National Biodiversity Strategy and Action Plan in Libya

2023 - 2030

Nature Conservation Adminstration **February 2023** **Ministry of Environment**

Speech by His Excellency the Minister of Environment

Biodiversity is the variation and difference in the types of living organisms in all their forms and genetic compositions, and it is a natural heritage that is the right of current and future generations; therefore, maintaining this variation in life, in parallel with the requirements of development and economic activities on the approach of sustainable development, requires efforts and seriousness to develop mechanisms and basics for joint action, bringing together all national institutions related to environmental issues, perhaps the most important of which are issues: Biodiversity, sustainable development, climate change and pressures on species in their natural environment.

The *Ministry of Environment* has realized the importance of working on the establishment of a strategic plan for the conservation of biological diversity in order to achieve the objectives for which this Ministry was established and to reach the sustainable use of the elements of this diversity in a wise, fair and rational manner that is balanced with the nutritional and health needs of citizens. On this basis, Libyan state issued legislation that protects the environment and preserves natural resources. Among the most important of them are: Law No. 7 of 1982, regarding improving and protecting the environment, and Amended Law No. 15 of 2003 and its executive regulations. It includes eleven chapters and seventy-nine articles, some of which dealt with the protection of biodiversity and ecosystems, in addition to the announcement by the Ministry of Environment against the background of the Environment Public Authority in 2021, and defining its tasks, including: formulating policies, and developing plans for national action in the fields of nature conservation, and preserving its elements.

In continuation of the work related to this field – being the national point of contact for the Convention on Biological Diversity, through one of its technical departments "Department of Nature Conservation" - the Ministry has previously prepared the fourth national report on biodiversity of the Convention, to document the state of biodiversity and efforts in the success of projects in this field, and from the principle of our commitment and awareness

of the importance of biodiversity - as a noble national action - as well as our commitment to the relevant international conventions; this plan aims to reach the maximum possible measures for the conservation and sustainability of Libyan biological resources.

There is no doubt that this goal will lead to the establishment of a sound scientific base for the management of Libya's natural resources and their sustainable use, coinciding with the efforts of comprehensive development with its various elements: agriculture, industry, mining, tourism, and housing, thus organizing as much as possible not to harm the right of future generations to benefit from such resources. By completing this strategy, the Ministry of Environment has developed broad outlines of national priorities and a scientific plan to protect our natural resources, in fulfillment of our commitment to the homeland and future generations.

We thank Allah who helped us along with the cooperation of all parties, led by our partners from state institutions, experts and researchers from the Department of Nature Conservation, to complete the work, and I also extend my sincere thanks and great gratitude to our partners from Libyan institutions and civil society institutions, for their determination to come up with an agreed national plan leading to the issuance of this strategy.

Dr. Ibrahim Alarabi Munir
Minister of Environment

A word of thanks and appreciation

The Ministry of Environment is pleased to extend its thanks and great gratitude to all institutions, research bodies, and universities, which contributed to cooperation and the provision of information and data, to complete this work at the required scientific level, and thanks are also extended to the reviewers of the technical and scientific aspect of this strategy.

The Ministry of Environment, in cooperation with state institutions, has prepared the national strategy for biodiversity in Libya, fully confident to form a working methodology and a plan for the conservation of natural resources, through the principle of partnership in action and implementation with all authorities related to biodiversity and nature conservation, in addition to the German Foundation for International Cooperation (GIZ).

We hope that the Almighty Allah will grant success to this noble plan in protecting our natural resources.

Working Team

State of Libya

Ministry of Environment

National Biodiversity Strategy and Action Plan in Libya (2023 – 2030)

Implementation and Supervision by the Nature Conservation Department – Ministry of Environment

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Executive Summary

Nature plays a crucial role in providing food, fodder, energy, medicines and genetic resources and also provides a variety of substances essential for the physical integrity of humans and for the preservation of culture. Through its ecological and evolutionary processes, nature maintains the air, freshwater and soil quality on which humanity depends, distributes fresh water, regulates climate, provides pollination and pest control and reduces the impact of natural hazards.

According to the Global Assessment Report on the State of the World's Biodiversity, the past 50 years have witnessed a high rate of change in nature unprecedented in human history on the surface of the globe. The most direct drivers of change for nature were: (1) changes in land and sea use; (2) direct exploitation of living organisms; (3) climate change; (4) pollution; and (5) Alien and invasive species. These five direct drivers also arise from several underlying causes – indirect drivers of change in nature – which in turn are based on: (1) societal values and behaviors; (2) patterns of production and consumption; (3) population dynamics and trends; (4) trade; (5) technological innovations; (6) governance systems from the local to the global level.

The Earth's environment can be preserved through enhanced international cooperation and associated measures of local importance. The review and renewal of internationally agreed environment-related goals and targets based on the best available scientific knowledge, and the widespread adoption and funding of actions on environmental conservation, ecological restoration and sustainable use by all actors, including individuals, are key factors in achieving this safeguarding. This broad adoption means the advancement of national and international efforts to sustain and reconcile and mainstream and sustain biodiversity across all extractive and productive sectors, including mining, fisheries, forestry and agriculture, so that combined individual and collective actions reverse the degradation of ecosystem services globally. However, these bold changes in the direct drivers of nature degradation cannot be achieved without a transformative change that addresses these indirect drivers simultaneously.

Therefore, the International Convention on Biological Diversity (CBD), in its decision (CBD/COP/15/6) issued as one of the decisions of the Conference of the

Parties at its fifteenth meeting (7 to 19 December 2022) in Canada, stressed the need to strengthen implementation and core commitments by Parties to put the global community on track towards achieving Vision 2050.. The same decision also emphasized that national biodiversity strategies and action plans (NBSAPs) are the main instrument for the implementation of the Convention at the national level, and that all States must work to update national biodiversity strategies and action plans in line with the Kunming-Montreal Global Biodiversity Framework, in accordance with its targets and objectives as the main tool for implementing the global biodiversity framework.

In response to this international commitment to the International Convention on Biological Diversity, Libyan Ministry of Environment (Department of Natural Conservation) has developed the National Strategy and Action Plan for Biodiversity of the State of Libya during the period from 2023 to 2030. The strategy document consists of three main chapters: the first chapter, which provides a background on biodiversity at the national level; the second chapter addresses the importance of biodiversity and the pressures on it; and the third chapter presents the strategy and action plan for the National Biodiversity.

The first chapter begins with a background explanation of the location of Libya, its area and the common borders with neighboring countries, then the same chapter deals with an explanation of the climate at the national level (temperatures - rainfall - humidity - etc.), then the chapter moves to explain the topography of Libyan territory, which can be limited to three main areas: (1) The first scope: includes the coastal plains in the Eastern region, the Benghazi plain, Sirte, the Misrata plain and the Jafara plain; 2) The second range: It includes the Northern highlands, which are represented in the plateau of Al-Batnan, the Green Mountain and the Western Mountain; (3) The third range: a desert range, which includes plateaus such as the Hamada red desert and the Northern depressions such as the depression of Al-Jaghbub, Awjila, Jaloa, Ajkhara and the depression of Murada, and this range also includes the basins of Ubari, Murzuq and Kufra basin in addition to the mountains that are represented in Jabal Al-Harouj, Mount Tibesti, Jabal Al-Owainat and Jabal Al-Aswada, and the desert range includes several large valleys such as Wadi Ishatti, Wadi Al-Ajal in addition to the sandy flats. After that, the nature of the geology of Libyan lands and the fossils contained in those lands are explained, where the

presence of fossils of some crocodiles from Mount Zalten with a length of about 8 meters has been documented, and the remains of bird fossils are relatively rare compared to those in other major classifications of vertebrates, where there are remains of fossils of some large wading and galloping birds in layers of the Tertiary period (tertiary).), in addition to the presence of ostrich egg shells in post-ice age sediments. All known fossil mammals in Libya date back to the Neolithic Ages, and Libya is the only country in Africa with fossils of mammals in layers of all successive ages: Eocene, Oligocene, Miocene, Pliocene, and Pleistocene. There are also four onshore geological basins and one marine basin in Libya: Kufra, Ghadames, Murzuq, Sirte and Sabratha (marine basin).

The first chapter then moves on to an explanation of the state of the ecosystems in Libya, which includes:

- Marine and coastal ecosystems:
- Phytoplankton and zooplankton: The latest studies documented the presence of 92 genera of diatom belonging to 390 organisms, 12 genera of rotary flagella, and 40 species of surface zooplankton were identified in Libyan waters.
- Macroalgae: Recent studies have documented the presence of 78 species (belonging to 52 genera) of marine algae, of which 36 species (belonging to 23 genera) of red algae, 19 species (belonging to 12 genera) of green algae, 20 species (belonging to 14 genera) of brown algae and 3 species (belonging to 3 genera) follow blue-green algae.
- Seaweed: There are two types of seaweed: (1) seaweed or Mediterranean grass (*Posidonia oceanica*); and (2) *Cymodocea nodosa*, in the Mediterranean Sea, the first type of which is completely widespread along the coasts of Libya and the latter is partially present in different regions.
- Cephalopods: 24 species of cephalopods (Cephalopods) have been recorded in Libyan coast, where these species belong to 8 families and 3 orders.
- Benthic animals: During 2020, a study conducted along Libyan coast on marine mollusk species recorded a total of 343 species of molluscs (187 species of

cephalopods, 119 species of bivalves, 27 species of cephalopods, 5 species of polyplatelets, and 5 species of scaphopods).

- Marine mammals: Four species of dolphins and three species of whales have been documented, in addition to the monk seal.
- Sea turtles: In recent decades, three species of sea turtles have been documented along Libyan coast: the green turtle, the leatherback turtle, and the loggerhead turtle. During 2021, through the Ministry of Environment and the Regional Activities Center for Special Protected Areas, a study was conducted on turtles, which concluded that there was a discrepancy in The total number of loggerhead sea turtle nests observed along Libyan coast over the period 2005-2019, ranging from 10 nests in the Jabal Akhdar area to 393 nests on the shores of the Gulf of Sirte.
- Waterbirds: A total of 101 waterbird species were identified during the census period between 2005 and 2010, through the observation of waterbirds found in 110 coastal wetlands.
- Terrestrial ecosystems:
- Mountain ecosystems: ranging from dry mountain forests at low altitudes to plants found on mountain tops. Only 0.01% of these terrestrial systems (217,000 square meters) are forest lands, with an average annual rainfall of about 200-300 mm.
- Semi-desert ecosystems: It is located just south of the mountainous region and this area is often used as pastures and some agricultural activities carried out by some Bedouins in some valleys.
- Desert ecosystems: They are divided into three sections: the Western section (starting from the coast to the Acacus Mountains); the central section (from Sirte to the Tibesti bed); and the Eastern section (from Cyrenaica through Libyan Desert and Kufra to the border with Sudan).

The first chapter continues its explanation of the current state of biodiversity, where it moves on to present the state of biodiversity of living organisms, as follows:

- Plant biodiversity:

- The Green Mountain region is the most vegetarian diversity region at the national level, containing 75-80% of Libya plants.
- The desert areas, which cover most areas of Libya, are characterized by the presence of vegetation cover with a weak diversity, especially the sand dune gatherings in the sand sea south of Al-Jaghbub along the Egyptian border, the sand dunes in the Al-Raybyana area, Northeast of Kufra, and the Murzuq basin, which is covered with vast areas of sand.
- Some 2118 plant species belonging to 864 genera and 161 families have been recorded in Libya, of which 2088 plants (844 genera and 145 families) are angiosperms, 15 plants (8 genera and 6 families) are gymnosperms, and 15 plants (belong to 12 genera and 10 families) are ferns.
- During 2018, research on Libya Plant List Update was published, revising and updating a list of plants comprising 43 families out of 150 families recorded in Libya Plant Book, including 138 genera and 411 plant species. As a result of this update, six new plant families were documented in Libya: Hypericaceae, Adoxaceae, Lophiocarpaceae and Limeaceae.), Gisekiaceae and Cleomaceae.
- 5 important plant areas have been identified in Libya: Jabal Al-Akhdar, Sabkha Tawergha, Jabal Nafusa, Jabal Al-Owainat and Jabal Masak, and five other areas have been identified that need further studies to determine their status as areas of international importance, namely: Al-Haysha, Farwa Island, Al-Batnan, Jabal Al-Harouj and Benghazi Beach.
- The total endemic plant species in Libya are about 80-81 species, distributed in four endemic centers in Libya: (1) Jabal Akhdar with 44 plants with 54% of the country's endemic plants, (2) the coastal strip including Jebel Nafusa and the

Batnan plateau with 26 endemic plants with 32% endemic plants, (3) the desert range which includes 9 plants with 11% endemic plants, and (4) the Ghat Plateau, Tibesti and Jabal Owainat with 2%. Overall, vegetation in Libya has a low percentage of endemic vegetation, no more than 7% due to similar terrain and harsh environment.

- Animal biodiversity:

- According to preliminary estimates, the number of animals in Libya was 4,590 species. The most important of these organisms in terms of number are insects (81%) followed by birds (7%). However, animal diversity in Libya still needs more taxonomic studies to document it well.
- Ten orders of mammals have been recorded in Libya with 25 families and 47 genera comprising 76 species.
- 113 different species of reptiles belonging to 14 species have been recorded . Of these, 4 species are registered as endangered.
- 356 species of birds were recorded, belonging to 61 families, and 18 orders. Of these, 41 species are threatened, both locally and globally.

The second last part of the first chapter provides a detailed explanation of the nature reserves in Libya, where the first nature reserve in Libya was declared in 1978 and the number of these reserves reached 11 nature reserves until the issuance of the fourth national report in 2010. The ratio of the total area of reserves to the total area of Libya is about 0.16% of the total area of Libya. During 2021, the Ministry of Environment announced 22 new reserves, in addition to the Ministry of Environment announcing 6 new sites as wetlands and a number of 2 site for wildlife conservation. There are also 4 proposed reserves that will be announced in the future. The last part of this chapter then proceeds to an explanation of the legislation and laws related to the protection of biodiversity as well as the agreements signed by the Libyan state, in addition to a detailed analysis of the relevant authorities and key stakeholders regarding biodiversity in Libya.

The second chapter focuses on the importance of biodiversity and the pressures on it, as it addresses the current situation of some sectors such as:

- Oil and gas sector: Oil constitutes about 94% of the country's resources, as there are 29 large fields in Libya, each containing more than one billion barrels of oil, and these fields contain 68% of the total oil discovered so far in the country. Libya ranks first in terms of proven reserves at the level of Africa, fifth at the level of the Organization of Arabic Petroleum Producing Countries, seventh at the level of the Organization of Petroleum Exporting Countries, and ninth in the world. It also ranks eighth among the Arabic countries in terms of natural gas reserves.
- Agriculture: Agriculture was considered an important economic sector in Libya until oil was discovered in the early sixties of the last century, where agricultural production declined over the past few years, its contribution constituted 2.83 percent of GDP on average between 2000 and 2018. The total agricultural land is estimated at 15.4 million hectares, consisting mainly of pastures (13.3 million hectares). Arable land constitutes 2.2 million hectares, equivalent to only 1.7 percent of the country total area.
- Water resources: There are five main groundwater reservoirs under Libyan territory, as the first and second reservoirs are interconnected and form the western aquifer. Only the coastal aquifers, Jafara in the Northwest and Jabal Akhdar in the Northeast are shallow and are naturally recharged from the rainfall. Renewable inland surface water resources are estimated at 200 MCM/yr and renewable groundwater resources at around 600 MCM/yr., but 100 MCM/yr. is considered overlapping between surface and groundwater, giving a value to total renewable inland water of about 700 MCM/yr., or 111.5 m^3/yr. per capita in 2015, so Libya below the absolute water scarcity threshold of 500 m^3/year per capita.

- Fisheries: Some statistics indicate that the total fish production from Libyan waters reached 50,000 tons in the year 2000 and this production consisted of approximately 21,000 tons of small pelagic fish such as sardines, mackerel and anchoka, about 2,000 tons of bluefin tuna and about 24,000 tons of other fish. However, this production declined significantly between 2000 and 2013, when the production of Libya of marine fisheries reached about 41,700 tons.
- Almarai(Pasture Land: Libyan pastures are one of the important pillars to support Libyan national economy. Libyan pastures occupy about 13.3 million hectares, stretching across more than 70% of the country's land area. It is distributed over four regions according to the classification of the Rangelands Development Authority: the Western, Central, Eastern and Southern regions.

The second chapter then goes on to explain the threats to biodiversity at the national level, which are summarized as follows:

NO.	Threats and Risks	Root Causes	Threat Severity
Forest Threats			
1	Fires	- Natural fires due to drought and high temperatures	Low
		- Accidental fires due to neglect by park visitors	Medium
		- Deliberate fires to convert forested areas into farms	High
2	Deforestation	- Logging for charcoal production	Medium

NO.	Threats and Risks	Root Causes	Threat Severity
		- Logging to convert forest land into farms	High
		- Logging for construction purposes	Medium
		- Logging to clear roads	Low
3	Overgrazing	- Breeding large numbers of animals beyond the forest's capacity to regenerate	Medium
		- Introduction of animals with destructive behavior to forests	Low
4	Invasive and alien species	- Introduction of animals that may harm forest ecosystems	Low
		- Use of introduced plants in afforestation and road decoration	Medium
5	Pollution	- Lack of control over factory and vehicle smoke near forests	Medium
		- Ineffective solid waste management	Low
		- Discharge of sewage into forests without treatment	Medium
6	Drought	- Increased temperatures with low rainfall	High
7	Misuse of plants	- Excessive use of medically important plants	Medium
Non-forest areas			
1	Overgrazing	- Grazing large numbers of animals in limited areas	High
		- Unregulated grazing practices preventing pastures from recovering	High
		- Destruction of plants before flowering and fruiting, leading to scarcity and disappearance of the original plant cover, encouraging invasive and undesirable plants to invade these pastures	High
		- Destruction of natural habitats for wild animals, such as burrows and tunnels	Medium
2	Degradation of vegetation	- Logging for charcoal production	High
		- Conversion of land into farms	Medium
		- Drought	High
		- Urban encroachment	Low
		- Hiking and resulting plant destruction	Low
		- Overgrazing	High
4	Introduction of invasive and alien species	- Introduction of animals that may cause harm to wild environments	Medium
		- Use of introduced plants in pastoral and agricultural areas	Medium
5	5. Pollution	- Lack of control over factory and vehicle smoke	High
		- Pollution from pesticides used in pest control	Low
		- Ineffective solid waste management	Medium
6	Overfishing	- Hunting of wild animals threatening their existence	High
Aquatic and Marine Environment			

NO.	Threats and Risks	Root Causes	Threat Severity
1	Destruction of habitats	- Use of trawl nets	High
		- Use of explosives in fishing	Medium
		- Beach filling	Low
		- Agricultural expansion	Medium
		- Urban expansion	High
		- Utilization of beach sands as building material	Low
2	Pollution	- Water pollution by solid waste	Low
		- Discharge of untreated sewage into water bodies	High
		- Marine pollution by oil due to bilge water discharge	High
		- Pollution from offshore oil fields	High
		- Pollution from pesticides and fertilizers used in agriculture	Medium
**3	Overfishing	- Unregulated fishing of aquatic organisms	Low
		- Use of fishing methods harmful to aquatic organisms	Medium
4	Introduction of alien species	- Introduction of species not originally present in the local environment	Medium
5	Drying of inland water bodies	- Increased temperatures with decreased rainfall	Medium

The third chapter begins with an introduction to the accession of Libya to the Convention on Biological Diversity (during 1992), then presents the guiding principles governing the strategy and the national action plan, as well as an explanation of the main considerations taken into account during the preparation of the strategy, which include:

- Scientific management and proper planning of natural resources to ensure the continuation of the ecological balance and the preservation of ecosystems from degradation and their living organisms from decline and extinction.
- Work on developing local scientific capacities in the fields of nature protection and biodiversity and develop a program of research and studies.
- Forming a national committee for the protection of biodiversity that includes all relevant authorities, bodies and individuals in its implementation and follow-up of its results.

- Developing environmental legislation in the field of biodiversity and providing economic and social incentives to support the implementation of the national strategy for the protection of biodiversity.
- Complement action at the national level with regional and international efforts in the areas of biodiversity conservation.
- Present capacities and institutions for biodiversity management at the national level.

