات الأولية التي حصلنا عليها من الاستبانة الأولى أعدنا هذه الاستبانة التي تبين بشكل أكثر دقة وجهة نظر الذين استجابوا للإستبانة الأولى. وفي هذه المرحلة الثانية والأخيرة نأمل من الجميع التعاون معنا في الاستجابة لهذه الاستبانة للتأكد من المعلومات التي استقيناه منكم لتحديد بصورة أدق وأوضح وضع التنوع الحيوي في البحرين.

إن تعاونك معنا في الاستجابة لهذه الاستبانة سوف يكون له أبعاد الأثر في صياغة الاستراتيجية الوطنية للتنوع البيولوجي. شاكرين ومقدرين لك تعاونك.

أولاً: معلومات عامة

| الاسم | |
|------------------------------------|--|
| الوظيفة | |
| الجهة الوظيفية | |
| العلاقة بالتنوع البيولوجي (القطاع) | حكومة <input type="checkbox"/> خاص <input type="checkbox"/> مجتمع مدني <input type="checkbox"/> تعليم <input type="checkbox"/> أخرى <input type="checkbox"/> |

ثانياً: الدوافع (الاحتياجات والاستخدامات البشرية):

1. يبين الجدول التالي ترتيب الأنظمة البيئية حسب أهميتها للاحتياجات والاستخدامات البشرية (الدوافع) وفقاً للمعلومات التي استقيناها من الاستبانة السابقة، فالنظام رقم 1 يعني أهم الأنظمة من وجهة نظر غالبية الذين استجابوا للإستبانة الأولى. يرجى اختيار الخانة التي تناسب وجهة نظرك في الجدول التالي:

| التسلسل حسب الأهمية | موافق تماماً | موافق لحد ما | غير موافق |
|------------------------------|--------------|--------------|-----------|
| 1 النظام البيئي البحري | | | |
| 2 النظام البيئي الزراعي | | | |
| 3 نظام العيون العذبة والجدول | | | |
| 4 نظام البيئة الصحراوية | | | |

2. يبين الجدول التالي ترتيب البيئات والموائل حسب أهميتها للاحتياجات والاستخدامات البشرية (الدوافع) وفقاً للمعلومات التي استقيناها من الاستبانة السابقة، فالنظام رقم 1 مثلاً يعني أهم البيئات من وجهة نظر غالبية الذين استجابوا للإستبانة الأولى. يرجى اختيار الخانة التي تناسب وجهة نظرك في الجدول التالي:

| التسلسل حسب الأهمية | موافق تماماً | موافق لحد ما | غير موافق |
|------------------------|--------------|--------------|-----------|
| 1 مهاد الحشائش البحرية | | | |
| 2 بيئة الشعب المرجانية | | | |
| 3 مهاد الطحالب البحرية | | | |
| 4 بيئة نبات القرم | | | |
| 5 السواحل | | | |
| 6 المسطحات الطينية | | | |
| 7 مهاد محار اللؤلؤ | | | |

ثالثاً: الضغوط (الأنشطة البشرية):

تبين الجداول التالية ترتيب **الضغوط** الناتجة من الأنشطة البشرية على النظم البيئية الرئيسية في البحرين وفقاً للمعلومات التي استقيناها من الاستبانة السابقة، فالضغط رقم 1 مثلاً يعني أعلى ضغط من وجهة نظر غالبية الذين استجابوا للإستبانة الأولى (كما هو مبين من النسبة المئوية). يرجى اختيار الخانة التي تناسب وجهة نظرك في الجداول التالية:

أ. النظام البيئي البحري:

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|-----------------------------------|----------------|--------------|--------------|-----------|
| 1 ردم الأراضي | 74 | | | |
| 2 الصيد الجائر | 63 | | | |
| 3 التلوث البحري* | 44 | | | |
| 4 التجريف | 37 | | | |
| 5 المخلفات الصناعية | 29 | | | |
| 6 الصيد الغير مدروس | 18 | | | |
| 7 تحلية المياه | 11 | | | |
| 8 تغير المناخ | 7 | | | |
| 9 مياه التوازن | 7 | | | |
| 10 مياه الصرف الصحي | 3 | | | |
| 11 زيادة استهلاك المنتجات البحرية | إضافة | | | |