This chapter included an explanation of the vision and mission of the national strategy and action plan, which stated:

- **Vision:** "By 2030, biodiversity in Libya is assessed and urgent and innovative measures and actions are taken across Libyan society to conserve and sustainably use biodiversity and ensure the fair and equitable sharing of benefits arising from the utilization of genetic resources, for the sustainable use of present and future generations."
- **Mission:** "By 2030, Libya will take effective and innovative actions to reduce biodiversity loss to ensure that ecosystems continue to serve all Libyans as well as ensure that pressures on biodiversity are reduced, with the sustainable use of biological resources and the sharing of benefits arising from the use of genetic resources in a fair and Equitable manner, and work to mainstream biodiversity issues, appropriate values and policies effectively and through a participatory approach with all"

This is followed by the third chapter presenting the three main axes and the twenty-five strategic objectives contained in the National Action Plan, which can be summarized as follows:

Strategic National targets and Objectives	The main axes of the strategy
Target 1: By 2027, integrated spatial planning for biodiversity (terrestrial and marine) is integrated into national efforts to	**First Theme**: Reducing Biodiversity Loss

Strategic National targets and Objectives	The main axes of the strategy
regulate the use of state land and territorial waters to ensure the retention of existing healthy land and marine areas.	
Target 2: By 2030, a full assessment of the state of Libya's ecosystems (terrestrial , marine , freshwater) is carried out, and 20% of degraded ecosystems are restored.	
Target 3: By 2030, expand the existing network of national protected areas to cover 30% of Libyan territory, focusing on areas important for biodiversity at the national level, implement mechanisms and procedures to ensure the effective management of the network of national protected areas (terrestrial and marine), linking them with areas with other effective conservation measures, and mainstream them into the wider terrestrial and seascape.	
Target 4: By 2030, develop and implement actions to manage and conserve the biodiversity of wild species, especially endemic, endangered and migratory species, within and outside the network of national reserves, and work to restore degraded species through sectoral or site-related plans.	
Target 5: By 2030, an effective and universally recognized national framework for harvesting, sustainable use and trade in wild species to ensure human health is identified and implemented.	
Target 6: By 2030, inventory, identify and implement national mechanisms and actions aimed at reducing the rate of introduction of alien and invasive species into the country by 50%, with the implementation of national programs to monitor and manage the spread of these species that work to combat and eliminate them, with a focus on priority species within the network of reserves.	
Target 7: By 2030, update existing mechanisms and programs and implement innovative new measures to reduce pollution (terrestrial-marine) from all sources, with the aim of reducing environmental pollution with organic nutrients to 50%, pesticides by 60%, and completely eliminating the dumping of plastic waste in terrestrial and marine environments.	
Target 8: By 2030, reduce the impacts of climate change on biodiversity by 25%, through the implementation of programs and projects that apply the concepts of nature-based solutions,	

Strategic National targets and Objectives	The main axes of the strategy
and contribute to mitigating and adapting to the negative effects of climate change on biodiversity.	
Target 9: By 2030, sustainable management of terrestrial (terrestrial-marine-aquatic) species to achieve food security and livelihoods for people, especially communities and the poorest.	
Target 10: By 2030, develop and implement national actions and programs aimed at achieving sustainable farming methods for 40% for existing agricultural and forestry areas, as well as applying sustainable aquaculture methods for 50%, in order to support their resilience to the effects of climate change.	
Target 11: By 2030, identify and implement plans and tools to protect air and water quality, with rapid response programs to disaster risks and natural phenomena.	**Second Theme:** Sustainable Use of Biodiversity
Target 12: By 2030, mainstream the principles of sustainable urban planning into national urban expansion plans, with the aim of achieving human health and the environment, especially in densely populated areas.	
Target 13: By 2030, update existing procedures and national legislation to ensure the effective operation of the Biosafety Protocol (Cartagena Protocol) and the Protocol on the Equitable Sharing of Benefits Arising from Genetic Resources (Nagoya Protocol) (under consideration for signature), as well as the documentation of traditional knowledge on the uses of natural and genetic resources.	
Target 14: By 2030, biodiversity values are identified and mainstreamed into sectoral policies and national planning processes, ensuring that environmental impact assessments (strategic-site-level) are applied to all development projects (governmental and private).	
Target 15: By 2030, develop and implement national plans and programs for the sustainable production and use of natural resources and ecosystem services targeted by development projects, with effective follow-up mechanisms to ensure that the negative impacts of such projects on biodiversity are minimized.	**Third Theme:** Strategy Implementation, Dissemination and Evaluation
Target 16: By 2030, national, sectoral and local programs to raise public awareness of biodiversity conservation and 50% reduction of food and non-food waste are planned and implemented to change public behavior with regard to excessive	

Strategic National targets and Objectives	The main axes of the strategy
consumption of natural resources and food, linking all of this to national poverty reduction efforts.	
Target 17: By 2030, national, sectoral and local capacity-building programs for technology transfer and scientific research are developed and implemented, focusing on the negative impacts of biotechnology on biodiversity and human health, as well as how to control and reduce those impacts.	
Target 18: By 2030, formulate and implement a national strategy to redirect (especially the most harmful incentives) incentives harmful to biodiversity, and convert 50% of those harmful incentives to incentives with a positive or neutral impact on biodiversity.	
Target 19: By 2030, develop and implement a national strategy for resource mobilization and regulation of financial flows aimed at effective national financial planning for biodiversity conservation efforts.	
Target 20: By 2030, ensure equitable and effective participation in biodiversity decision-making by communities and the most vulnerable, as well as women, girls and youth.	

The third chapter then discusses in detail the national priorities and indicators related to each strategic objective, in addition to defining the implementation responsibility, time frame and implementation costs for each strategic target.

The third chapter then ends with an explanation of how to evaluate the strategy through the following suggested steps:

- Conduct a detailed desk review of the NBSAP and extract information relevant to the assessment process.
- Review the alignment of the NBSAP with national, regional and international commitments.
- Distribution of questionnaires to: (a) National focal points for international conventions on biodiversity: (b) Representatives of national actors involved in biodiversity and the environment.

- Interviews (formal and informal): (a) National focal points for international conventions on biodiversity: (b) representatives of national actors involved in biodiversity and the environment, to discuss the results of the questionnaires and to clarify some additional information.
- Interviews (formal and informal) with national experts and regional consultants relevant to national biodiversity strategies and action plans.
- Review of national reports relevant to international conventions related to biodiversity.
- Analyze the effectiveness of the implementation of national authorities in implementing the objectives and activities of the national strategy.

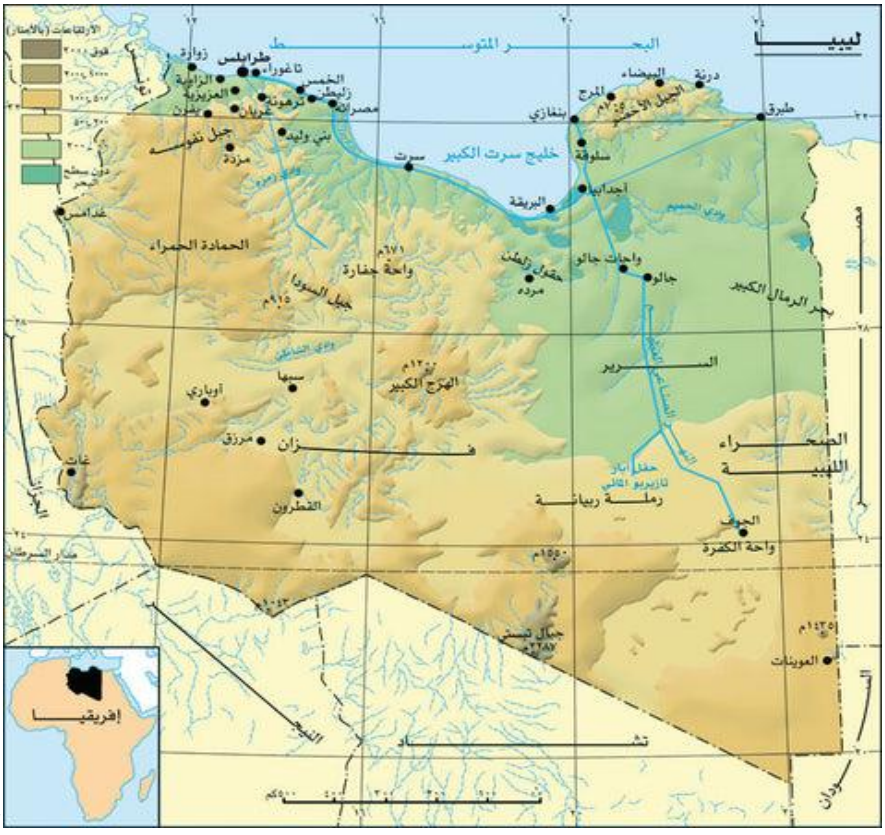
Chapter One: Background

I. Geographical location

Libya occupies a large area of Northern Africa, where it lies between 9 west longitude and 25 east longitudes, while its Southern most extension reaches 18.25 south latitude and 32.57 north latitude. This geographical location made Libyan state extend from the Mediterranean coast to the Southern borders with Niger and Chad, while to the east it shares its borders with Egypt and Sudan and to the west it shares the borders of Tunisia and Algeria.

This specificity clearly shows the breadth of Libyan state, which is estimated at 1,750,000 square kilometers, as the fourth largest country in Africa, and the seventeenth in the world. It is bordered by a group of borders of about 6335 km, of which 4383 km are land borders, and the rest in 1952 is the length of the coastal strip extending from Bir Ramla in the east to Ras Ajdir in the West.

Map 1: Map showing the geographical location of the country of Libya



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Source: Website of the Embassy of Libya in Canada [1]

Table 1: Common border lengths between Libya and neighboring countries

No.	Neighboring countries of Libya	Common boundary lengths (km)
1	Egypt	1150
2	Chad	1055
3	Algeria	982
4	Tunisia	459
5	Sudan	383
6	Niger	354
7	Mediterranean coast	1952
Total		**6335**

Due to its geographical location, Libya is an important bridge linking Africa and Europe, and its privileged location on the Southern coast of the Mediterranean Sea has led to its direct impact since ancient times by the important historical events that the Mediterranean region has known, and its ports suitable for receiving ships throughout the year, such as the ports of Benghazi, Tripoli and others, are good ports for trade in some African countries such as Niger, Chad and Mali with the outside world, and Libya with its strategic location represents an important link between the East and the Maghreb of the Arab world, and for this reason It clearly shows the convergence and mixing of cultural, civilizational and Arabic Islamic trends.

In terms of tourism, Libya's closeness to the main tourist markets represented in Western European countries, and its connection to neighboring countries by a network of paved roads makes it easy to access, whether by sea, land or air.

II. Climate

The privileged location of the State of Libya, especially the Northern border with the Mediterranean Sea, has made the climate in Libya a Mediterranean climate in the thin coastal strip and deserts in the interior. In fact, although the temperatures on

[1] https://embassyoflibya.ca/pages/about-libya-ar Embassy of Libya in Canada

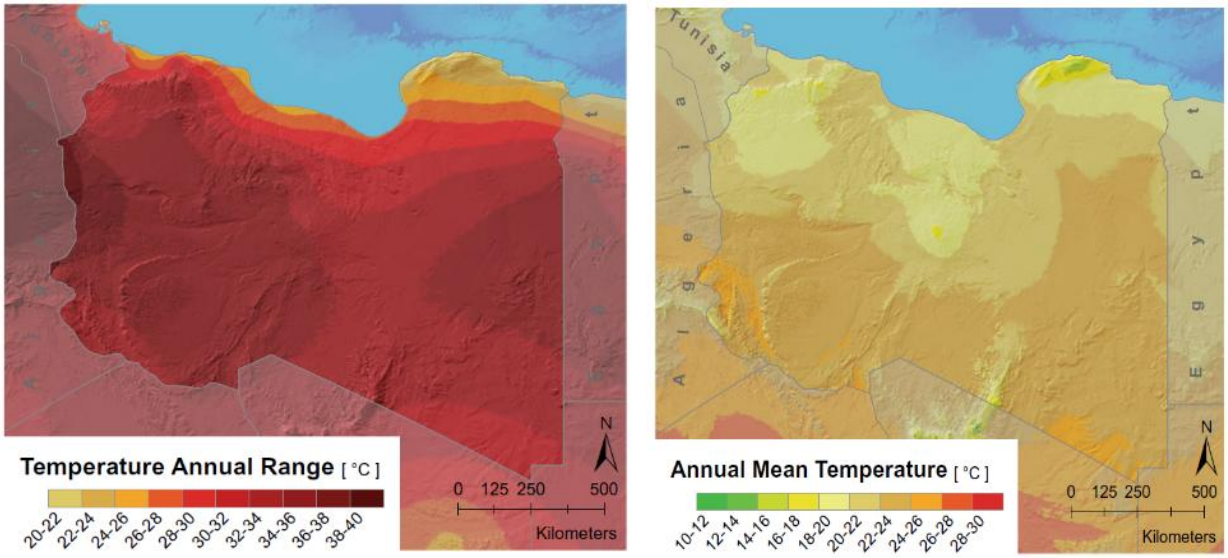
the coast are typical of the Mediterranean climate, the level of rainfall is very low and semi-desert in Tripoli and Cyrenaica, and even the desert in the Gulf of Sidra (Gulf of Sidra (Gulf of Sirte). The only exception is in the hills near the coast of Cyrenaica called the Green Mountain, where rainfall ranges from 400 to 700 mm (16 to 27.5 inch) per year, so much so that it is covered by Mediterranean forests. Libyan coast is the only plain region that receives uninterrupted rainfall, with most rainfall from October to early April, reaching its peak during December and January. The amount is usually low, between 200 and 350 mm per year in Tripolitania and Cyrenaica, and between 100 and 200 mm in the Gulf of Sirte, while to the east of Cyrenaica (in the eastern part of the coast and on the border with the state of Egypt) rainfall rates drop again to about 100 mm. Precipitation on the coast is caused by depressions coming from the Atlantic or the Mediterranean Sea, and between one depression and another, there are long periods of good weather even in winter; Winter rainfall occurs in droughts, the effects of which are felt until the following autumn[i].

Along the coast, the air humidity rises, although sea breezes blow in the afternoon, which softens the heat. In fact, in summer, the Northern winds blow even at high altitudes, as they are due to the barometric formation of the region, with a high-pressure system over the western part of the Mediterranean and a low-pressure regime on the eastern side, which explains why Libyan desert is not as hot as the Algerian desert. The average maximum temperature in summer ranges from 30°C along the coast, to 35/37°C in the north-central interior region, and to 40/41°C in the south throughout the year. But often in spring and autumn, Libya can be affected by Ghibli winds, which are hot and dry winds, capable of raising dust and causing a sudden rise in temperatures, as this phenomenon is most evident along the coast, where it also produces a sudden drop. at relative humidity, which is generally high due to the influence of the sea. In such cases, the temperature can exceed 40 ° C (from April to October even on the coast, while in winter it can reach 30 ° C.

Libya's main cities on the coast (Tripoli, Benghazi and Misrata) have a Mediterranean climate, with mild rainy winters and hot and sunny summers, with highs in July and August around 30 degrees Celsius and in summer as mentioned weather humid and north winds prevail.

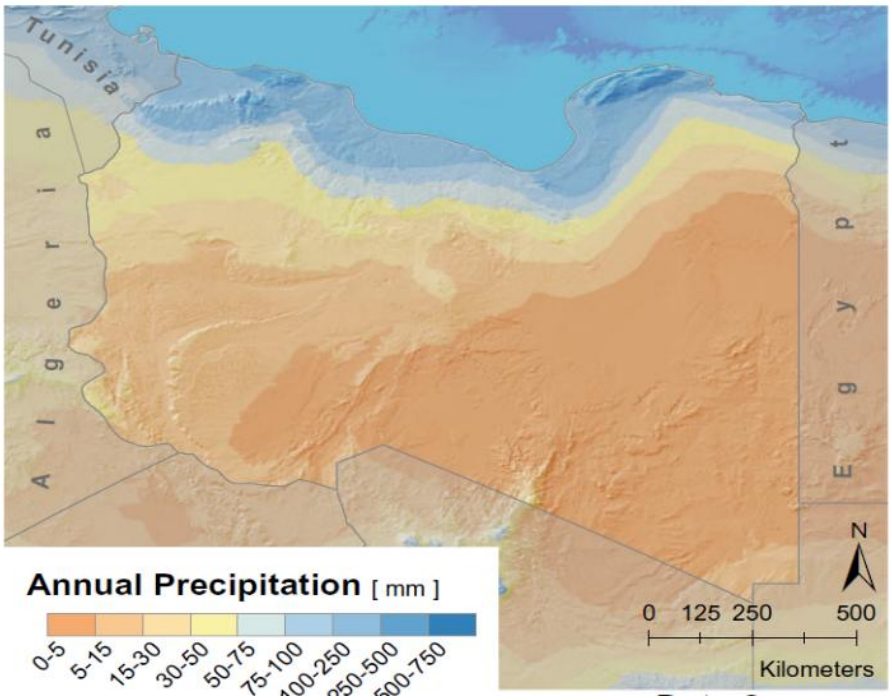
Good weather prevails all year round in the vast desert areas of Libya. During winter, the temperature range is high, the nights are cold (the temperature can drop to near freezing, and even a few degrees below in the north-central part), while on some day's temperatures are mild at around 20°C. In summer, temperatures are at their highest, reaching about 47/48 degrees Celsius, and rainfall is rare. Very and intermittent (some areas do not see any rain for years). Libyan desert is almost ubiquitous, except for oases fed by springs of water emerging from the ground, such as the oases of Kufra and Sebha.

Map 2: Maps showing the distribution of average annual temperatures and extensions In Libya country



Source: Klaus Braun, Jacqueline Passon (2020). Across the Sahara: Tracks, Trade and Cross-Cultural Exchange in Libya

Map 3: Average annual rainfall rates and its extension In Libya country



Source: Klaus Braun, Jacqueline Passon (2020). Across the Sahara: Tracks, Trade and Cross-Cultural Exchange in Libya

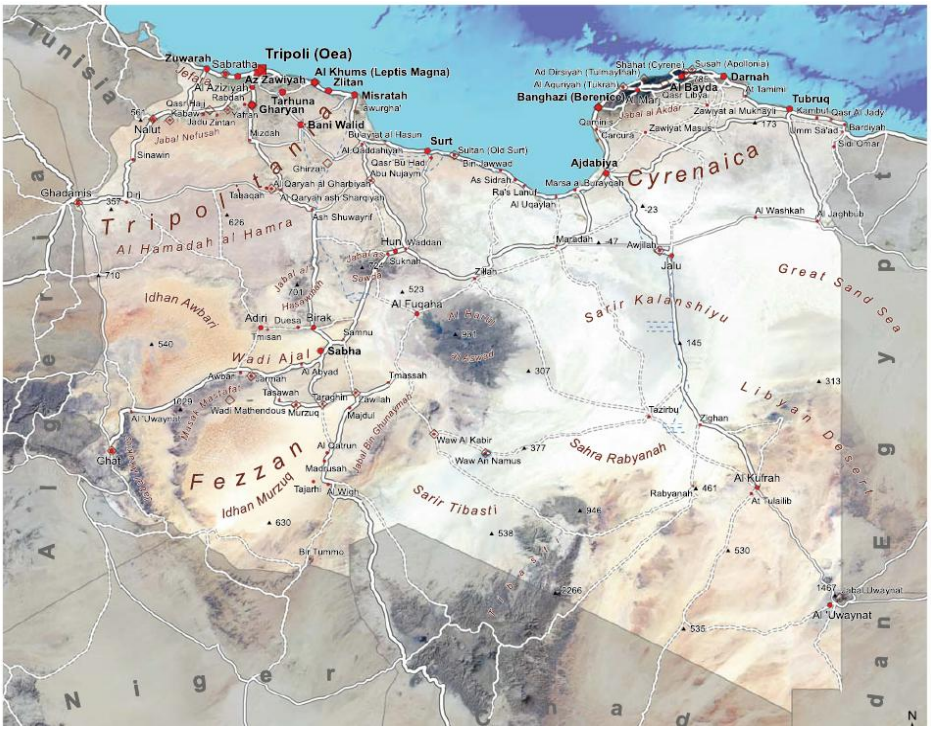
III. Topography

Except for some relatively small areas along the Mediterranean coast, Libya is mainly characterized by huge deserts and semi-deserts, which cover about 85-90% of the country. Most of Libya areas belong to the so-called Sahara, which means in Arabic "Sahara Desert", and the most famous components of these deserts are the lands of the red Hamada desert, the Tibesti bed desert, and the huge sandy seas in the areas of Idhan Ubari and Idhan Murzuq. The gravel-filled lands and deserts also form large flat plains that dominate much of the terrain of Libya. In the Western part of the Hamada Red Desert, it reaches heights ranging from 300 to 600 meters above sea level, while the heights of the Sarir Kalanshiyu and Sarir Tibesti in the east range between 150 and 350 meters. The only exception is the Sabkhat Ghuzayil depression, which is 150 kilometers south of Ajdabiya where it has the lowest point in Libya located at a depth of 47 meters below sea level. Libya's mountainous regions are located in the south and southeast with the highest point at the peak of Pico Petit in the Tibesti Mountains near the border with Chad, which rises to 2266 m above sea level. The country also has relatively smaller mountain ranges such as

the Black Haruj Mountain., Mount Akakos, and Masak (or Ben Ghanima Mountain) in the central or southwestern part of the country's Sahara Desert, which reaches an altitude of at least 1,000 meters above sea level. Between these mountain ranges and the Southern slopes of the Hamada al-Hamra Desert, there are two huge sand seas in Idan Ubari and Idhan Murzuq, which are characteristic terrain of the Sahara Desert although it covers no more than 20% of the country. Libyan desert is not only famous for these sandy seas, but also for containing many oases, most of which are concentrated along valleys or in basins where groundwater appears on or near the surface (Klaus Braun). and Jacqueline Basson, 2020).

Regarding areas along the Mediterranean coast and especially mountainous areas in coastal outback in the western and eastern parts of Libya, completely different environments can be discovered. The coastal terrain and highlands have a unique vegetation cover, demonstrating more fertile conditions in those highlands. The most important of these heights are those represented by the mountainous area of Nafusa Mountain in the west, and the heights of the "Green Mountain" in the east, which are exposed to the rains that fall during the winter. These mountains are characterized by Mediterranean vegetation and agricultural uses. Among these fertile areas of vegetation cover is a stretch of about 500 kilometers between the cities of Sirte and Ajdabiya, where semi-desert conditions extend north to the Mediterranean Sea. Along this stretch, only small areas of scattered grassland separating the desert from the coast can be found. Except for the east, the heights of Jebel Akhdar reach directly to the Mediterranean Sea, where the coast itself is mostly characterized by an overlapping system of coastal oases, sandy areas and salt flats, or sabkhas (Klaus Brown and Jacqueline Basson, 2020).

Map 4: Terrain Map Topography Surface of the State of Libya



Source: Klaus Braun, Jacqueline Passon (2020). Across the Sahara: Tracks, Trade and Cross-Cultural Exchange in Libya

In general, the territory of Libyan state is mostly spacious and has an average height between 200-600 meters above sea level, where its lands gradually descend as we head north until it ends at the Mediterranean coast, forming a low coastal belt whose breadth varies from one region to another. There are many topography features in Libyan territory, but they can be limited to three main areas: (1) The first range: includes the coastal plains in the eastern region, the Benghazi plain, Sirte, the Misrata plain and the Jafara plain; (2) The second range: includes the Northern highlands, which are represented by the Batnan plateau, the Green Mountain and the western mountain; (3) The third range: the desert range, which includes plateaus such as the Hamada al-Hamra desert and the Northern depressions such as the Jaghbub depression, Awjila, Jallo, Ajkhara and Murada depression.This range also includes the basins of Ubari, Murzuq and Kufra Basin, in addition to the mountains represented in Jabal Al-Harouj, Mount Tibesti, Jabal Al-Owainat and Jabal Al-Harouj Al-Sud, and the desert range includes several large valleys such as Wadi Al-Shati, Wadi Al-Ajal, in addition to the sand flats and Isrir (Khaled Mohamed, 2011).

The Libyan territory extends in its largest part within the dry desert range that prevails in most of the Northern part of the African continent bordering the Mediterranean Sea , with the exception of only a narrow coastal strip that extends along the Mediterranean Sea and some mountainous heights located in the north of the country, where rainfall falls in quantities in winter sufficient for the growth of natural plant life that varies in intensity and importance for the establishment of animal and human life according to the amount of rainfall fall. Of these areas, enough rainfall to grow Evergreen forests and forests like those that grow in the Mediterranean climate, such as in the Jabal Akhdar plateau, from which the rains are not enough to grow seasonal grasses that quickly disappear with the disappearance of the last rain in the season, as is the case in the Jafara plain area (Khaled Mohamed, 2011).

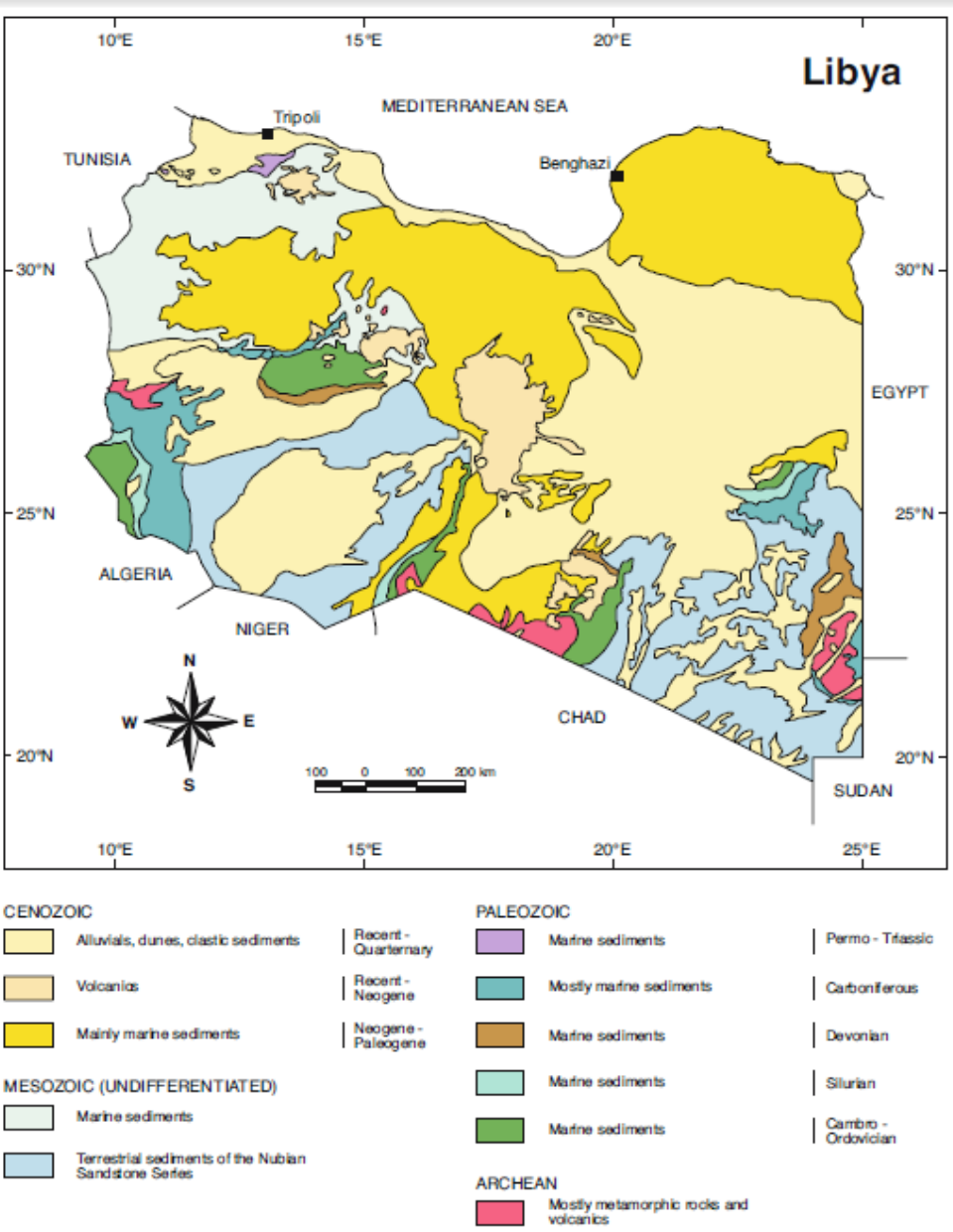
IV. Geology

In terms of geologically structure, Libya is part of the Mediterranean land formed by the North African Shield, and contains a sedimentary section that has been subject to rises and declines since early geological times, resulting in a mixture of non-marine sediment plates (sandstone and conglomerate) and other shallow marine carbonates deposited in the Cratonic basins. Libya belongs entirely to the desert region that forms the Northern part of the African Shield. Apart from a few Precambrian deposits, the country is mostly covered by ancient sediments from the Paleozoic, Mesozoic, and Cenozoic eras, and Neogene volcanics.

Prominent Precambrian outcrops are rare in Libya, but Precambrian strata have been identified in various locations through drilling. These consist of metamorphic and folded deposits with schists, gneisses, some quartzites, and granites. Precambrian formations are covered by coarse sandstones, possibly Cambrian, such as the Hasouna sandstones, and intersect with formations like the blue-purple Murizidie formation. These sediments continue throughout the Paleozoic era, but crustal movements began in the Ordovician period. The Silurian period, relatively quiet, ended with widespread tectonic extensions and a complete absence of the Lower Devonian (Gedinnian). The Devonian period starts with coarse Siegenian sandstones, coinciding with local disturbances that persisted until the Lower Carboniferous. In Jebel Uweinat and along the eastern edge of the Kufra Basin, the Paleozoic era ends with volcanic series of folding and extensions, intruded by ring

dykes, probably from the Early Paleozoic age. Following these movements in the Jefara Plain, further deposits in the Upper Carboniferous continued into the Permian, including active rifting movements that extended into the Triassic and occasionally into the Jurassic (Thomas Schulter, 2006).

Map 5Geological Map of Libya



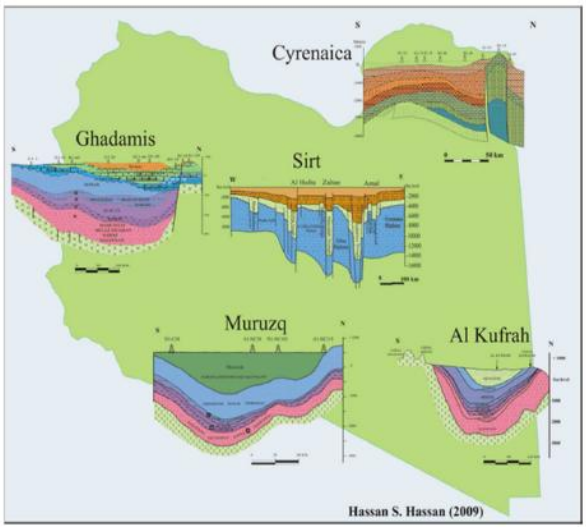
Source: Thomas Schulter (2006)

In the Murzuq and Kufra Basin, continental sedimentation continued from the Mesozoic period after interruption in the Upper Paleozoic to the Lower Cretaceous. At the end of the Lower Cretaceous period Libyan tilting began. Existing basins stabilized while subsidence occurred in the eastern part of the country, which later became stable. Geological movements, initiated over Sirte during the Cenomanian, spread east of Fezzan during the Maastrichtian, reaching the Tibesti area in the Lower Eocene. These fault movements persisted through the Miocene and Pliocene. The Oligocene period was marked by the formation of fault basins coinciding with the extension by the African block. The current edges of the Gulf of Sirte correspond to Pliocene tectonic flows followed by Quaternary tectonic flows in the same direction, whereas the Ionian Sea depression to the east of the stable coastal block is very recent (Thomas Schulter, 2006).

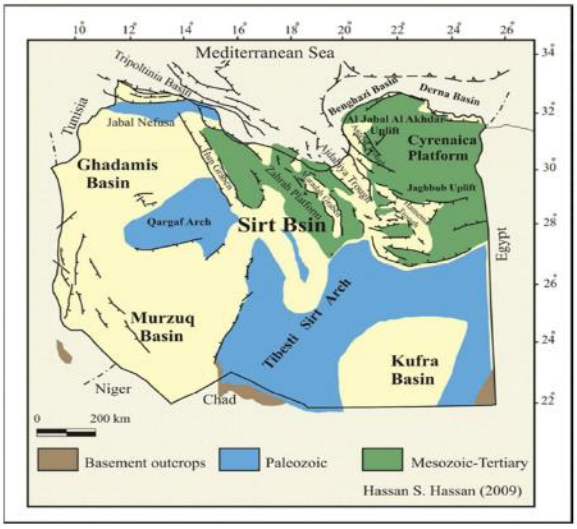
The stratigraphic history of rocks north of Cyrenaica does not belong to the basins, as it is a unique type. Biogeographical studies show that these layers are related to the unstable central Tunisian platforms. Elevations occurred in this region during the Eocene. The area became intensely folded during the Middle Miocene due to Hellenic folding movements. Current marine depth measurements indicate that the Gabes Trench is the negative axis of this basin. Significant volcanic activity occurred from the end of the Tertiary period until recent times, clearly visible in the Jebel Uweinat region and along the Tibesti axis (Thomas Schulter, 2006).

The oil sector remains the most important component of Libya's mineral industry and will remain so in the future, as the country has the largest hydrocarbon reserves in Africa. Other commodities include gypsum, iron, phosphates, potassium sodium chlorides and sulfur. Potential unique geological sites have yet to be surveyed, but there are plenty of them, especially because of their scenic beauty in the Sahara Desert.

Map 7 Sedimentary Basins in Libya

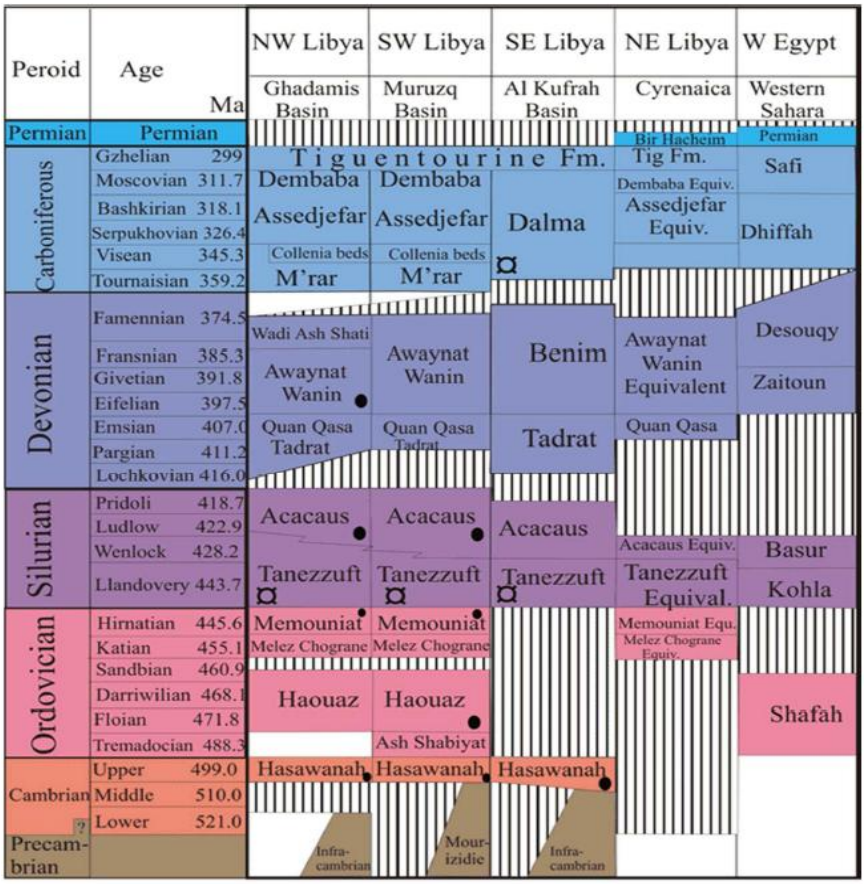


Map 6 Major Tectonic Elements of Libya



Source: Hassan Salem (2010)

Illustration 1: Stratigraphic Sequence of the Southern and Eastern Basins of Libya and Table Correlating the Paleozoic Era and Different Basins in Libya



Source: Hassan Salem (2010)

V. Fossils

Regarding geological eras, Libya features both the Devonian and Carboniferous periods in rocks of marine and continental origins. The early Devonian Tadrartian sandstones contain plant remains and are expected to include remnants of agnathan and placoderm fishes. The continental Carboniferous, as represented by the sandstone in the Kufra Basin, similarly lacks fish remains. Although there is potential for vertebrate preservation in Paleozoic layers, this has yet to be scientifically realized. The Nubian sandstone dominates the Mesozoic layers. This non-marine sequence of thick sandstones is primarily of fluvial origin and is one of the most widespread formations in Africa. Petrified wood is common in these deposits, but vertebrates have not yet been found (LeBlanc-Jacquet, 2000).

In Cenozoic rocks, fish, reptiles, birds and mammals have been recorded. Among fossils of these fish, sharks predominate in the marine environment while catfish are mostly found in a freshwater environment. Freshwater fish often appear near mammals remains in both the Eocene and Miocene periods. Crocodile and large turtle fossils are abundant during these periods. Some crocodile fossils from Jebel Zaltan measure about 8 meters in length, equivalent to the largest present-day Nile crocodiles. Bird fossil remains are relatively rare compared to other major vertebrate groups, with some wading and large running birds found in Tertiary layers, and ostrich eggshells in post-glacial deposits. All known mammalian fossils in Libya date to the Cenozoic, appearing in marine, fluvial, lacustrine, and continental environments, ranging in age from the Eocene onwards. Libya is unique in Africa for having mammal fossils in layers from all successive ages: Eocene, Oligocene, Miocene, Pliocene, and Pleistocene. No Mesozoic mammals have yet been identified in Libya, despite the widespread non-marine Nubian sandstone formations (Leblanc-Jacquet, 2000).

Libya hosts four onshore geological basins and one offshore basin: Kufra, Ghadames, Murzuq, Sirte, and Sabratah (offshore basin):

- Kufra Basin: Located in southeast Libya, the Kufra Basin forms a rectangular depression trending northeast-southwest, covering approximately 400,000 square kilometers. The basin's maximum thickness is 2,600 meters, consisting of a series of Paleozoic deposits overlying Mesozoic layers unconformably, with remnants from the late Paleozoic. The basin's center is covered by sands, except for isolated hills of Nubian sandstone and chalk, limited to the north, southeast, and southwest of Kufra Oasis. The Paleozoic sequence base is exposed only in the southeast and southwest, lying unconformably over Precambrian rocks. The basin contains the following fossils (Leblanc-Jacquet, 2000):
    - The basic sandstones of the Binem Formation in Wadis Binem and Unga contain plant remains over a meter long and shell fragments.
    - Jebel al-Zalma (northeast Kufra) contains the Dalma Formation with stratified deposits and numerous plants remains and roots.

- Ghadames Basin received deposits presumed from the late Precambrian to the early Paleozoic. The Paleozoic sequence is thickest in central Ghadames Basin, thinning towards the southern edge, around the Gargaf Arch, which shows positive features throughout the Paleozoic. Mesozoic rocks exposed in Jebel Nefusa range from the Upper Triassic to the Upper Cretaceous. The basin contains the following fossils (Leblanc-Jacquet, 2000):

    - The Al Aziziyah Formation from the Middle Triassic (found in Jebel Nefusa) contains ammonite and bivalve fossils.
    - The Aouinet Ouenine II Formation from the Middle Devonian contains trilobite, algae, coral, and arthropod fossils.
    - The Cabao Formation, along Jebel Nefusa from Jadu to the Tunisian border, contains vertebrate fossils, such as Spinosaurus remains, shark teeth, fish scales, crocodile teeth, and turtle fossils.

- The Chameau Mort Formation from the Upper Jurassic (found from Kalla to Wazen near the Tunisian border) contains numerous plant fossils.
- The Chicla Formation from the Lower Cretaceous, along the northern slopes of Jebel Nefusa, contains plant remains and large petrified tree trunks and freshwater fish fossils.
- The Dembaba Formation from the Upper Carboniferous contains numerous cephalopod remains.
- The Kasbah-Leguine and Bir Ben Tartar Formations from the Middle Ordovician contain various non-marine arthropods and cnidarians.
- The Melez Chograne Formation from the Ordovician contains trilobite, brachiopod, and coral fossils.
- The Ouan Kasa Formation from the Lower Devonian contains fish, brachiopod, and echinoderm fossils.
- The Wadi Thamat Formation from the Middle Eocene contains gastropod fossils.

Murzuq Basin: This large structure is filled with Cambrian to Quaternary deposits, exceeding 3,000 meters in thickness in the central part. The basin contains the following fossils (LeBlanc Jaquet, 2000):

- Acacus Formation from the Silurian period, which contains various plant formations among the oldest plants ever discovered.
- Aouinet Ouenine II Formation from the Middle Devonian period, which contains fossils of radiolarians and non-articulated brachiopods.
- Murizidie Horst Formation from the Silurian period, which contains abundant fossils of graptolites, bivalves, and corals.
- Ouan Kasa Formation from the Lower Devonian period, which contains abundant fossils of brachiopods, echinoderms, and trilobites.