*يرجى تحديد نوع التلوث:

ب. النظام البيئي الصحراوي:

| التسلسل حسب الأهمية | النسبة | موافق تماماً | موافق لحد ما | غير موافق |
|--------------------------|--------|--------------|--------------|-----------|
| 1 التلوث * | 48 | | | |
| 2 التوسع العمراني | 44 | | | |
| 3 التخثيم | 41 | | | |
| 4 الصناعة والمنشآت | 18 | | | |
| 5 تغير المناخ | 11 | | | |
| 6 صيد الحيوانات | 11 | | | |
| 7 تدمير البيئات | 11 | | | |
| 8 استخراج الصخور والرمال | 7 | | | |
| 9 قطع النباتات | 7 | | | |

*يرجى تحديد نوع التلوث:

ج. النظام البيئي الزراعي:

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|---------------------|----------------|--------------|--------------|-----------|
| 1 التوسع العمراني | 63 | | | |
| 2 التلوث * | 33 | | | |
| 3 هجر مهنة الزراعة | 26 | | | |
| 4 تغير المناخ | 11 | | | |
| 5 الحشرات الدخيلة | 7 | | | |
| 6 نظام الري | 3 | | | |
| 7 النباتات الغازية | 3 | | | |

*يرجى تحديد نوع التلوث:

د. نظام المياه العذبة والجداول:

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|-----------------------------------|----------------|--------------|--------------|-----------|
| 1 الاستخدام المفرط للمياه الجوفية | 52 | | | |
| 2 الردم والتجريف | 44 | | | |
| 3 التوسع العمراني | 7 | | | |
| 4 ضعف إدارة مصادر المياه | 7 | | | |
| 5 التلوث * | 7 | | | |
| 6 التحول إلى الطرق الحديثة | 3 | | | |
| 7 حفر الابار الخاصة | 3 | | | |
| تدهور القنوات المائية الأرضية | إضافة | | | |

*يرجى تحديد نوع التلوث:

رابعاً: حالة الأنظمة البيئية (الأنشطة البشرية):

تبين الجداول التالية الحالة الفيزيائية والكيميائية وحالة الأنواع والمجتمعات الحية للنظم البيئية الرئيسية في البحرين وفقاً للمعلومات التي استقيناها من الاستبانة السابقة (كما هو مبين من النسبة المئوية). يرجى اختيار الخانة التي تناسب وجهة نظرك في الجداول التالية:

أ. النظام البيئي البحري:

| الحالة | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|-------------------------|----------------|--------------|--------------|-----------|
| الحالة الفيزيائية | | | | |
| ممتازة – جيدة جداً | 11.1 | | | |
| جيدة | 55.5 | | | |
| سيئة – سيئة جداً | 3.3 | | | |
| الحالة الكيميائية | | | | |
| ممتازة – جيدة | 7.4 | | | |
| جيدة | 51.8 | | | |
| سيئة – سيئة جداً | 40.7 | | | |
| حالة الأنواع والمجتمعات | | | | |
| ممتازة – جيدة | 15.3 | | | |
| جيدة | 38.5 | | | |
| سيئة – سيئة جداً | 46.1 | | | |

ب. النظام البيئي الصحراوي:

| الحالة | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|-------------------------|----------------|--------------|--------------|-----------|
| الحالة الفيزيائية | | | | |
| ممتازة – جيدة جداً | 29.7 | | | |
| جيدة | 48.1 | | | |
| سيئة – سيئة جداً | 22.2 | | | |
| الحالة الكيميائية | | | | |
| ممتازة – جيدة | 20 | | | |
| جيدة | 56 | | | |
| سيئة – سيئة جداً | 24 | | | |
| حالة الأنواع والمجتمعات | | | | |
| ممتازة – جيدة | 7.4 | | | |
| جيدة | 59.2 | | | |
| سيئة – سيئة جداً | 33.3 | | | |