Sirte Basin: The Sirte Basin extends southward to the Kufra Basin, through major marine deposits extending from the Eocene to the Tibesti Massif. The sedimentary units of the Sirte Basin extend eastward until they reach the Western Desert Basin of Egypt. The primary source of sediment supply for the Sirte Basin was the elevated land to the south and west, containing rocks from the Middle, Early, and Cretaceous periods. This basin contains the following fossils (LeBlanc Jaquet, 2000):

- Atrun Limestone from the Upper Cretaceous period, a white limestone extending from the mouth of Wadi Atrun to the Marsa Hilal area in northern Cyrenaica, containing fossils of radiolarians and crustaceans.
- Cyrene Formation from the Oligocene period, covering a wide area on the upper plateau of Jebel Akhdar, containing fossils of nummulites.
- Derna Limestone from the Middle Eocene period, composed of limestone, with outcrops along the coastal cliff near Derna and covering a large part of Jebel Akhdar, containing fossils of algae, nummulites, echinoderms, and mollusks.

- Faidia Formation from the Middle Eocene period, found along the road below the ruins of the old castle near the entrance to the village of Faidia, about 16 km south of Shahat, containing fossils of mollusks, algae, and echinoderms.
- Jardas Formation from the Upper Cretaceous period, composed of limestone near the village of Jardas Al-Abid, about 24 km south of Marj in northern Cyrenaica, containing fossils of mollusks, echinoderms, gastropods, and bivalves.
- Marada Formation from the Lower Middle period, found along the southern cliff of Dor Marada in the central Sirte Basin, containing abundant fossils of plant remains and terrestrial vertebrates (such as mammals) in the exposed sand basins along the base of Jebel Zaltan, while the upper section contains shallow marine fossils (such as bivalve banks and coral reefs, etc.).
- Mizda Formation from the Upper Cretaceous period, found around and south of Mizda Oasis, about 175 km south of Garian, containing fossils of gastropods, brachiopods, echinoderms, and bivalves.
- Regima Formation from the Middle Miocene period, found along the front of the cliff below the village of Regima, about 29 km east of Benghazi, containing fossils of mollusks, echinoderms, and coral reefs.
- Zmzam Formation from the Upper Cretaceous period, found on an isolated hill near the entrance to Wadi Tar, about 48 km northwest of Sukna Oasis, containing fossils of arthropods, gastropods, and coral reefs.

VI. State of Libya ecosystems

Considering the state of biodiversity in Libya, it can be said that despite the vast size of the country, biodiversity in Libya is somewhat weak in terms of recorded species. Studies and research have shown the presence of 1800 species of plants and 4590 species of animals, and these figures certainly do not represent the number of species registered in the country, especially animal species due to the lack of surveys.

Although most of the country is arid desert, the fertile, rainy coastal zone makes up only a small part of the region (Fourth National Report, 2010). There are four main ecosystems in Libya:

1) Marine and coastal ecosystem

It represents an area starting from the seashore and ranging in width between 5-25 km along the Libyan coast. The coastal strip widens in the west of the country, reaching up to 120 kilometers as in the western Jafara Plain; and narrows to less than a kilometer as in the Tolmeitha area in Benghazi; the annual rainfall in this region ranges between 200-250 millimeters. This strip is characterized by a biological diversity predominantly of the Mediterranean type with many models of semi-desert biodiversity in both plants and animals. It includes most of Libya's economic and industrial activity and houses more than half of the country's population, creating pressures on the marine and coastal environment. The Mediterranean climate prevails in this region with wet winters and dry summers. This strip receives significant amounts of rainfall with occasional dry years. It includes many wetlands such as sabkhas, swamps, and salt lakes in addition to sand dunes. The strip is composed of several plains separated by semi-desert areas.

I. Marine phytoplankton and zooplankton

There is no comprehensive study of phytoplankton and zooplankton along the Libyan coast. Available information on these organisms is available through a study carried out by Nijamuddin (1984), which identified a list of Libyan diatoms present in marine and freshwater environments. This study showed that more than 60% of the total recorded organisms are plankton, while 92 genera of diatoms were documented, including 390 organisms. Another study conducted along the Tripoli coast documented three groups of phytoplankton (diatoms, dinoflagellates, and cyanobacteria), recording 40 genera of phytoplankton, 28 of which were diatoms, 12 were dinoflagellates, and few cyanobacteria and other unspecified types. In 2006, a field study along the western coast of Libya revealed that the western coast's phytoplankton was characterized by many diatoms, dinoflagellates, rare coccolithophores, and very rare silicoflagellates. The highest concentration of phytoplankton was found in the Misrata area, where diatoms were the dominant phytoplankton followed by coccolithophores and silicoflagellates (Khaled Al-Tayeb, 2020).

Table 2: List of phytoplankton (diatom algae) collected from the coast of Tripoli (2009)

Amphora sp.	*Triceratium* sp	*Pleurosigma* sp
Chaetoceros sp	*Eucampia* sp	*Rhbdonema* sp
Climacosphenia sp	*Bellerochea* sp	*Striatella* sp
Cocconeis sp	*Gyrosigma* sp	*Tabellaria* sp
Biddulphia sp	*Entomononeis* sp	*Dytilum* sp
Licmophora sp	*Centronella* sp	*Skeletonema* sp
Navicula sp	*Coscinodiscus* sp	*Hemiaulus* sp
Pinnularia sp	*Grammatophora* sp	*Odontella* sp
Pseudonizschia sp	*Proboscia indica*	
Rhizosolenia sp	*Nitzschia* sp	

Source: Marine Biology Research Center - Tripoli – Libya

During the same 2006 survey, zooplankton was studied in the area from Zuwara to Misrata to examine the main concentration area of surface zooplankton (fish eggs and larvae). The survey showed that the dominant zooplankton were anchovy fish, representing 51% of the collected larvae, followed by sardine fish zooplankton at 9.6% of the larvae, and the remaining part from other species such as Serranidae, Gobidae, and Labridae families. Eleven orders, 39 families, 39 genera, and 40 species of surface zooplankton were identified in Libyan waters (Khaled Al-Tayeb, 2020).

Table 3: List of phytoplankton (diatom algae) collected from the coast of Tripoli

Copepoda	Copepods Larvae
Tintinides	Gastropods
Foraminifera	Polychaeta larvae
Larvacea	Ascidacea
Cladocera	Echinodermata
Hydrozoa	Bryozoa
Thalliacea	Decapodes
Lamellibranchia	Chaetogntha

Source: Marine Biology Research Center - Tripoli – Libya

II. Large Marine Algae

Although there are no comprehensive studies on marine vegetation in Libya, available information indicates that that marine plant richness is not high. Fifteen genera (representing 29 species) of green algae (Chlorophyta), 19 genera (representing 34 species) of brown algae (Phaeophyta), 76 genera (representing 112 species) of red algae (Rhodophyta), and two genera (representing 3 species) of cyanobacteria (Cyanophyta) have been recorded (Nizamuddin et al., 1979).

According to a study by Joudah et al. (1992) in eastern Libya (Tobruk and Ain Ghazala coasts), 46 species of marine algae were recorded, including 18 species of green algae, 12 species of brown algae, and 16 species of red algae. The same study recorded the presence of Halimeda algae near Marj Al-Tal in Ain Ghazala, documented as an introduced species to the marine environment of Libya. The study by Joudah et al. (1992) also noted that the Penicillus capitatus algae were found in large numbers in the Ain Ghazala area, although it is registered as a rare species in the Mediterranean. In a separate study, benthic algae samples were collected in 2007 from the Tripoli coast (Tajura) from different depths ranging from 5 to 30 meters below sea level, recording 47 algae species, including 14 green algae species, 9 brown algae species, and 23 red algae species. Another study conducted on the Benghazi coast, published in 2011, focused mainly on brown algae, identifying a total of 37 species (representing 19 genera), showing a gradual increase in brown algae compared to previous studies on Benghazi's marine algae (Joudeh et al., 1992).

A study on algae was conducted in 2015 on the western coast of Libya in the Zawiya area, documenting 195 species of marine algae, including 41 species (belonging to 22 genera) of brown algae, 102 species (belonging to 48 genera) of red algae, 44 species (belonging to 18 genera) of green algae, and 8 species (belonging to 5 genera) of cyanobacteria (Shteiwi and Hana, 2015).

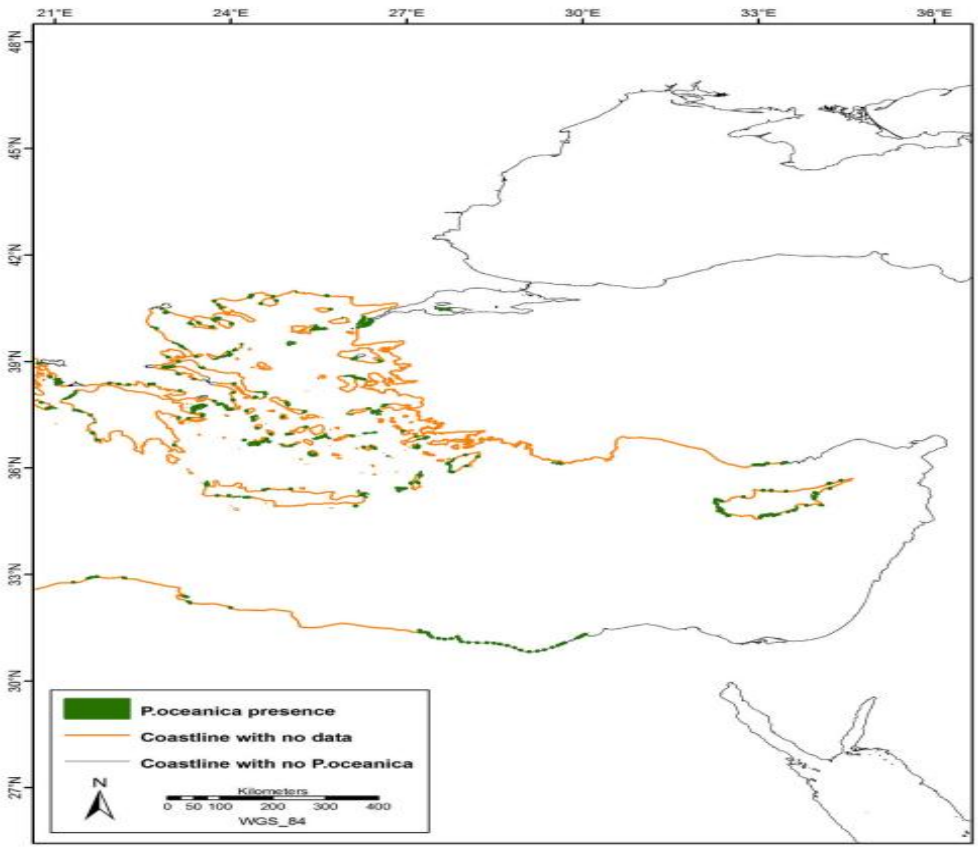
Another study on algae was conducted in 2019 on the western coast of Libya in the Sabratha area, documenting 78 species (belonging to 52 genera) of marine algae, including 36 species (belonging to 23 genera) of red algae, 19 species (belonging to 12 genera) of green algae, 20 species (belonging to 14 genera) of brown algae, and 3 species (belonging to 3 genera) of cyanobacteria (Hana et al., 2019).

III. Seaweed (Seagrasses)

Two species of seaweed have been studied: (1) seaweed or Mediterranean grass (Posidonia oceanica); (2) and Cymodocea nodosa, well in the Mediterranean Sea, the former being completely widespread along the coasts of Libya and the latter partially found in different regions. Although there is no comprehensive study on this seaweed, some studies have been conducted on this species in Libyan coast, a study was conducted at the beginning of the last century In Farwa Lake (1937), another scientific study was conducted by the Marine Biology Research Center

(1970), and most recently, two studies were conducted as part of the Action Plan for the Conservation of Marine Vegetation in the Mediterranean, a project adopted during the Eleventh Meeting of the Contracting Parties to the Barcelona Convention in October 1999. The Regional Activities Centre for Specially Protected Areas has been entrusted with the implementation of this project. In the first study conducted in Farwa Lake, three types of seaweed were recorded to prevail in the lake: *Cymodocea nodosa*, *Posidonia oceanica*, and *Caulerpa prolifera*. The second study was conducted near Ain El Ghazala Lake and revealed the presence of three main plant formations: *Cymodocea nodosa meadow*, which covers most of the lake bed, and *Posidonia Oceanica* meadow. located at the mouth of the lake and in the open sea and photophilous clusters on rocks at the edges of the shore. However, the seaweed species *Halophila sterulacea* in Ain el-Ghazala has been reported as a species introduced from the Red Sea, yet the species extends southwest along the Mediterranean coasts.

Map 8: Current distribution Map of meadows Posidonia Oceanica In the Eastern Mediterranean



Source: Teleska et al . (2015)

IV. Cephalopods

Twenty-four species of cephalopods (Cephalopods) have been recorded along the Libyan coast (RAC/SPA, 2017), belonging to 8 families and 3 orders. Most of these species have economic value in Libyan markets. However, no comprehensive study on these species exists, and knowledge gaps remain.

No.	Family	Species
1.	Sepiidae	*Sepia elegans*, Blainville, 1827
2.		*Sepia officinalis*, Linnaeus, 1758
3.		*Sepia orbignyana*, Ferussac, 1826
4.	Sepiolidae	*Rossia macrosoma*, Delle Chiaje, 1829
5.		*Heteroteuthis sp*, Gray, 1849.
6.		*Sepiola rondeleti*, Leach, 1817
7.		*Rondeletiola minor*, Naef, 1912
8.		*Sepietta oweniana*, Orbigny, 1840
9.	Loliginidae	*Loligo forbesi*, Steenstrup, 1856
10.		*Loligo vulgaris*, Lamarck, 1798
11.		*Alloteuthis ntedia*, Linnaeus, 1758
12.		*Alloteuthis subulata*, Lamarck, 1798
13.	Enoploetuthidae	. *Abralia veranyi*, Ruppell, 1844.
14.	Ommastrephidae	*Illex coindetii*, Verany, 1839
15.		*Todaropsis eblanae*, Ball, 1841
16.		*Todarodes sagittatus*, Lamarck, 1798
17.	Thysanoteuthidae	*Thysanoteuthis rhombus*, Troschel, 1857
18.	Octopodidae	*Octopus macropus*, Risso, 1826
19.		*Octopus vulgaris* Cuvier, 1797
20.		*Scaeurgus unicirrhus*, Orbigng, 1840
21.		*Pteroctopus tetracirrhus*, Delle Chiaje, 1830
22.		*Eledone cirrhosa*, Lamarck, 1798
23.		*Eledone moschata*, Lamarck, 1798
24.	Argonautidae	*Argonauta argo*, Linnaeus, 1758.

Source: RAC/SPA, 2017

V. Sponges

Although there are very few studies of sponges in Libya, commercial sponges (bath sponges) are natural resources with high economic potential but deserve careful management of their natural stock (Milanese et al., 2008). There are five types of sponges well distributed in the Mediterranean: *Hippospongia communis*, *Spongia officinalis*, *Spongia lamella*, *Spongia mollissima* and*Spongia zimocca*, where those sponges are currently under threat due to poaching and the spread of diseases. These species are included in the Protocol on Biodiversity and Specially Protected Areas of the Barcelona Convention (Annex II) and the Berne Convention (Annex III), where sponge harvesting is required to be regulated or regulated by some rules in

different countries. However, an effective and coordinated cross-border strategy has not been developed between countries to regulate sponge fisheries for them (Milanese et al., 2008). A study has been conducted in the area from Khoms to Misrata, where many economic species *Spongia officinalis*, *Hippospngia communis* and other species such as *Arcorina cerebum*, *Axinella* sp and *Petrosia* sp have been recorded.(RAC/SPA, 2010).

VI. Benthic animals

The Mediterranean coastal region is one of the world's significant biodiversity hotspots. The diversity of habitats along the Libyan coastline reflects the variety of benthic animals, particularly in the intertidal zone and the continental shelf occupied by marine mollusks (Abu Shaala et al., 2014). Additionally, the presence of lagoon ecosystems is a common feature along the southern Mediterranean coasts. The Libyan coastline includes four large lagoon systems: Farwa in the west, Ain Ziana, Lake Bomba Bay, and Ain Ghazala in the eastern region. Recently, 36 species of mollusks were recorded in the western part of Libya, including 25 gastropod species, 10 bivalve species, and one polyplacophoran species (Abu Shaala et al., 2014). Recently, two more studies were conducted in the eastern part of Libya. The first study in the Brega area recorded a total of 12 gastropod species, including three new records, and 28 bivalve species, including three new records. The second study in Lake Ain Ziana, 10 kilometers north of Benghazi, recorded 15 gastropod species and three bivalve species, totaling 18 mollusk species (Amer and El-Toumi, 2018). Amer and El-Toumi (2018) also documented the presence of 8 crustacean species, 3 ostracod species (Ostracoda), 2 isopod species (Isopoda), and 3 amphipod species (Amphipoda) in the eastern part of the country. The latest study conducted in 2020 (Bick-Benghazi et al., 2020) along the Libyan coast recorded a total of 343 marine mollusk species (187 gastropod species, 119 bivalve species, 27 cephalopod species, 5 polyplacophoran species, and 5 scaphopod species).

VII. Marine mammals

As stated in Libya's National Biodiversity Monitoring Program and Libyan National Document aimed at identifying important ecosystem characteristics and assessing the ecological situation and pressures on marine and coastal biodiversity in the Mediterranean Sea in Libya, studies and literature on marine mammals are very limited. To date, only two papers (Berzi, 2006) and (Berzi et al., 2008) on cetaceans

have been published. According to information collected and documented by fishermen, it has been found that dolphins are abundant and increasing in numbers. on Libyan coast.

Table 5: Types of cetaceans (whale) found in Libyan waters

	الاسم العلمي	الاسم الإنجليزي	الاسم العربي
	Tursiops truncatus	Bottlenose dolphin	الدلفين قارورى الأنف
	Delphinus delphus	Common dolphin	الدلفين ذو المنقار القصير
	Stenilla colarualba	Striped dolphin	الدلفين المخطط
	Grampus griseus	Risso's dolphin	دلفين ريسو
	Ziphius cavirostris	Cuvier's beaked whale	حوت كوفييه ذو المنقار
	Physeter macrocephalus	Sperm whale	حوت العنبر
	Balaenoptera physalus	Fin whale	الحوت الزعنفي

Source: Etayeb, K. S. (2020)

In addition to these publications, there are other sources that provide information about cetaceans such as the Mediterranean Database on cetaceans (www.medaces.uv.es). However, there are no comprehensive studies and monitoring activities focusing on cetaceans and marine mammals in general in Libya.

Regarding other marine mammals, notably the monk seal (*Monachus monachus*), a critically endangered species, there is historical information confirming the existence of some colonies in Cyrenaica during the seventies (Sergent et al., 1978). Until 2011, there was no information on this species, but a female seal was caught by a fishing net in the vicinity of the Ain El Ghazala marine reserve (Al-Faji et al., 2013). However, a study was conducted between the Ministry of Environment and the Regional Activities Center for Enjoying Areas Specially protected (RAC/SPA) in late spring 2002 with the aim of identifying potential "hot spots" for the presence of Mediterranean seals in the coastal region of Cyrenaica (Hamza et al., 2003), seals were seen in the Farwa 2021 region by hunters.

VIII. Sea Turtles

In recent decades, three species of sea turtles have been documented along Libyan coast: the green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), which does not appear regularly and is rarely noticed, the loggerhead turtle (*Caretta caretta*), the only well-studied turtle species on Libyan coast (Laurent 1997; 1999), and the nesting activity of this species in turtles has been documented since the eighties. But special scientific studies have begun in the mid-nineties,

through cooperation between the Ministry of Environment, the Marine Biology Research Center (MBRC) and the Regional Activities Center for Special Protected Areas (RAC/SPA), national surveys were conducted aimed at monitoring the whereabouts and nesting of these species of turtles and their presence along Libyan coast (1995-1998).

Sea turtle nesting image east of Sirte (LibSTP)

The results of the first phase of the field survey, which took place during 1995, on 50 beaches located along the coast extending from the Egyptian border to the city of Sirte (145 km), showed the presence of a total of 176 nests and 342 paths for crawling to lay eggs, and the same research showed that sea turtles were exposed to significant threats as a result of predation caused by carnivores and sea crabs, which led to the loss of 44.8% of the eggs in the nests of sea turtles. During 1996, The second phase of the field survey in the area between Sirte and Misrata, with a length of 209 km from Libyan coast, where 66 turtle encroachment paths were recorded. This was followed by the implementation of the last phase of the field survey, which took place during 1998, where 15 crawling paths were recorded for female loggerhead turtles. Not only that, but it has also been documented that turtle bycatch levels by fishermen's nets and other fishing gear also pose another threat to Mediterranean turtles.

During 2005, the Ministry of Environment launched an initiative to implement the National Action Plan for the Protection of Sea Turtles and their Habitats, where a

program was established under the name of Libyan Sea Turtle Program (LibSTP), which aims to study, protect and increase awareness of sea turtles in Libya, and the program also aims to train volunteers and students to monitor and protect the nesting beaches of sea turtles on a voluntary basis. Based on Field surveys , conducted during the years 2005-2008, where the results showed that the nesting of sea turtles is mainly concentrated in four areas: the Gulf of Sirte, the area around Benghazi, some sandy beaches in Jabal Akhdar (Cyrenaica), and the Derna-Tobruk area. The results of the field survey conducted during 2005 showed the presence of 73 healthy nests on 3 beaches west of Sirte, which resulted in the successful exit of more than 3,000 young chicks. During 2006-2007, a field survey was conducted for 28 beaches along Libyan coast, with a total of 550 and 841 nests recorded in 2006 and 2007 respectively. In the 2009 season, 358 nests were recorded at five nesting sites in the Sirte region, confirming the monitoring program that the Gulf of Sirte is the most important breeding and feeding area for sea turtles. A recent study of loggerhead turtles was also conducted in two sites west of Tobruk (Qaradba and um al-Frays) and reported a total of 21 nests comprising about 40 turtle tracks (Ministry of Environment, 2020).

During 2021, the Regional Activities Centre for Special Protected Areas (RAC/SPA), in collaboration with the Ministry of Environment and the United Nations Environment Program (UNEP), carried out a recent study entitled "Sea turtle research and conservation in Libya: a contribution to the protection of Mediterranean biodiversity", which concluded with the following findings (RAC/SPA-UNEP/MAP, 2021):

- The highest average density of nesting trails for loggerhead sea turtles was documented on the beaches of Sirte, at about 14.5 ±8.5 trails/km. The lowest average density of nesting trails was on the beaches of Misrata at 2 ±2.1 trails/km. A deterioration in the nesting rates of sea turtles on the beaches of Misrata (hence the number of nests) decreased from 5.9 routes/km in 2007 to less than 0.1 routes/km in 2018. The density of the nesting path in Cyrenaica was halfway between the density of the trails between the beaches of Sirte and Misrata. The natural predation of turtle nests, as well as illegal activities to extract sand from beaches, have been shown to significantly alter the natural geomorphology of the beaches where turtles nest.

- Nesting density rates for loggerhead turtles have been documented on Libyan beaches, where Sirte beaches have the highest average nest density of 10.1 ±5.1 nests/km, while the beaches of Misrata recorded the lowest average nesting density of 1.3 ±1.0 nests/km.
- The total number of loggerhead sea turtle nests observed along Libyan coast over the period 2005-2019 varied, ranging from 10 nests in the Jabal Akhdar region to 393 nests on the shores of the Gulf of Sirte

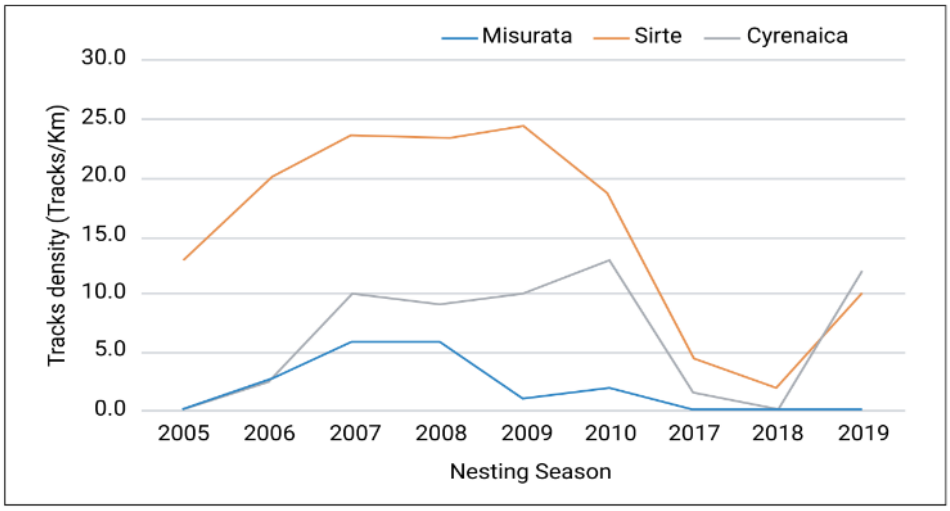
Table 2: Average nesting density (nest/km) and average nesting path density (route/km) of loggerhead sea turtles recorded in Libya (2005 - 2019)

Zone	Nest or track	2005	2006	2007	2008	2009	2010	2017	2018	2019	Max	Min	Mean	± SD
Misurata	Nests/km	NS	1.3	2.9	NS	0.9	2.1	0.4	0.5	NS	2.9	0.4	1.3	1.0
	Tracks/km	NS	2.6	5.9	NS	0.9	2.1	0.3	0.1	NS	5.9	0.1	2.0	2.1
Sirte	Nests/km	8.2	16.8	17.2	NS	12.9	10.2	4.1	5.6	5.8	17.2	4.1	10.1	5.1
	Tracks/km	13.0	19.9	23.4	NS	24.4	18.7	4.5	1.8	10.1	24.4	1.8	14.5	8.5
Cyrenaica	Nests/km	NS	2.4	9.6	4.5	5.2	9.0	1.2	0.0	5.8	9.6	1.2	5.4	4.0
	Tracks/km	NS	2.4	10.0	9.2	10.2	12.9	1.4	0.0	11.9	12.9	1.4	8.3	5.3

NS= no surveys conducted.

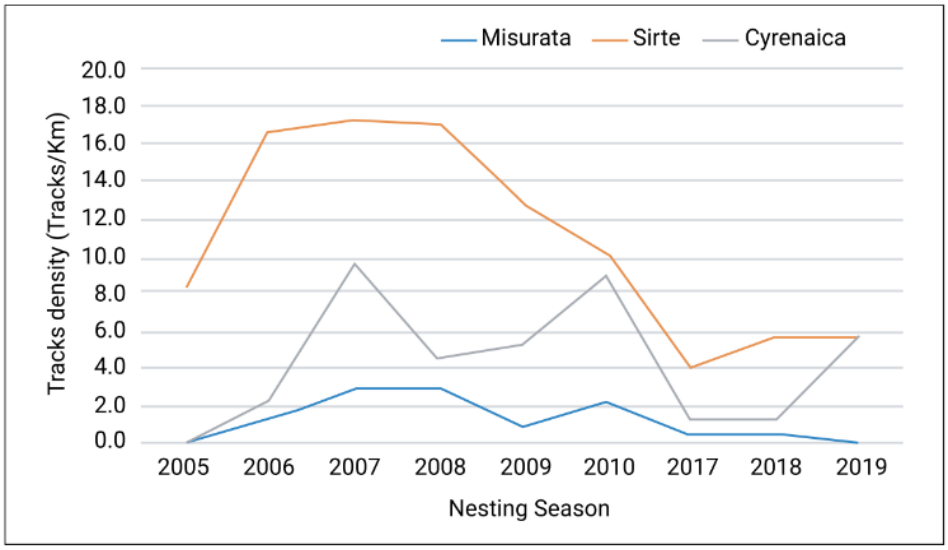
Source: RAC/SPA-UNEP/MAP, 2021

Illustration 1: The density of nesting paths for loggerhead turtles, which were monitored annually in the areas of Misrata, Sirte and Cyrenaica



Source: RAC/SPA-UNEP/MAP, 2021

Illustration 2: The density of nests for loggerhead turtles, which was monitored annually in the areas of Misrata, Sirte and Cyrenaica



Source: RAC/SPA-UNEP/MAP, 2021

This study concluded with some recommendations, which can be summarized in the following points:

- Strengthening the legal framework for protected areas in Libya, through the preparation of the proposed draft law that was drafted in 2022, by the Ministry of Environment with the participation of the relevant authorities.
- Continued monitoring of beaches with turtle nesting activities, with monitoring activities increased to cover other areas such as the shores of the Gulf of Sirte, the eastern region of Sirte, west of Zweitina, east of Tobruk and northwest of Benghazi.
- Maintain monitoring efforts for major beaches along Libyan coast, to maintain turtle nesting data on an annual basis to predict future national nesting data.
- programs for gender monitoring, genetic studies and turtle tracking studies continued to be implemented, by expanding them to other areas to the east of the country.
- Establish a national project on the assessment of interactions between sea turtles and fisheries in Libyan waters.
- Establishment of relief and rescue centers in the nesting area between Tripoli and Tobruk.

- Develop a national strategy to increase awareness efforts for stakeholders, fishers, schools and decision-makers at the national and local levels.

Aquatic Birds

The first attempt to monitor and document birds was by a researcher (Pandey, 1976) where a study of birds was prepared in Libya but it was limited information and included a checklist of bird species in Libya, where 317 species of birds were recorded, including 92 species known to breed within Libyan territory, 145 species that migrate regularly and do not breed locally, and 80 other species that migrate passing through Libyan territory accidentally.

A photo of birds within the Hisha Reserve

The second of these attempts was through a survey carried out during 1993 on Libyan coast through a joint project with the International Working Group for Waterbirds and Wader Research (WIW) in cooperation with the Marine Biology Research Center (MBRC) and the University of Tripoli, where this study showed the presence of small colonies of concentrations of the small crested tern), where there are no serious threats to the colonists observed during the survey, as 40 pairs and 1,700 pairs of terns were recorded respectively (Meinninger et al., 1994).

Photo from Al-Haysha Reserve (Ministry of Environment)

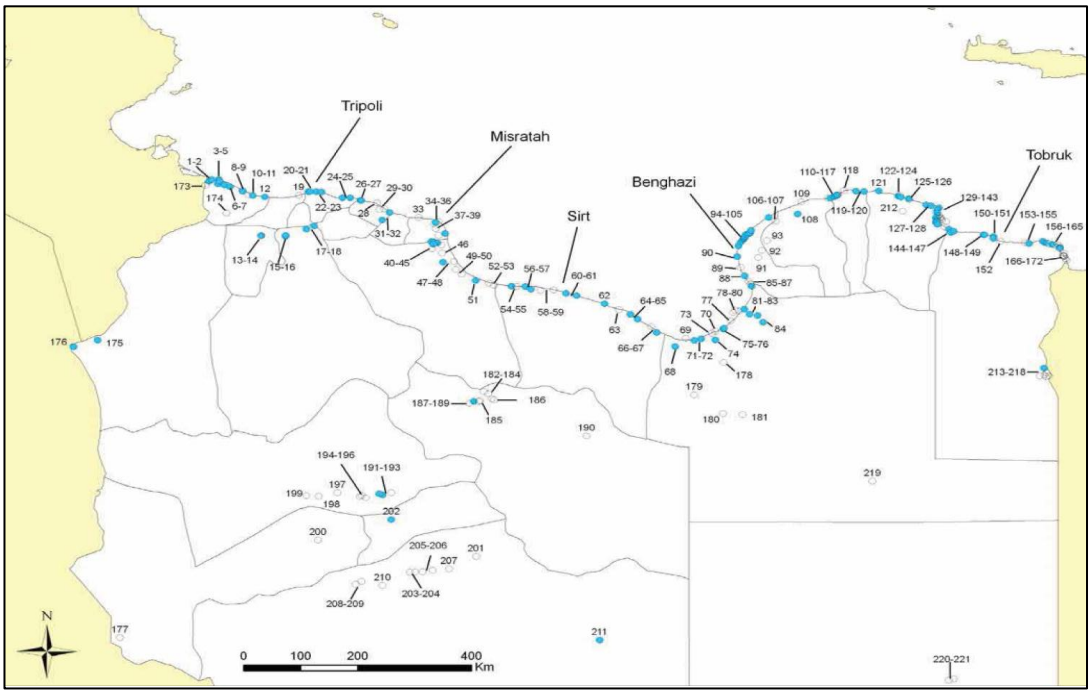
There has been increasing interest in Libyan wetlands over the past two decades. Since the development of the UNEP Action Plan for the Mediterranean (MAP) in 1995, which includes 21 countries around the Mediterranean (including Libya), within the framework of the Barcelona Convention (the "Convention for the Protection of the Marine Environment and the Coastal Area of the Mediterranean"). Furthermore, in 2000, Libya became a party to the Ramsar Convention. Subsequently in 2005 Libya acceded to the African-Eurasian waterfowl (AEWA). In January 2005, the Ministry of Environment participated in conducting the first Libya Wetland Survey, under a memorandum of agreement with the Regional Activities Centre for Special Protected Areas (RAC/SPA) and the African-Eurasian Waterfowl Convention (AEWA), and with the support of Wetlands International and the National Wildlife Institute (INFS). Italy, ONCFS-France.

Several research papers covering waterfowl have also been issued, such as Al-Taib (2002), where he monitored waterbirds in the far west of the country (Farwa), and the researcher DeVos during 2003 documented the birds observed during a survey of coastal areas, and the researcher / Jaskel prepared during 2005 a research paper

that included valuable new information on the status and distribution of some Libyan birds during field surveys in 2004 and 2005.

A repeated survey was conducted during the period from January 2006 to 2010, where sufficient data were collected to help publish the Atlas of Winter Waterbirds in Libya during the period (2005-2010), during which a total of 101 waterbird species were identified during the census period between 2005 and 2010, by monitoring waterbirds found in 110 Libyan Coastal wetlands. The same survey also showed that seagulls account for more than 50% of Libyan waterbirds found in Libyan wetlands. None of Libyan wetlands observed in this survey exceeded more than 20,000 bird populations on average (Ramsar V Standard for International Bird Importance), with the largest number of birds recorded in Sabkha Qanfudhah, where 20,186 bird individuals were recorded during 2006 (EGA-RAC/SPA, 2012).

Map 9: Map of Libyan wetlands



Source: EGA-RAC/SPA, 2012

Table 3Total number and species of birds recorded in Libyan wetlands during the period (2005-2010)

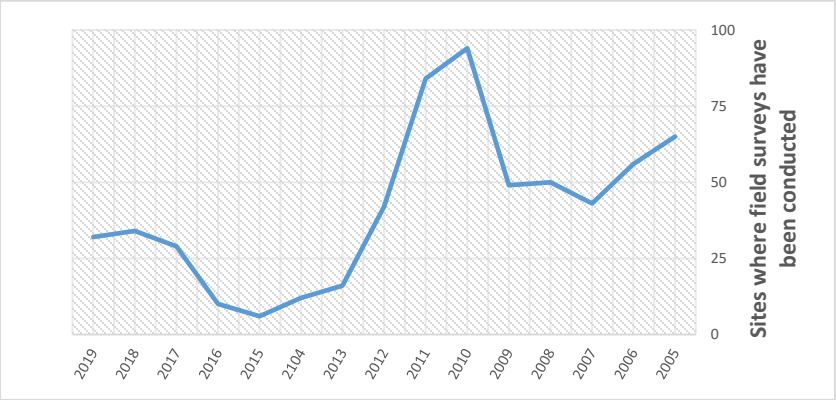
Average	2010	2009	2008	2007	2006	2005	Years
44338	51112	41325	52489	39326	51782	29995	Total recorded bird populations

Average	2010	2009	2008	2007	2006	2005	Years
79	83	67	77	78	79	80	Total number of bird species recorded

Source: EGA-RAC/SPA, 2012

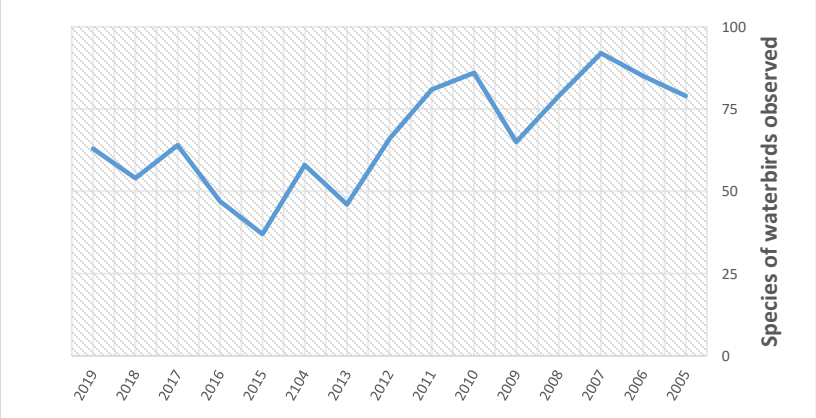
Thereafter, the winter census for the years following 2010 continued until 2020, when the results of the winter waterbird census in Libya for 2011 and 2012 were published (Buras et al., 2013; Al-Taib et al., 2015). Since 2013, the number of sites surveyed and monitored has decreased due to the general security situation, conflicts and wars in some areas of Libyan territory, and this security situation has affected the results of the winter bird census as well as the results of monitoring the species and numbers of birds in general.

llustration 3: Sites where field surveys have been conducted for waterfowl



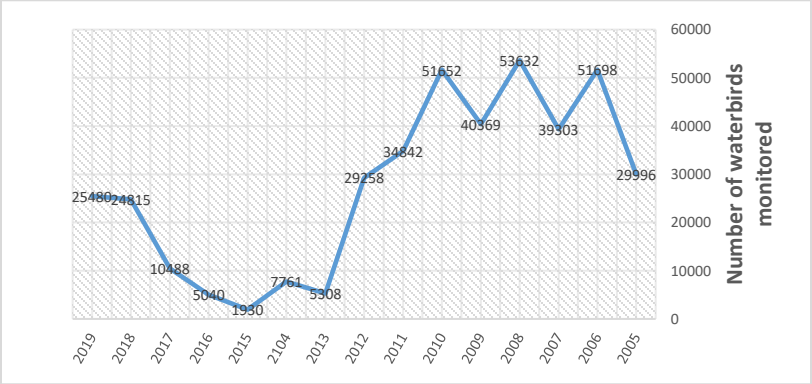
Source: Etayeb, K. S. (2020)

Illustration 4Species of waterbirds observed in Libyan wetlands (2005-2019)



Source: Etayeb, K. S. (2020)

Illustration 5Number of waterbirds monitored in Libyan wetlands (2005-2019)



Endemic Seabirds in Libya

Several studies have documented the breeding of seabirds in different locations along Libyan coast (Meininger et al., 1994, Zafzaf et al., 2006, Al-Taib and Al-Saghir, 2007, Hamza, 2014). The presence of other seabirds in the winter in Libya was also documented during the International Winter Bird Census (IWC) during the period (2005-2020), where this literature identified the types of seabirds that breed in Libya, namely:

Table 8: List of Endemic and registered seabirds in Libya

الاسم العربي	الاسم العلمي	الاسم الانجليزي	رقم
الخرشنة المتوجة الصغيرة	*Thalasseus bengalesnis*	Lesser-crested Tern	1
الخرشنة الشائعة	*Sterna hisundo*	Common Tern	2
الخرشنة الصغيرة	*Sterna albifrons*	Little Tern	3
الخرشنة القزوينية	*Hydroprogne caspia*	Caspian Tern	4
النورس أصفر الأرجل	*Larus cachinananus michahellis*	Yellow-legged Gull	5
الغاقة الخضراء الأوروبية	*Phalacrocorax aristotelis desmarestii*	European Shag	6
قطقاط اسكندراني	*Charadrius alexandrines*	Kentish plover	7
جلم ماء البحر المتوسط	*Puffinus yelkouan*	Mediterranean Shearwater	8
أطيش شمالي	*Morus bassanus*	Northern Gannet	9
غراب البحر	*Phalacrocorax carbo*	Great Cormorant	10
غاق شائع	*Phalacrocorax aristotelis*	European Shag	11
عقاب نسارية	*Pandion haliaetus*	Osprey	12
كركر كبيرة	*Stercorarius skua*	Great Skua	13
كركر بومارياني	*Stercorarius pomarinus*	Pomarine Skua	14
نورس مستدق المنقار	*Chroicocephalus genei*	Slender-billed Gull	15
نورس أسود الرأس	*Chroicocephalus ridibundus*	Black-headed Gull	16
النورس الصغير	*Hydrocoloeus minutes*	Little Gull	17
نورس البحر المتوسط	*Larus melanocephalus*	Mediterranean Gull	18
نورس أدوين	*Larus audouinii*	Audouin's Gull	19
نورس الرنجة	*Larus argentatus*	Herring Gull	20

الاسم العربي	الاسم العلمي	الاسم الانجليزي	رقم
نورس السمك	*Larus ichthyaetus*	Pallas's Gull	21
نورس شائع	*Larus canus*	Common Gull	22
نورس دغبة	*Larus fuscus*	Lesser Black-backed Gull	23
نورس أصفر الساق	*Larus michahellis*	Yellow-legged gull	24
خرشنة قزوين	*Hydroprogne caspia*	Caspian Tern	25
خرشنة سندويتشية	*Sterna sandvicensis*	Sandwich Tern	26
خرشنة بنغالية	*Thalasseus bengalensis*	Lesser Crested Tern	27

Seabirds were also well documented during the International Winter Census (IWC) from 2005 to 2020, where the number of species documented ranged from 7 to 20 species, while the minimum documented was 7 species during 2015 and the maximum number documented was 20 species during 2007. The total number of bird individuals documented ranged from 598 to 36,000 species as shown in the figure. Next.