ج. النظام البيئي الزراعي:

| الحالة | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|-------------------------|----------------|--------------|--------------|-----------|
| الحالة الفيزيائية | | | | |
| ممتازة – جيدة جداً | 18.5 | | | |
| جيدة | 55.5 | | | |
| سيئة – سيئة جداً | 25.9 | | | |
| الحالة الكيميائية | | | | |
| ممتازة – جيدة | 0 | | | |
| جيدة | 52 | | | |
| سيئة – سيئة جداً | 32 | | | |
| حالة الأنواع والمجتمعات | | | | |
| ممتازة – جيدة | 0 | | | |
| جيدة | 56 | | | |
| سيئة – سيئة جداً | 36 | | | |

د. نظام العيون العذبة والجداول:

| الحالة | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|-------------------------|----------------|--------------|--------------|-----------|
| الحالة الفيزيائية | | | | |
| ممتازة – جيدة جداً | 0 | | | |
| جيدة | 4.2 | | | |
| سيئة – سيئة جداً | 95.6 | | | |
| الحالة الكيميائية | | | | |
| ممتازة – جيدة | 0 | | | |
| جيدة | 8.3 | | | |
| سيئة – سيئة جداً | 91.6 | | | |
| حالة الأنواع والمجتمعات | | | | |
| ممتازة – جيدة | 0 | | | |
| جيدة | 8.3 | | | |
| سيئة – سيئة جداً | 91.6 | | | |

خامساً: التأثير (الأثر الناتج من الضغوطات):

تبين الجداول التالية أثر (محصلة) الضغوطات البشرية على النظم البيئية في البحرين وفقاً للمعلومات التي استقيناها من الاستبانة السابقة (بدون أولوية لأثر على آخر). يرجى اختيار الخانة التي تناسب وجهة نظرك لدرجة كل أثر. كما يرجى إضافة أي أثر آخر تراه مناسباً مع درجته.

أ. النظام البيئي البحري:

| الأثر | درجة الأثر | | |
|--------------------------------|------------|--------|-------|
| | عالية | متوسطة | ضعيفة |
| لا أعرف | | | |
| تدهور الأنظمة والبيئات البحرية | | | |
| قلة الإنتاجية | | | |
| انخفاض عدد الأنواع | | | |
| انخفاض عدد أفراد الأنواع | | | |
| زيادة أسعار المنتجات البحرية | | | |
| إنخفاض مساحة البيئات الساحلية | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

ب. النظام البيئي الصحراوي:

| الأثر | درجة الأثر | | |
|----------------------------------|------------|--------|-------|
| | عالية | متوسطة | ضعيفة |
| لا أعرف | | | |
| تدهور الأنظمة والبيئات الصحراوية | | | |
| زيادة التعرية | | | |
| انخفاض عدد الأنواع | | | |
| انخفاض عدد أفراد الأنواع | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

ج. النظام البيئي الزراعي:

| درجة الأثر | | | | الأثر |
|------------|-------|--------|-------|-----------------------------|
| لا أعرف | ضعيفة | متوسطة | عالية | |
| | | | | زيادة ملوحة التربة |
| | | | | زيادة ملوحة المياه |
| | | | | انخفاض كمية مياه الري |
| | | | | انخفاض عدد الأنواع |
| | | | | انخفاض عدد أفراد الأنواع |
| | | | | انخفاض مساحة الغطاء النباتي |
| | | | | انخفاض الأمن الغذائي |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

د. نظام العيون العذبة والجداول:

| درجة الأثر | | | | الأثر |
|------------|-------|--------|-------|---------------------------|
| لا أعرف | ضعيفة | متوسطة | عالية | |
| | | | | انخفاض جودة مياه العيون * |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

* هل يمكنك أن تذكر أسماء ومواقع وحالة أي من العيون العذبة التي لا زالت موجودة ؟

| اسم العين | الموقع | الحالة (يوجد ماء أو يوجد أثر العين فقط) |
|-----------|--------|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

سادساً: الاستجابة (القوانين والقرارات):

تبين الجداول التالية أهم القوانين والقرارات التي تم إتخاذها للتقليل من أثر الضغوطات البشرية على الأنظمة البيئية في البحرين وفقاً للمعلومات التي استقيناها من الاستبانة السابقة. يرجى اختيار الخانة التي تناسب وجهة نظرك لتأكيد أهمية القانون أو القرار في تقليل الأثر.