Illustration 6: Number of seabird species recorded in the International Winter Census (2005 - 2020)

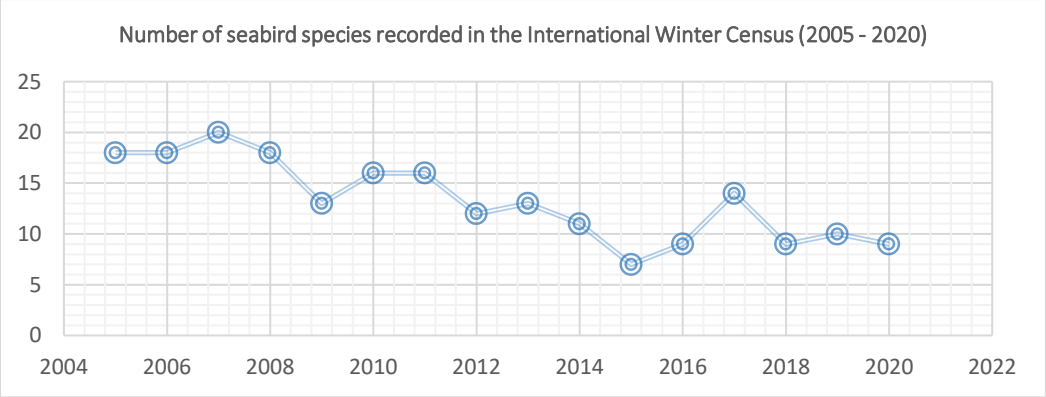
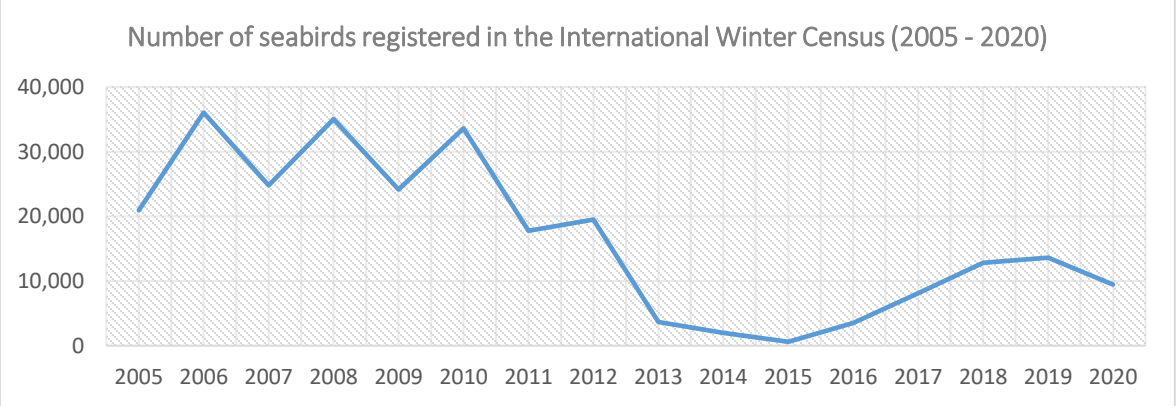


Illustration 7: Number of seabirds registered in the International Winter Census (2005 - 2020)



IX. Coastal salt marshes

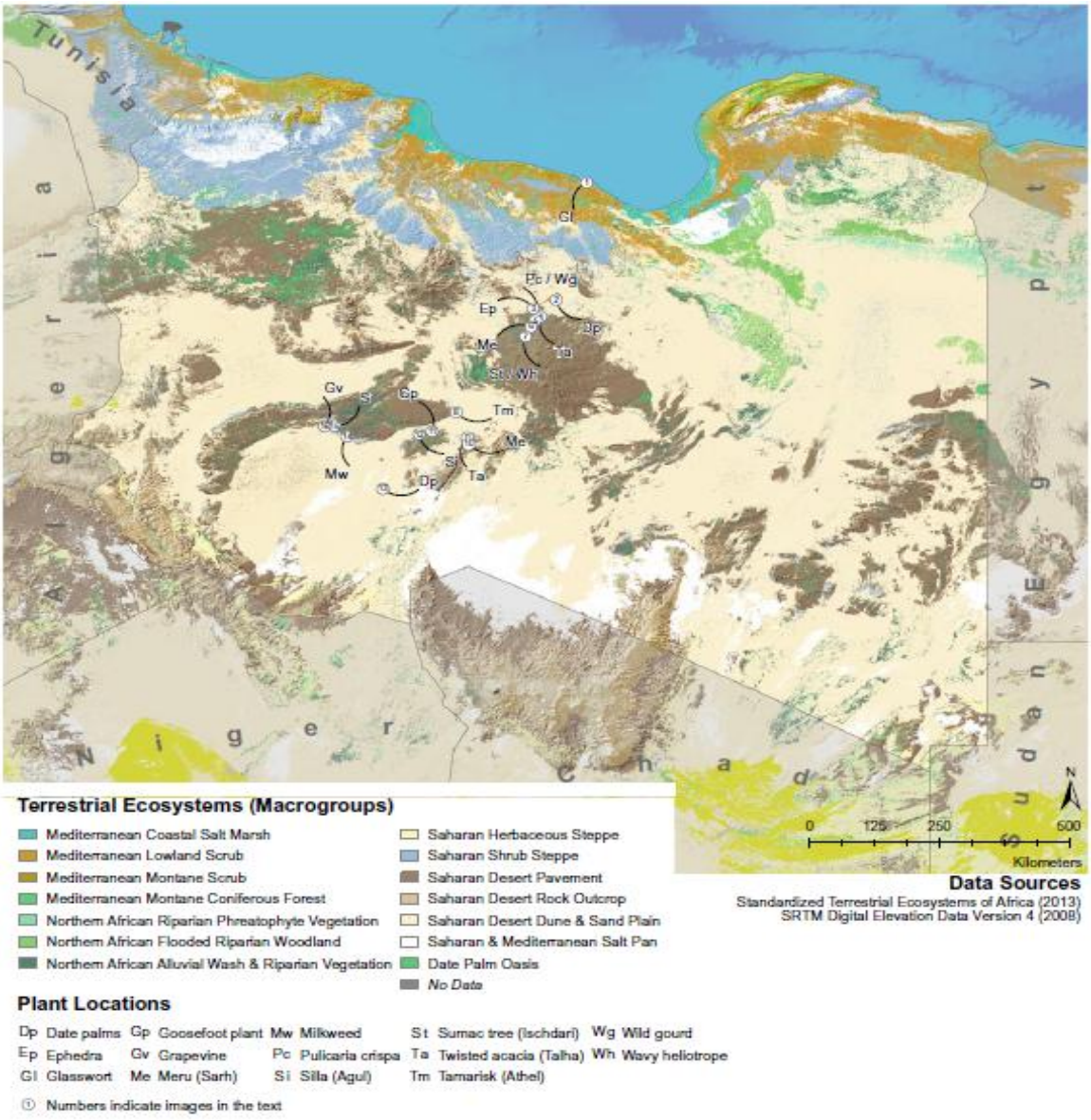
They are found in low-lying areas along Libyan coast, where high evaporation rates cause almost all seawater to evaporate, forming flat salt ponds called "sabkhas" in

North Africa. These areas are characterized by particularly saline-loving plants, including dense populations of perennial grasses such as grasses that tolerate high levels of alkaline or saline soils, which form the coastal salt marshes of the Mediterranean Sea, which are mainly found along the west coast of Tripoli, eastern Misrata, and in the area between Ajdabiya and Benghazi. Salt sabkhas are known as wetlands dominated by vegetation cover consisting of short shrubs or grasses, and sabkhas are associated in their composition with the low level of the coast and sabkhas arise in protected or low places, which are usually submerged in water, especially in winter, where sea water passes through the sand dunes through waterways to the sabkha and remains until spring, then evaporates in summer and salt is deposited. The vegetation in the sabkha is characterized by salt-tolerant plant species (Halophytes) as it is characterized by its high osmotic pressure that may reach 100 atm or more. As well as plants that live in these environments have many different mechanisms to adapt to conditions of high salinity It is noted that many halophytes are succulent and that their leaves and trunks become juicy as a result of the growth of water-saving tissue as well as halophytes to shrink the surface layer of the leaf and increase the thickness of the outer layer and cover it with a layer of wax and bristles to reduce the evaporation of water and the effect of high temperatures, some of which have salt glands, which act as filters for salts in excess of the plant's need, and this explains their ability to grow and reproduce in saline soils, where no other non-saline plants can grow in them, and one of the main halophytes that make up the vegetation cover in the sabakh is the Sueida or Shafshav plant (*Suaeda vermiculata*) of the Ramrami family (Chenopodiaceae) (Freiha, 2010).

2) Terrestrial ecosystems

In line with their topographical and climatic nature, the terrestrial ecosystems in Libya are characterized mainly by groups of terrestrial ecosystems representing the Mediterranean Sea in the north and desert ecosystem clusters in the south. There are no clear boundaries between these groups of ecosystems, with some transition areas having plant populations affected by those adjacent Northern and Southern ecosystems.

Map 10: Map showing the distribution of terrestrial ecosystems in Libya



Source: (Klaus Braun, Jacqueline Passon 2020)

I. Mountain Ecosystems

Mountain ecosystems are in Libya's western mountains, such as Nafusa Mountain and Jabal Akhdar. They range from dry mountain forests at low altitudes to plants found on mountain tops. Only 0.01% of these terrestrial systems (217,000 square meters) are forested lands, with an average annual rainfall of about 200-300 mm. However, these forests should be more accurately called "shrubs of the Mediterranean coast". The most prevalent plants in these systems. The mountainous ecology in Libyan lands are Mediterranean cypress trees (*Cupressus sempervirens*),

eucalyptus trees (*Eucalyptus camaldulensis*), Indian or Persian lilac (*Melia azedarach*) and olive (*Olea europaea*).

II. Semi-Desert Ecosystem

The arid or semi-desert region, which is located just south of the mountainous region and parallel to it. The average rainfall is between 50 to 150 mm, and this area is often used as pasture and some agricultural activities carried out by some Bedouins in some valleys.

III. Desert Ecosystem

The Libyan desert can be divided into several deserts or smaller areas, where Libya can be divided into three sections: the western section (from the coast to the Acacus Mountains); the central section (from Sirte to the bed of Tibesti); and the eastern section (from Cyrenaica through Libyan desert and Kufra to the border with Sudan).

i. **Western Section:** This part includes the following areas:
   - Hamada Al-Hamra Desert (Red Plateau): It is a mixture of sandy seas and rocky plains, located just south of the Western Mountain down to the sandy Ubari Sea and Wadi Al-Shati, and is often reached via Daraj and Ghadames.
   - Edhan Ubari (or Ubari sandy sea): It is a sandy desert with magnificent sand dunes and desert lakes, starting from the Algerian border and extending east to Sabha, and bordered to the south by small Hamada (west) and Wadi Al-Hayat, where a strip of oases and settlements passes from Sabha to Owainat near the Algerian border.
   - Ghat: Located just south of Idhan Ubari, it includes three mountains: Acacus, Mesk Millet, and Masak Sitafit, which are separated by Wan Kasa (a narrow strip of sand that runs around Mount Akakus from south to north). This sand strip is usually used to enter Mount Akakus either down from Serdillis (Owainat) or from Wadi Metkhentoush via Masak Sitafit.
   - Edhan Murzuq (Murzuq Sandy Sea): just west of Masak Milt and all the way east to Jabal al-Ghanima.

ii. **Middle Section:** This part includes the following areas:

- Pre-Saharan areas: The term is generally used to refer to the area just before the actual desert, which is just south of Misrata and just west of the Western Mountain and includes several sites such as Garza.
- Sirte (Sirte Desert): This small desert is located south of the Gulf of Sirte between Tripolitania and Cyrenaica, which includes Jebel Waddan and Montenegro (Aswada).
- Jabal al-Haruj al-Aswad (Black Harouj Mountain): Located in the immediate center of Libya, it is 1200 meters high (Kraf Al-Sabah), surrounded by a huge area of lava deposits. It can be reached from the Zallah area (north) via a path that crosses the mountain all the way south to Tamassa and Wau al-Kabir.
- Tibesti bed: Starting from the Great Wau area, passing west with the morning bed, then Jebel Ben Ghanima (the site of many Stone Age discoveries), continuing south towards the Tibesti bed (which extends slightly to Chad) and heading southwest towards Wau al-Namos.
- Rabiana Sand Sea: It extends from Wau Al-Namous to the east through the huge Ramlet Rabiana (Sand Sea of Rabiana) towards Tazerbo (in the eastern section).

iii. Eastern Section: This part includes the following areas:

- (Al-Batnan): It is a small desert area that starts directly south of the coast, passing between the Green Mountain and the Egyptian border in Cyrenaica, and extends all the way to the large sandy seas and even Kufra.
- Great Sand Sea: These great sandy seas separate Cyrenaica from Libyan desert in the south and along the Egyptian border and include different oases: Jaghbub (at the border), Awjila, Jallo, as well as various oil fields.
- Libyan Desert: occupies a large part of southeastern Libya and extends to Egypt, which includes: the Sea of Ribiana Sands (coming from Wau al-Namos), then Zigen, Bazima, Rabiana and Al-Jawf, through which you can head north towards Jallo (via a paved road) or the path south towards Jabal al-Owainat.
- Jabal Al-Owainat (Jabal Al-Owainat): It is located near the Egyptian border.

VII. Biodiversity Status of Living Organisms

1) Plant biodiversity

Libya is characterized by a distinctive vegetation cover, especially during the spring, as it is spread with many plant species with attractive pink colors, which are found on hills, mountains, valleys and desert areas, in addition to the vast coastal environments along Libyan coast. Libya consists of three main local plant areas: coastal ecosystems, mountain ecosystems, and desert ecosystems, which include more than 1,800 plant species, and provide a great diversity with variable features between Different plant areas in Libya. These plant species constitute a variable, altered plant species (Boulos, 1972). The native vegetation of the coastal area is dominated by *Artemisia campestris* and *Retama raetam* with some other plants that thrive during early spring such as mountain arugula (*Senecio gallicus*), feathery hossonia (*Hussonia pinnata*), wild watercress (*Eruca sativa*), and golden-flowered chrysanthemum (*Chrysanthemum segetum*), forest hibiscus (*Malva sylvestris*), chasperous numbering (*Erodium laciniatum*), as well as narrow-leaved snake (*Echium angustifolium*).

The Jabal Akhdar region is considered the most vegetarian diversity in Libya, due to its unique re loamy soil (terra rosa), as well as the region's relatively good rainfall (up to 600 mm/year in certain locations) and its proximity to the influence of the mild Mediterranean climate. Some plant species predominate in the Jabal al-Akhdar region, such as: Libyan Shamari (*Arbutus pavarii*), Phoenician juniper (*Juniperus phoenicea*), African wild olive (*Olea europaea var.*), lenticular ducks (*Pistacia lentiscus*), *Phlomis floccosa* and Mediterranean cypress (*Cupressus sempervirens*). While the western mountain region is dominated by the allied plant (*Stipa tenacissima*) and the *Asphodelus microcarpus plant*, there are scattered populations of Atlantic duck (*Pistacia atlantica*) at certain sites. As for the desert areas, which are known for their dryness, which cover most areas of Libya, they are characterized by the presence of vegetation cover and low diversity, especially the sand dune clusters in the sand sea south of Jaghbub along the Egyptian border and sand dunes. In the area of Al-Raybyana, northeast of Kufra and the Murzuq basin, which is covered with large areas of sand. The plant species found in desert valleys are quite different from those found in coastal or mountainous valleys. Where the plants are concentrated in oases and desert valleys represented by palm trees (*Phoenix dactylifera*), trees (Tamarix), Retama raetam *trees, Sidr (Zefizf) lotus (*Ziziphus

lotus*)*, *European cherry (*Lycium europaeum) (Ausej), acacia trees *(*Acacia tortilis), and perennial herbs such as *Panicum turgidum*, *Stipagrostis pungens*, *Stipagrostis plumosus*, Compositae plants such as *Francoueria crispa*, wormwood (*Artemisia judaica*), Egyptian drunken (Hyoscyamus muticus *of the* Solanaceae family), and Sherm (*Zilla spinosa*) of the cabbage family.

A picture showing nature on the beach in the Eastern Province

During the spring season, many annuals appear that spread in large areas in a short time after the rains in winter and in early spring, such as: gray elegina (*Senecio gallicus*), and *Hussonia pinnata*), watercress (*Eruca sativa),* chrysanthemum *segetum*, forest mallow (*Malva sylvestris*), and chasperous numbering (*Erodium laciniatum*). These annuals bear fruit and dry immediately before summer. On the other hand, salt marshes along Libyan coastline are dominated by halophytes, with most of these halophytes belonging mainly to the family Chenopodiaceae, while a few other plants belong to the families Retretic (Zygophyllaceae) and lead (Plumbaginaceae). Examples of halophytes include *Suaeda* sp., *Atripkex halimus*, *Limoniastrum monopetalum*, *Limonium pruinosum*, *Nitraria retusa*, *Zygophyllum album*.). Winter rains reduce salinity and compensate for the evaporation of water during the summer, allowing some halophytes to grow, such as the red *centauri (Centaurium pulchellum*).

The floral composition of plants in Libya is still relatively unknown as far as in-depth environmental and plant studies go (Bergen et al., 2002). Analysis of the floral structure of plants, which was carried out according to studies conducted by (Jeffrey and Ali, 1981), (Kloper et al., 2007) and (Feng et al., 2013), led to the registration of about 2118 plant species belonging to 864 genera and 161 families in Libya, of which 2088 plants (belonging to 844 genera and 145 families) were angiosperms, and 15 plants (belonging to me). 8 genera and 6 families) of gymnosperms, and 15 plants (belonging to 12 genera and 10 families) of ferns.

Libyan flora is relatively rich in numbers, with the vast majority of plant families widely spread (Aceticus, 1985 - Hammer et al., 1988 - Keith, 1965), with the following plant families dominating vegetation in Libya: *Asteraceae* with 237 species, *Gramineae* with 288 species, *Leguminosae* with 200 species, and the cabbage family (*Brassicaceae*, which includes 100 plants, the oral family (*Rubiaceae*) with 90 species, the oral family (*Labiatae*) with 63 species, the pink family (*Caryophyllaceae)* with 62 species, the protected family (*Boraginaceae*) with 53 species, and the Sercopian family (*Chenopodiaceae)* with 49 species. Dominant plant families account for 51.8% of the species found at the national level. The dominant plant genera in Libya are *Euphoria*, which includes 27 species, *Astragalus*, which includes 25 species, *Silene*, which includes 23 species, *Trifolium*, which includes 22 species, and the Garlic family Allium.) which includes 18 species,

Medicago with 18 species, *Erodium* with 15 species, *Lotus* with 15 species, Buttercup (*Ranunculus*) with 14 species, and *Helianthemum* with 14 species.

Table 4: Major plant families in Libya

Plant Families	At the international level		In Libya country	
	Species	Genera	Species	Genera
Asteraceae	1100	25000	237	97
Grass (Poaceae)	700	11000	228	93
Leguminous (Fabaceae)	500	2000	200	42
Cabbage (Brassicaeae)	350	3000	100	59

Source: (Mahklouf and Etayyeb, 2018)

Table 10: Main plant genera in Libya

In Libya country	At the international level	Plant genera
26	2000	*Euphoria*(اليوفيرا)
25	1500	*Astragalus*(القرنية)
23	500	*Silene*(السيلينية)
22	300	*Trifolium*(النفولية)
18	60	*Medicago*(النفلاوية)
15	100	*Lotus*(اللوتسية)
15	90	*Erodium*(الغرقونية)
14	250	*Convolvulus*(اللبلابية)
13	50	*Stipagrostis*(النجيلية)
13	40	*Echium*(الحمحمية)

Source: (Mahklouf and Etayyeb, 2018)

During 2018, research on updating the list of plants was published in Libya, where this research touched on the history of documenting Libyan plants, which were issued in a series of volumes published between 1976 and 1989. Since then, there have been individual attempts by researchers to rearrange the lists of plant families, species and genera in Libya, especially after the discovery of several new plant species. During this research, a list of plants comprising 43 out of 150 families was reviewed and updated. They are recorded in the Book of Plants Libya, including 138 genera and 411 plant species. As a result of this upgrading process, six new plant species have been documented in Libya: Hypericaceae, Adoxaceae, Lophiocarpaceaee, Limeaceae, Gisekiaceae, and Cleomaceae.) which are included in the National List of Libyan Plants (Gawhari et al., 2018).

2) Important Plant Areas in Libya

Five important plant areas have been identified in Libya: Jabal Akhdar, Sabkha Tawergha, Nafusa Mountain, Jabal Owainat and Jebel Yasak, and five other areas need further studies to determine their status as areas of international botanical importance: Al-Haysha, Farwa Island, Al-Batnan, Jabal Al-Harouj and Benghazi Beach. Important Libyan plant areas are found on Coastal, mountainous and desert habitats. The significant and largest among them is Jabal Akhdar in Cyrenaica, northeastern Libya are considered one of the most important and largest plant areas in Libya. The physical geography and unique climatic conditions that separate the Cyrenaica Mountains from the rest of Libya made the Jabal Akhdar (Green Mountain) distinctive, as it contains 75-80% of Libya plants, and that it contains an important and high proportion of plant species endemic to Libya, although it constitutes only 1% of Libya area. Other important Libyan plant regions include the hot springs and open canals of Tawergha, and limestone formations in the important plant area of Nafusa Mountain, which extends 500 km from the border of Tunisia and even the Nakaza region on the Mediterranean coast, where the latter includes the recently established Chavin National Park, and the Ministry of Environment is working to establish a reserve in the Owainat region in the southeast of the country. Approximately 26 plant species are native to the coastal strip of Cyrenaica (Qusayr and Qadi, 1984), of which two genera *of plants Pachyctenium maare* and *Libyella Pamp* are endemic to the Green Mountain, each of which includes only one species *Pachyctenium mirabile* and *Libyella cirenaica*. Libyan important plant regions face various risks and threats, such as tourism infrastructure development, overgrazing, deforestation for timber and charcoal, and the spread of invasive species. Additionally, unregulated coastal development is a real threat, regular planning is rare and environmental impact assessment studies (required by law) are rarely carried out. There is also a weakness in environmental planning and management as coastal areas are developed without environmental impact assessments and deforestation for fuel and charcoal has led to the death of araar (Juniperus) forests (Rudford et al., 2011).

Map 11: Map of important vegetation areas in Libya

Source: (Rudford et al., 2011)

The total number of native plant species in Libya are about 80-81 species, distributed in four endemic centers in Libya: (1) Jabal Akhdar with 44 plants with 54% of the country's native plants, (2) the coastal strip including Jebel Nafusa and the Marmarika plateau with 26 native plants (32% of native plants), (3) the desert range which includes 9 native plants with 11% native plants, and (4) the Ghat Plateau, Tibesti and Jabal Owainat which includes 2 native plants. Generally, vegetation in Libya has a low percentage of native plants, no more than 7% due to similar terrain and harsh environment. However, endemic plants form a unique genetic diversity that is limited to the country's flora. Examples of endemic plants in Libya include *cyclamen rholfsianum*, Barqawi loofah (*Arum cyrenaicum*), mountain togarium (*Teucrium cyrenaicum*), *linseed sabkha* (*h linaria tarunensis*), *Tourneuxia varrifolia*, nebulae (*Sedum cyrenaicum*), Darias (*Thapsia garganica var*), Mediterranean cypress (*Cupressus sempervirens var*) (Mahklouf and Etayeb, 2018).

The following Table shows the names of species and sub-species of **flowering** plants endemic to Libya:

Table 11: List of names of species and subspecies of flowering plants endemic to Libya

اسم النوع أو تحت النوع	منطقة الجبل الأخضر	منطقة الشريط الساحلي	منطقة وسط الصحراء	منطقة تيبيستي وغات وجبل العوينات
Ephedra altissima var. *altissiama*	+	+	-	-
Cupressus sempevirens var. *horizontalis*	+	-	-	-
Romulea cayrenaica	+	-	-	-
Croucus boulosii	+	+	-	-
Arum cyrenaicum	+	-	-	-
Allium negrianum	+	-	-	-
Allium ruhmerianum	+	+	-	-
Bellevalia cyernaica	+	-	-	-
Muscari stenanthum	-	؟-	-	-
Poa vaginata	+	+	-	-
Poa pentapolitana	+	-	-	-
Cynosorus junceus	+	-	-	-
Trisetaria vaccariana	+	-	-	-
Libyella cyrenaica	+	-	-	-
Stipagrostis libyca	+	+	+	-
Stipagrostis schawii	-	-	-	+
Orchis cyrenaica	+	+	-	-
Ranunculus cyclocarpus	+	-	-	-
Capparis spinosa var. *krugeriana*	-	+	-	-
Ammosperma variabile	-	+	؟+	-
Matthiola glutinosa	-	-	+	-
Oudneya africana	-	-	+	-
Savignya parviflora ssp. *globosa*	-	-	+	-
Erodium keithii	-	+	-	-
Erodium tocranum	-	+	-	-
Sedum bracteatum	+	-	-	-
Sedum mirum	+	-	-	-
Reseda pampaniana	-	+	-	-
Herniaria ericifolia	-	+	-	-
Cyclamen rholfsianum	+	-	-	-
Hypericum decaisneanum	+	-	-	-
Silene cyrenaica	+	-	-	-
Silene articulata	؟+	+	-	-
Silene marmarica	-	+	-	-
Petrohagia cyrenaica	+	-	-	-
Theseium erythronicum	+	-	-	-
Polygala aschersoniana	+	-	-	-
Fagonia longipedicellata	-	+	-	-
Fagonia sinaica var. *pseudocretica*	+	+	-	-
Fagoina arabica var. *membanacea*	-	-	+	-
Limonium cyrenaicum	+	-	-	-
Limonium subrotudifolium	+	-	-	-
Campanula monodiana	-	-	-	-
Rhamnus alternus	+	-	-	-
Oronbanche cyrenaica	+	-	-	-
Alkanna tinctoria ssp. tripolitana	-	+	-	-
Nonea viviani	+	+	-	-
Onosma cyrenaicum	+	-	-	-
Convolvulus maireanus	+	-	-	-
Linaria tarhunensis	+	+	+	-

اسم النوع أو تحت النوع	منطقة الجبل الأخضر	منطقة الشريط الساحلي	منطقة وسط الصحراء	منطقة تيبيستي وغات وجبل العوينات
Linaria laxiflora ssp. calcarlongum	-	+	-	-
Parentucellia floribunda	+	-	-	-
Medicago cyrenaica	+	-	-	-
Valerianella petrovichii	+	-	-	-
Ballota andreuzziana	+	-	-	-
Teucrium barbeyanum	+	-	-	-
Teucrium linivaccarii	-	+	-	-
Teucrium apollinis	+	-	-	-
Teucrium davaeanum	-	+	-	-
Teucrium Zanonii	-	+	-	-
Micromeria guichardii	+	-	-	-
Origanum akdarense	+	-	-	-
Nepeta cyrenaica	+	+	-	-
Pachyctenium mirabilis	+	-	-	-
Scabiosa obertimanenetti	-	+	-	-
Scabiosa libyca	+	-	-	-
Anthemis cyrenaica var. *cyrenaica*	+	-	-	-
Anthemis cyrenaica var. *radiata*	+	-	-	-
Anthemis glareosa	+	-	-	-
Anthemis krugeriana	+	-	-	-
Anthemis taubertii	+	-	-	-
Bellis sylvestris var. *cyrenaica*	+	+	-	-
Carthamus divaricatus	+	-	-	-
Centurea haimanniana	+	-	-	-
Centaurea cyrenaica	+	-	-	-
Ferula marmarica	+	-	-	-
Evax libyca	-	+	-	-

المصدر: (EGA, 2010)

3) Animal biodiversity

Libya has a great diversity of habitats and ecosystems such as sea, beaches, forests, mountains, steppes, grasslands, and a variety of terrestrial and desert wetlands. There is also diversity of wetlands in Libya, such as: (1) salt marshes (sabkhas) such as Sultan, Abu Kamash and Benghazi; (2) coastal lakes such as Ghazala and Aziana; (3) water springs such as Tawergha and Ain Kaam; (4) desert oases such as Qabaroun and the oasis of Bazima; (5) Dams such as the Mejnine Dam and Wadi Zart; (6) Artificial reservoirs such as man-made river reservoirs; (7) Water treatment plants (Ministry of Environment, 2010).

According to preliminary estimates, the number of animals in Libya was 4,590 species. The most important of these organisms in terms of number are insects (81%)

followed by birds (7%). However, animal diversity in Libya still needs further taxonomic studies to document it well (Ministry of Environment, 2010).

Table 12: Numbers of Animal Groups Present in Libya

Taxonomic groups	Total Number	Native species	Endangered species
Primitive Animals	؟	؟	؟
Mollusks	139	؟	؟
Spiders	170	؟	؟
Insects	3763	؟	؟
Amphibians	3	؟	؟
Fish	98	1	1
Reptiles	113	1	4
Birds	356	؟	41
Mammals	76	4	12

Source: (EGA, 2010)

Ten orders of mammals have been recorded in Libya with 25 species and 47 genera and 76 species. Mammals are among the most sensitive groups to any environmental imbalance, which led in Libya to the disappearance of many species, and the following Table shows the types of mammals that have been recorded in Libya and threatened at the global level, and it is believed that some of them disappeared from Libya (Ministry of Environment, 2010).

Table 13: Threatened Libyan mammals

The situation at the global level	Scientific name	م
Near Threatened	*Felis margarita*	1
Vulnerable	*Rhinolophus mehelyi*	2
Vulnerable	*Acinonyx jubatus*	3
Vulnerable	*Gazella dorcas*	4
Vulnerable	*Ammotragus lervia*	5
Endangered	*Gazella leptoceros*	6
Endangered	*Allactaga tetradactyla*	7
Critically Endangered	*Monachus monachus*	8
Critically Endangered	*Gazella dama*	9
Critically Endangered	*Addax nasomaculatus*	10
Critically Endangered	*Gerbillus grobbeni*	11
Critically Endangered	*Gerbillus syrticus*	12
Extinct in the wild	*Oryx dammah*	13

Reptiles include lizards, snakes and turtles, and 113 different species of reptiles belonging to 14 species have been recorded . Of these, 4 species are registered as threatened (Ministry of Environment, 2010).

Table 14: Threatened reptiles in Libya

The situation at the global level	order	Phylum	Scientific name	م
Vulnerable	Squamata	Lacertidae	*Acanthodactylus pardalis*	1
Near Threatened	Squamata	Scincidae	*Chalcides occelatus*	2
Critically Endangered	Testudines	Testudinidae	*Testudo kleinmanni*	3
Vulnerable	Testudines	Testudinidae	*Testudo graeca*	4

Source : EGA, 2010

356 species of birds have been recorded, belonging to 61 species, and 18 orders. Of these, 41 species are threatened both locally and globally (Ministry of Environment, 2010).

Table 15: Threatened birds in Libya

الحالة على المستوى العالمي	الحالة على المستوى المحلي	الاسم العلمي	م
Near-threatened	Near-threatened	*Aegypius monachus*	1
Least Concerned	Rare/Accidental	*Aenigmatolimnas marginalis*	2
Vulnerable	Vulnerable	*Aquila clanga*	3
Vulnerable	Vulnerable	*Aquila heliacal*	4
Near-threatened	Near-threatened	*Aythya nyroca*	5
Least Concerned	Rare/Accidental	*Caprimulgus ruficollis*	6
Near-threatened	rare/Accidental	*Chersophilus duponti*	7
Vulnerable	Vulnerable	*Chlamydotis undulate*	8
Least Concerned	Rare/Accidental	*Cinclus cinclus*	9
Near-threatened	Near-threatened	*Circus macrourus*	10
Least Concerned	Rare/Accidental	*Columba palumbus*	11
?	Rare/Accidental	*Coracias abyssinicus*	12
Near-threatened	Near-threatened	*Coracias garrulus*	13
Least Concerned	Rare/Accidental	*Corvus albus*	14
Near-threatened	Near-threatened	*Crex crex*	15
Endangered	Rare/Accidental	*Falco cherrug*	16
Near-threatened	Near-threatened	*Falco concolor*	17
Vulnerable	Vulnerable	*Falco naumanni*	18
Least Concerned	Extirpated	*Falco Subbuteo*	19
Near-threatened	Near-threatened	*Falco vespertinus*	20
Near-threatened	Near-threatened	*Gallinago media*	21
Near-threatened	Near-threatened	*Glareola nordmanni*	22
Near-threatened	Near-threatened	*Larus audouinii*	23
Near-threatened	Near-threatened	*Limosa limosa*	24

الحالة على المستوى العالمي	الحالة على المستوى المحلي	الاسم العلمي	م
Least Concerned	Rare/Accidental	*Luscinia Luscinia*	25
Vulnerable	Vulnerable	*Marmaronetta angustirostris*	26
Least Concerned	Rare/Accidental	*Mergus serrator*	27
Near-threatened	Near-threatened	*Milvus milvus*	28
Endangered	Endangered	*Neophron percnopterus*	29
Near-threatened	Near-threatened	*Numenius arquata*	30
Critically endangered	Critically endangered	*Numenius tenuirostris*	31
Least Concerned	Rare/Accidental	*Oenanthe finschii*	32
Least Concerned	Rare/Accidental	*Oenanthe xanthoprymna*	33
Endangered	Endangered	*Oxyura leucocephala*	34
?	Rare/Accidental	*Phylloscopus orientalis*	35
Least Concerned	Rare/Accidental	*Pluvianus aegyptius*	36
Critically endangered	Critically endangered	*Puffinus mauretanicus*	37
Least Concerned	Rare/Accidental	*Stercorarius pomarinus*	38
Least Concerned	Extirpated	*Struthio camelus*	39
Near-threatened	Near-threatened	*Sylvia undata*	40
Near-threatened	Near-threatened	*Tetrax tetrax*	41

Source : MoE, 2010

VIII. Nature reserves in Libya

The conservation of biodiversity in Libya is of great interest to all those responsible for its management and protection as it is the real wealth of humanity and a source of food and medicine. For the State to achieve the principles of biodiversity conservation, a number of reserves and natural parks have been established, and the first nature reserve in Libya was declared in 1978, and the number of these reserves reached 11 nature reserves until the issuance of the fourth national report in 2010. The ratio of the total area of the reserves to the total area of Libya has about 0.16% of the total area of the country, and the most important of these reserves and parks are the following:

1) Current Reserves

Alkuf National Park:

Al-Kuf National Park was established in 1978 by a decision of the former General People's Committee. The reserve is in the Jabal al-Akhdar area northeast of Libya near the city of Al-Bayda. The reserve is the only area of natural forest located between the Gulf of Gabes in North Africa and the reserve; the total area of the park is 8,000 hectares. AlKuf Park features unique plants and endemic species such as shammari and natural forests of juniper, carob, carob and oak. In addition to

documenting the presence of dolphins near the beaches and nesting sites of the Loggerhead sea turtle *Caretta caretta*, there is also a great animal diversity in a group of mammals such as hyenas, foxes, jackals, European rams, night hunters and wild cats. Since the park Containing some humid areas, the area includes many species of birds, especially resident and migratory waterfowl. Locals use part of their land for agriculture, and the most important crops and farms are apple trees, wheat and barley (Ministry of Environment, 2010).

Al-Haysha Park and Pastures:

Established in 1984 by a decision of the former General People's Committee, the Haysha Reserve is located north-central Libya, west of Sirte (about 320 kilometers east of Tripoli), covering an area of 160,000 hectares. The gazelle is one of the most important species of wildlife that has been re-introduced. Besides the species of raptors, the most important wild birds in the park are flamingos (Basharush) and wading species (EGA, 2010).

Bir Ayyad Reserve:

Bir Ayyad Reserve was established in 1992 under former General People's Committee Decree No. 631. Bir Ayad Reserve is located on the Northern edge of the Nafusa Mountains in the Southern Jafara Plain, covering an area of 12,000 hectares. Bir Ayyad Reserve combines various geological formations, slopes, plains and valleys. All these environments are inhabited by many animal species such as hyenas, jackals, foxes and hares, as well as species endemic to Mount Nafusa and Kandi, as well as a variety of reptiles. Plant species include in the area acacia trees, semi-crustacean plants and some medicinal plants (and Ministry of Environment , 2010).

Abu Ghailan Park:

Abu Ghailan Park was established by a decision of the former General People's Committee No. 631 of 1992 and is located at the foot of Mount Nafusa in the Gharyan area, 70 km south of Tripoli, with a total area of 5,000 hectares. The reserve is located in an area with a mountainous nature that contains Aleppo pine trees, shrubs and various medicinal herbs. It contains hyenas, jackals and a variety of reptiles and wild birds (DEM , 2010).

Surman Park:

The Surman National Reserve was established by the former General People's Committee Decree No. 931 in 1992 and covers an area of about 1,100 hectares. The reserve is in Surman, about 60 kilometers west of Tripoli. The nature of the area is forested, predominantly cypress (camphor) and some Aleppo pine trees. Among the animals, foxes, hares, night hunting, some birds that live and nest in the area and some reptiles have been recorded, and some mammals, such as gazelles (and the Ministry of Environment, 2010.

Al-Nakaza Park:

Al-Nakaza Park was established in 1993 under the former General People's Committee Decree No. 991 of 1993 and covers an area of 4,000 hectares. The park includes a coastal forest area with a unique terrain, where the forest covers an area of about 2,000 hectares, mostly Aleppo pine trees, but there are also other types of natural plants, some of which have medicinal value. As for the coastal area of the park, it is rich in terrestrial and marine biodiversity, and forms a unique ecosystem due to the flow of the valley into the sea. Some of the park's land is used by locals for agriculture, and the area also has a tourist hotel, in addition to taking advantage of the sandy beach for vacationers.

Sabratha Park:

Sabratha Reserve was established by the General People's Committee Decree No. 311 of 1995, covering an area of 500 hectares and located on the coastal area of the city of Sabratha. This reserve is an artificial forest area of Aleppo pine trees, and on the Northern side there are many trowel trees and acacia trees. Some animals have been reintroduced for breeding, such as gazelles. One of the obstacles facing the management of the reserve is the presence of building brick quarries near the reserve (Ministry of Environment, 2010).

Nalut Reserve:

The Nalut Reserve was established in 1997 with an area of 200 hectares in the Nalut area. The reserve is characterized as a mountainous area with a vegetation cover of palm trees, and receives water from valleys during the winter, and contains many plants that are characteristic of the Nafusa Mountain area (Ministry of Environment, 2010).

Maslata Reserve:

Maslata Reserve was established by a decision of the former General People's Committee in 1998. This reserve is a mountain forest in which medicinal plants such as thyme, rosemary, lavender and adults are spread, and the tree species are carob and ducks, and the area of this reserve is 1000 hectares located in the Southern part of the Maslata area (Al-Shaafien). They are characterized by the presence of a gundi animal. In addition to other species such as hyena, fox and jackal (Ministry of Environment , 2010).

Zalten Reserve:

Zaltan Reserve was established by a decision of the General People's Committee in 1998, and its area is 1000 hectares, and the reserve is characterized by being located in a coastal sabkha area where plants that tolerate high salinity grow, which would help protect the lands of the reserve, as it helps to stabilize the soil and prevents its degradation and transformation into a barren desert. 2010.