أ. النظام البيئي البحري:

| درجة الأهمية | | | | القانون أو القرار |
|--------------|-------|--------|-------|---|
| لا أعرف | ضعيفة | متوسطة | عالية | |
| | | | | قانون حظر صيد الربيان في موسم معين قرار 3 لسنة 1997 |
| | | | | قانون 53 لسنة 2006 انشاء محمية خليج تبلي |
| | | | | قانون رقم 20 -2002 بشأن تنظيم الصيد البحري |
| | | | | مرسوم 8 لسنة 1983 الانضمام إلى اتفاقية ROPME |
| | | | | قرار 3 لسنة 2003 حظر صيد السلاحف وبقر البحر |

ب. النظام البيئي الصحراوي:

| درجة الأهمية | | | | القانون أو القرار |
|--------------|-------|--------|-------|--|
| لا أعرف | ضعيفة | متوسطة | عالية | |
| | | | | إنشاء محميات |
| | | | | منع صيد الأنواع المهددة بالانقراض |
| | | | | مرسوم 91 سنة 2012 تنظيم المجلس الأعلى للبيئة |
| | | | | تنظيم مسابقة أفضل مخيم |
| | | | | الانضمام إلى المعاهدات الإقليمية والدولية |

ج. النظام البيئي الزراعي:

| درجة الأهمية | | | | القانون أو القرار |
|--------------|-------|--------|-------|---|
| لا أعرف | ضعيفة | متوسطة | عالية | |
| | | | | قوانين استيراد النباتات والحجر الصحي قرار 1980 25 |
| | | | | قانون حماية النخيل 21 سنة 1983 |
| | | | | المناطق الخضراء والحزام الأخضر |
| | | | | إنشاء المجلس الأعلى للبيئة |
| | | | | إنشاء محميات |

د. نظام العيون العذبة والجداول:

| درجة الأهمية | | | | القانون أو القرار |
|--------------|-------|--------|-------|--|
| لا أعرف | ضعيفة | متوسطة | عالية | |
| | | | | قانون تنظيم استخدام المياه الجوفية والعيون |
| | | | | تشكيل المجلس الأعلى للبيئة |
| | | | | قوانين ترشيد الاستهلاك |
| | | | | إنشاء إدارة التنوع الحيوي |
| | | | | إنشاء خزانات جوفية |

سابعاً: الأولويات (الإجراءات الواجب اتخاذها للمرحلة القادمة):
تبين الجداول التالية أهم الإجراءات التي يجب اتخاذها لتقليل من أثر الضغوطات البشرية على الأنظمة البيئية والمحافظة على التنوع الحيوي بمنهجية مستدامة في البحرين وفقاً للمعلومات التي استقيناها من الاستبانة السابقة، فالإجراء رقم 1 مثلاً يعني أهم إجراء من وجهة نظر غالبية الذين استجابوا للاستبانة الأولى (كما هو مبين من النسبة المئوية). يرجى اختيار الخانة التي تناسب وجهة نظرك في الجداول التالية:

أ. النظام البيئي البحري:

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|--|----------------|--------------|--------------|-----------|
| 1 تطبيق القوانين الداعمة للتنوع الحيوي | 50 | | | |
| 2 تقليل وضبط الردم والتجريف | 27 | | | |
| 3 تطبيق برامج التوعية البيئية على جميع المستويات | 18 | | | |
| 4 إقرار وتنفيذ سياسة فعالة لحماية البيانات البحرية الحساسة | 14 | | | |
| 5 إعادة (Restore) الشعاب المرجانية | 14 | | | |
| 6 تمويل وتنفيذ الدراسات البيئية بالتعاون مع الجامعات والادارات | 9 | | | |
| 7 بناء قدرات العاملين في المجال | 9 | | | |
| 8 ضبط الصيد وأنشطة الصيادين | 9 | | | |
| 9 مراقبة السفن التجارية وسفن الصيد | 9 | | | |
| 10 الانضمام إلى الاتفاقيات الدولية | 5 | | | |
| 11 تقوية الادارات الحكومية التنفيذية | 5 | | | |
| 12 منع إلقاء المخلفات الصناعية | 5 | | | |
| 13 المعالجة الفورية لجميع أنواع الملوثات | 5 | | | |
| 14 تطبيق الادارة المستدامة للبيئة | 5 | | | |
| 15 العمل على زيادة وفرة الكائنات البحرية | 5 | | | |
| 16 إنشاء محميات وإدارة محميات بحرية | 5 | | | |
| 17 الادارة السليمة للمخزون البحري | 5 | | | |

ب. النظام البيئي الصحراوي :

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|--|----------------|--------------|--------------|-----------|
| 1 تطبيق برامج التوعية البيئية على جميع المستويات | 27 | | | |
| 2 تطبيق القوانين الداعمة للتنوع الحيوي | 27 | | | |
| 3 ضبط التوسع العمراني والأنشطة البشرية | 17 | | | |
| 4 إنشاء محميات وإدارة محميات برية | 14 | | | |
| 5 تمويل وتنفيذ الدراسات البيئية بالتعاون مع الجامعات والادارات | 9 | | | |
| 6 تطبيق الادارة المستدامة للبيئة | 9 | | | |
| 7 بناء القدرات بالتعاون مع المنظمات الدولية | 9 | | | |
| 8 الانضمام إلى الاتفاقيات الدولية | 5 | | | |
| 9 تقوية الادارات الحكومية التنفيذية | 5 | | | |
| 10 المحافظة على التنوع الوراثي | 5 | | | |
| 11 ضبط التخميم | 5 | | | |

ث. النظام البيئي الزراعي:

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|---|----------------|--------------|--------------|-----------|
| 1 الموازنة بين التوسع العمراني وزيادة الرقعة الزراعية | 27 | | | |
| 2 تطبيق القوانين الداعمة للتنوع الحيوي | 23 | | | |
| 3 زيادة الأنشطة الزراعية | 18 | | | |
| 4 تطبيق برامج التوعية البيئية على جميع المستويات | 18 | | | |
| 5 بناء القدرات وتأهيل المزارعين | 14 | | | |
| 6 إدارة مصادر المياه بفعالية | 9 | | | |
| 7 دعم جهود المحافظة على مهنة الزراعة | 5 | | | |
| 8 الانضمام إلى الاتفاقيات الدولية | 5 | | | |
| 9 تقوية الإدارات الحكومية التنفيذية | 5 | | | |
| 10 تمويل وتنفيذ الدراسات البيئية بالتعاون مع الجامعات والإدارات | 5 | | | |
| 11 تطبيق الإدارة المستدامة للبيئة | 5 | | | |
| 12 إنشاء وإدارة المحميات | 5 | | | |
| 13 المحافظة على التنوع الوراثي | 5 | | | |
| 14 تطبيق إدارة فعالة للحشرات | 5 | | | |

د. نظام العيون العذبة والجداول:

| التسلسل حسب الأهمية | النسبة المئوية | موافق تماماً | موافق لحد ما | غير موافق |
|---|----------------|--------------|--------------|-----------|
| 1 إقرار سياسة لصون العيون | 36 | | | |
| 2 تطبيق القوانين الداعمة للتنوع الحيوي | 18 | | | |
| 3 تطبيق برامج التوعية البيئية على جميع المستويات | 14 | | | |
| 4 وقف حفر الابار الارتوازية | 14 | | | |
| 5 القيام بالدراسات لتحديد حالة العيون | 9 | | | |
| 6 تطبيق الادارة المستدامة للبيئة | 9 | | | |
| 7 إنشاء وإدارة المحميات | 9 | | | |
| 8 بناء القدرات وتأهيل العاملين في المجال | 9 | | | |
| 9 دعم جهود المحافظة على مهنة الزراعة | 5 | | | |
| 10 الانضمام إلى الاتفاقيات الدولية | 5 | | | |
| 11 تقوية الادارات الحكومية التنفيذية | 5 | | | |
| 12 تمويل وتنفيذ الدراسات البيئية بالتعاون مع الجامعات والادارات | 5 | | | |
| 13 تنظيم أنشطة ترفيهية للمحافظة على العيون | 5 | | | |
| 14 إنشاء محطات تحلية مياه للمحافظة على العيون | 5 | | | |

شكراً على تعاونكم،،،،