2) Newly declared reserves by a decision of the Minister of Environment

Table 5 Protected areas declared by a decision of the Minister of Environment

Site Name	Importance	Threats	Date of Declaration	Decision Number	Protection Objective and Type of Reserve
Papyrus Bay	An important coastal area for the breeding of fish, migratory birds and seagrasses	Marine pollution, Gelatine fishing and potential tourist pressure	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal marine protected area.
The Gulf of Bomba and the nearby opposite islands (Fatha, Misurata and Barda'a)	An important coastal area for the breeding of fish, migratory birds and seagrasses	Marine pollution, Galatian fishing and sand clouds	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal marine protected area.
Gulf Valley	It provides important habitat and shelter for many seasonal domestic and migratory birds.	illegal extraction of huge amounts of sand, Accumulation of urban solid waste	December 2021	272 for the year 21	Marine and coastal reserve

Site Name	Importance	Threats	Date of Declaration	Decision Number	Protection Objective and Type of Reserve
	Coastal lagoon surrounded by sand dunes and limestone formations Sandy beaches are used by locals for bathing and picnics in summer	Hunting with explosives (Gallatin)			
Wadi Al-Hamsa	It represents a Suitable habitat for a variety of domestic and migratory birds.	Blasting Hunting (Galatian and guns)	December 2021	272 for the year 21	Wetland Reserve
Sabkha Ain Al-Shegaga	Its water consists of a mixture of seawater seeping through the canals, and fresh water from springs. A coastal lagoon surrounded by sand dunes and limestone formations is covered with a typical vegetation composed of athels. Funa includes waterfowl, amphibians, fish and mollusks	Poaching Unorganized visits	December 2021	272 for the year 21	Wetland Reserve
Sabkha Ain Zarqa	Its water consists of a mixture of seawater seeping through the canals, and fresh water from springs. The vegetation consists of the Athel, the Asl and the Qassab Funa includes waterfowl, amphibians, fish and mollusks	Poaching Unorganized visits	December 2021	272 for the year 21	Wetland Reserve
Wadi Al Kuf e Beach	One of the most important nesting habitats is sea turtles	Sand extraction Weak enforcement of regulations within the natural park,	December 2021	272 for the year 21	Coastal marine reserve

Site Name	Importance	Threats	Date of Declaration	Decision Number	Protection Objective and Type of Reserve
	The Mediterranean monk's seal was seen in it.	Informal construction in urban areas Overgrazing			
Sandy rocky coast Talmaitha - Aqla	The coast is characterized by a high density of turtle nests A site of historical-archaeological importance Habitat Suitable for Mediterranean monk seal (sea calf) Reproduction area for fish	Blasting fishing. Construction of a new road between Talmaitha and Qasr al-Libya would threaten the change of natural structures and the closure of the mouth of the valley Development of tourism facilities	December 2021	272 for the year 21	Protection of the human and natural heritage of the region - Man and the Biosphere Reserve
Sabkha al-Koz and the building east of Benghazi	Attracting migratory waterfowl in winter	Drought Pollution from wastewater Bird hunting activity	December 2021	272 for the year 21	Wetland Reserve
Ain al-Zayana (North Benghazi)	An important coastal area for the breeding of fish, migratory birds and seagrasses	Marine pollution, Galatian fishing	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal marine protected area.
Sabkha and Lake Galiana/ Benghazi	A site of cultural and biological significance A damp nesting area for the crested tern	Growth & Development And pollution with building debris and garbage	December 2021	272 for the year 21	Wetland
Continent Island Surrounding Marine Area	An important breeding island for threatened species of migratory birds, fish and seagrasses	Marine pollution, Galatian fishing	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal marine protected area. And to keep the nesting of the tern bird
Shatt Al Badin	One of the most important nesting sites for sea turtles Used for local picnics in summer	Indiscriminate fishing of sea turtle eggs Destruction of nests and wild plants	December 2021	272 for the year 21	Coastal and marine reserve

Site Name	Importance	Threats	Date of Declaration	Decision Number	Protection Objective and Type of Reserve
Sabkha Sultan	A vast wetland important for migratory birds and the corresponding beaches are important for sea turtles	Solid waste pollution, local tourism pressure and fishing operations	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal marine protected area.
The beaches of West Sirte (Althalathinat and Qubaiba)	Nationally Important Area for Sea Turtle Nesting	Pollution, incidental fishing	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal marine protected area. Important area in the nesting of sea turtles
Ain and Sabkha Tawergha	The largest freshwater springs in Libya and enjoys a distinctive ecological diversity. It meets the sea with a vast swamp	- Pollution with solid waste and wastewater. - Lack of interest - Fishing operations	December 2021	272 for the year 21	Protection of marine and coastal biodiversity - coastal reserve. It is an important wetland
Sabkhat Qaser Ahmed East Misurata	Vast wetlands important for migratory birds and beaches important for sea turtles, distinctive Mediterranean ecological diversity	Solid waste pollution, local tourist pressure and sand clouds Urban sprawl Fishing activity	December 2021	272 for the year 21	- Protection of marine and coastal biodiversity - coastal marine reserve. - Wetland Reserve
Ain Wadi Ka'am	It is a freshwater fish farming area Includes many animals, reptiles and amphibians An important stopping point for migratory birds An important extension of the Posidonia herbarium in front of the estuary Includes a group of coastal wetlands Nesting habitat for sea turtles	Difficulty in water management Pollution from wastewater and solid waste	December 2021	272 for the year 21	- Nature reserve To protect biodiversity and watch birds - Coastal wetlands

Site Name	Importance	Threats	Date of Declaration	Decision Number	Protection Objective and Type of Reserve
Wadi Targhath	A stopover zone for migratory and trans-Saharan birds in spring. Distinctive vegetation and the area of confluence of the valley with the sea (estuary)	- The spread of a huge amount of solid waste in the water and on the coasts - Fishing operations	December 2021	272 for the year 21	Biodiversity Protection - Nature Reserve
Wadi Al , Masid	A vast extension of Posidonia herbs Classification of the Garapoli region among the list of important sites for attracting migratory birds by the World Bird Society	pollution from wastewater and solid waste, forest fires, Indiscriminate use	December 2021	272 for the year 21	Protection of marine and coastal biodiversity Nature Reserve
Al-Malaha sabkha in Mitiga	A coastal sabkha connected to the sea through a channel characterized by attracting waterfowl and has a distinctive plant diversity and a nesting area for some species. The only natural wetlands in Greater Tripoli	- Lack of interest and threatened with pollution with building debris. - Dehydration due to channel closure	December 2021	272 for the year 21	Wetland Reserve
Sabkha Abu Kammash	A coastal sabkha nested between Libya and Tunisia, a vast area that attracts many important species of waterfowl, including flamingoes, in significant numbers	- Poaching of birds - Solid waste pollution - Urban sprawl - Quarry construction	December 2021	272 for the year 21	Wetland Reserve

Source: Libyan Ministry of Environment (2022)

3) Recently declared inland wetland sites by a decision of the Minister of Environment

Table 17: Wetland Sites Declared by the Minister of Environment

Site Name	Importance	Threats	Date of Declaration	Decision Number	Protection Objective and Type of Reserve
Lake Gabaroun	Wet/Desert Oasis	Tourism pressure and pollution	December 2021	273 for the year 2021	Protection of the biological and historical diversity of the area – Ramsar Site Reserve
Lakes of the Wau Al Namous Mountains	Wet/Mountain Oasis	A distinctive environment exposed to tourism pressure and pollution	December 2021	273 for the year 2021	Protection of the human and natural heritage of the region - Man and Biosphere Reserve - Ramsar Site Reserve
Lake Bazima, northwest of Kufra	Wet/Desert Oasis	A distinctive environment exposed to tourism pressure and pollution	December 2021	273 for the year 2021	Protection of the human and natural heritage of the region - Man and Biosphere Reserve - Ramsar Site Reserve
Lake Al-Maflaa in Al-Jaghbub	Wetlands/ Mountainous Desert Oasis Border with Egypt	A distinctive environment exposed to tourism pressure and pollution	December 2021	273 for the year 2021	Protection of the human and natural heritage of the region - Man and Biosphere Reserve - Ramsar Site Reserve
um Al Maa Lake	Wet/Desert Oasis	Tourism pressure and pollution	December 2021	273 for the year 2021	Protection of the biological and historical diversity of the area – Ramsar Site Reserve
Ain al-Dhaban in Ghadames	Desert lake	Tourism pollution	December 2021	273 for the year 2021	Protection of the biological and historical diversity of the area – Ramsar Site Reserve

Source: Libyan Ministry of Environment (2022)

4) Internal sites for wildlife protection

Table 6 Sites declared for the protection of wildlife by a decision of the Minister of Environment

Site Name	Importance	Threats	Declaration Date	Decision Number	Protection target and Reserve Type
Wadi Qara'a Zaid in Wadi Al Shati	A desert area with arid vegetation suitable for many mammals such as the Dorcas gazelle	Overfishing	December 2021	277 for the year 2021	Protection of biodiversity Nature Reserve
Wadi al-Naga in Derna	Mountain forests with great biodiversity, shelter for many mammals and	A distinctive environment exposed to the	December 2021	277 for the year 2021	- Protection of biodiversity - Nature reserve

Site Name	Importance	Threats	Declaration Date	Decision Number	Protection target and Reserve Type
	nesting area for some species of birds of prey	pressure of fishing and urban sprawl			- Man and Biosphere Reserve - Ramsar Site Reserve

Source: Libyan Ministry of Environment (2022)

5) Proposed Future Reserves.

1) Al-Jazaa Reserve:

Al-Jaza'a Reserve is in Jabal Al-Hasawneh in the Wadi Al-Shati area, and this reserve is characterized by being located in a semi-arid area interspersed with some valleys and is characterized by the presence of desert vegetation, which made it a suitable environment for many types of animals such as gazelles, deer and houbara, in addition to some types of birds of prey.

2) Wadi Qaraa Zaid Reserve:

Wadi Qara'a Zaid Reserve in Wadi Al-Shati is located within the scope of the oligarchy area, and this area is a suitable environment for wild species of animals found in Libyan territory, such as gazelles.

3) Bzema Reserve:

There is a reserve in the northwest of the city of Kufra, about 170 km away, and it is characterized by the presence of its unique vegetation cover as it is considered a desert oasis, and among the most important types of trees spread in it are palm trees, papyrus and some acacia trees.

4) Jodaym Reserve:

The Jodaym Reserve area is a coastal forest characterized by the presence of pine trees and some natural plants from its Northern border, and it is located west of Tripoli, about 30 km away. One of the natural signs that characterize this area is the presence of a rocky beach that is a good environment to contain many marine species, the most important of which are the fish that breed in it, and it is also an important area for birds as it attracts many migratory seabirds.

6- Characteristics and features of newly declared reserves

Studies conducted in recent years have helped to establish a list of marine and coastal sites to be preserved, comprising 24 sites distributed along Libyan coast (this list cannot be considered final and exhaustive, but rather as a preliminary basis for the declaration of marine protected areas):

Table 7: List of features of the declared reserves where

S. N.	Site	Site Characteristics
1	**Wadi Al , Masid**	• A vast extension of Posidonia herbarium • Classification of the Veraboli area among the list of important sites for attracting migratory birds by the World Bird Society
2	**Wadi Targhath**	• A stopover zone for migratory and trans-Saharan birds in spring. • It has the same characteristics as Wadi Al-Mesid in terms of the density of waterbirds
3	**Ain Wadi Ka'am**	• It is a freshwater fish farming area • Includes many animals, reptiles and amphibians • An important stopping point for migratory birds • An important extension of the Posidonia herbarium in front of the estuary • Includes a group of coastal wetlands • Nesting habitat for sea turtles
4	**Sabkha Qaser AHamad Tawergha**	• Attracting migratory waterfowl in winter
5	**Ain Tawergha**	• A site of cultural and biological significance • Funa includes many species of freshwater fish, reptiles and amphibians
6	**Sandy beaches juniper Boerat Al- Hasson**	• Excellent habitats for building nests of loggerhead sea turtles, • Important fishing site for cartilaginous fish
7	**Thirty Beach**	• One of the most important nesting sites for sea turtles

S. N.	Site	Site Characteristics
		• Used for local picnics in summer
8	**Sandy beaches Bishr, Ajdabiya and Zueitina**	• Excellent habitats for building nests of loggerhead sea turtles, • Attracting some migratory birds • An important incubator for cartilaginous fish • Contribute to the creation of populations of migratory fish
9	**Algarah Island**	• It is considered one of the most important breeding sites for small, crested terns Sterna bengalensis emigrata • The spread of Mediterranean monk seals on the coasts
10	**Shatt Al Badin**	• It represents the most important nesting habitat for the loggerhead sea turtle in eastern Libya
11	**Mtaifla Beach**	• Vegetation consists of mixed sand dunes and salt bog vegetation.
12	**Sabkha Jaliana/Benghazi**	• It is considered one of the most important sites that attract waterbirds nationwide, with 30% of them attracting winter
13	**Ain Al , Zayana**	• It is part of the important bird area in Benghazi • Its water consists of a mixture of seawater seeping through the canals, and fresh water from springs. • Important location for fish nursery
14	**Rocky coast Talmaitha/Aqla**	• The coast is characterized by a high density of turtle nests • A site of historical-archaeological importance • Habitat suitable for Mediterranean monk seals
15	**Wadi Alcove Beach**	• One of the most important nesting habitats is sea turtles • The Mediterranean monk's seal was seen in it.
16	**Sabkha Ain Zarqa**	• Its water consists of a mixture of seawater seeping through the canals, and fresh water from springs. • The vegetation consists of the Athel, the Asl and the Qassab

S. N.	Site	Site Characteristics
		• Funa includes waterfowl, amphibians, fish and mollusks
17	**Swamp Ain Al-Miqat**	• Its water consists of a mixture of seawater seeping through the canals, and fresh water from springs. • Coastal lagoon surrounded by sand dunes and limestone formations • Covered with a typical vegetation cover consisting of Athel and Asl • Funa includes waterfowl, amphibians, fish and mollusks
18	**Gulf wadi**	• It provides important habitat and shelter for a large number of seasonal domestic and migratory birds. • Coastal lagoon surrounded by sand dunes and limestone formations • Sandy beaches are used by locals for bathing and picnics in summer
19	**Wadi Al-Hamsa**	• It represents a suitable habitat for a variety of domestic and migratory birds.
20	**Bamba Bay**	• An area rich in seagrasses and small atolls • Important nesting site for loggerhead turtles • Potentially the feeding area for seals • Is a good location for fish nursery • A route for migratory waterfowl
21	**Abu Al-Faranis Beach**	• Contains a high density of sea turtle nests • Important site for waterfowl and brey birds
22	**Northern beaches of Ain El Ghazala**	• Important nesting site for sea turtles • A route for migratory birds from Europe to Africa • The presence of fish populations and herbarium Posidonia
23	**Ghardaba Beaches**	• Important nesting site for sea turtles
24	**Burdy Bay**	• Important nesting site for loggerhead sea turtles • The site is also of historical significance • Possible site of Mediterranean monk seal • Seagrasses cover the seabed

Source: Management Support and Expansion of Marine Protected Areas Project in Libya

IX. Legislative framework

With the evolving lifestyles, the increasing risks of pollution and accumulated environmental problems. legislators have begun to issue specialized legislation to regulate and exploit environmental elements while providing necessary criminal penalties to ensure respect for these guarantees. The Libyan legislator recognized this and issued many laws regulating and protecting various environmental elements. These laws included criminal provisions aimed at providing legal protection for the protected area by criminalizing dangerous actions. Environmental and nature protection laws have a long history in Libya, as follows:

- Law No. 27 of 1968 on Forest and Pasture Protection
- Law No. 33 of 1970 on Agricultural Land Protection, amended by Law No. 4 of 1973
- Law No. 8 of 1973 on Preventing Marine Oil Pollution
- Law No. 93 of 1976 on Industrial Safety and Public Safety
- Law No. 3 of 1982 on Water Resources Exploitation
- Law No. 5 of 1982 on Forest and Pasture Protection
- Law No. 7 of 1982 on Environmental Protection
- Law No. 13 of 1984 on Public Cleanliness Regulations
- Law No. 14 of 1989 on Marine Resources Exploitation
- Law No. 22 of 1989 on Industrial Regulation
- Law No. 15 of 2003 on Environmental Protection and Improvement

In 1992, Libyan government signed the United Nations Convention on Biological Diversity and ratified it under Law No. 11 of 2001.

- **Laws and decrees related to the protection of livestock**
  1. Law No. 14 of 1989 on the exploitation of marine wealth and its executive regulations.

2. Decree of the General People's Committee for Marine Resources of 1991 on the reorganization of the Secretariat of Marine Resources.
3. Resolution No. 80 of 1991 of the Secretary of the People's Committee of the General Authority for Maritime Resources on the issuance of Technical Regulations No. 14 of 1989.

- **Laws and decrees on the protection of forests and rangelands**
  1. Law No. 25 of 1950 promulgated on the protection of forests.
  2. Law No. 12 of 1956 on forests.
  3. Law No. 47 of 1971 on the protection of forests and rangelands.
  4. Law No. 5 of 1982 on the protection of pastures and forests, as amended by Law No. 14 of 1992.
  5. Decree No. 3 of 1984 of the General People's Committee for Agrarian Reclamation and Land Reconstruction on the necessary measures to protect pastures and forests from fires.
  6. Decree No. 365 of 1995 of the Secretary of the General People's Committee for Agriculture on the adoption of certain provisions for the protection of forests and rangelands.

- **Laws and decrees related to fishing**

1. Law No. 15 of 1984 on the protection of animals and trees prohibits poaching of wild animals.
2. Decree No. 453 of 1993 of the General People's Committee for Agricultural Reclamation, Land and Livestock Reconstruction on the Prohibition of Hunting Land and Sea Turtles.

- **Laws and decrees related to the protection of agricultural land**

1. Law No. 27 of 1966 on plant protection.
2. Law No. 33 of 1970 on the protection of agricultural land.
3. Law No. 15 of 1992 on the protection of agricultural land.

Institutional and Organizational Framework for National Parks and Nature Reserves

A series of decisions were issued in the establishment of institutions for the management of biodiversity:

1. General People's Committee Decree No. 11 of 1990 establishing the Technical Committee for Wildlife, which empowered it with technical and administrative supervision of reserves and parks.
2. General People's Committee Decree No. 326 of 1998 on transferring the management of protected areas and national parks to the Shaabiyat.
3. General People's Committee Decree No. 205 of 2001 establishing the Public Authority for Animal Resources and its technical supervision of national parks and natural reserves.

National Institutions Concerned with Biodiversity Management:

Several national institutions study and manage biodiversity:

- Ministry of Environment.
- Ministry of Agriculture and Livestock
- Ministry of Marine Resources.
- Agricultural Research Center.
- Marine Biology Research Center.
- Livestock Research and Studies Center.
- National Authority for Scientific Research.
- Universities and higher institutes.
- NGOs.

International Agreements:

Libya has signed many agreements with organizations interested in biodiversity at the Arab, regional and international levels, including:

Table 8 List of international conventions to which Libya parties related to biodiversity

M	Agreements	Date of signature	Date of Ratification
1	United Nations Convention on the Conservation of Biological Diversity (CBD)	29/6/1992	12/7/2001
2	Ramsar Convention on Wetlands	2/2/1971	5/8/2000
3	Convention for the Protection of Migratory Wild Animals (CMS)	1/9/2002	
4	African-Eurasian Convention for Migratory Waterfowl Conservation (AEWA)	16/6/1995	1/8/2005
5	Agreement on the Conservation of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)	1/9/2002	
6	Memorandum of Understanding on Prey Birds	29/11/2013	1/12/2013

M	Agreements	Date of signature	Date of Ratification
7	Sharks Memorandum of Understanding	17/2/2014	
8	World Heritage Convention (UNESCO)	13/10/1978	
9	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	28/1/2003	28/4/2003
10	United Nations Framework Convention on Climate Change	14/6/1999	29/6/1992
11	Paris Agreement		22/8/2016
12	Kyoto Convention		24/8/2006
13	United Nations Convention to Combat Desertification	15/10/1994	22/6/1996
14	International Plant Protection Convention	6/12/1951	18/5/1972
15	African Convention for the Conservation of Nature and Natural Materials	15/9/1968	16/7/1969
16	Agreement on the Establishment of a Commission to Control the Desert Locust in North-West Africa, as amended	1/12/1970	17/8/1971

Source: Convention websites and Fourth National Biodiversity Report (2010)

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
International stakeholders					
United Nations Environment Program (UNEP)	Depends on the existence of financial allocations in the Global Environment Facility and donors	A very old collaboration	3	• Obtaining the percentage of supervision of projects of international bodies • Implementation of protected areas of international conventions obligations • Technical support by program experts	• Provide financial support to support the implementation of protected activities • Providing capacity building programs for protected workers • Providing technical support by international experts
United Nations Development Program (UNDP)	Depends on the existence of financial allocations in the Global Environment Facility and donors	A very old collaboration	4	• Obtaining the percentage of supervision of projects of international bodies • Implementation of protected areas of international conventions obligations	• Provide financial support to support the implementation of protected activities • Providing capacity building programs for protected workers • Providing technical support by international experts
International Union for Conservation of Nature	Depends on the existence of financial allocations in the Global Environment Facility and donors	A very old collaboration	2	• Obtaining the percentage of supervision of projects of international bodies • Implementation of protected areas of international conventions obligations • Providing technical support by ITU experts	• Provide financial support to support the implementation of protected activities • Providing capacity building programs for protected workers • Providing technical support by international experts
Secretariat of International Agreements	Implementation by the State of the obligations of these conventions at the national level Preparation	A very old collaboration	2	• Implementation of protected areas of international conventions obligations	• Provide financial support to support the implementation of protected activities

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
	of national reporting reports			• Participation in meetings, conferences and convention workshops • Participation in the preparation of national reporting reports	• Providing capacity building programs for protected workers • Providing technical support by international experts
European Union	Providing technical and financial support to the reserves	A very old collaboration	1	• Implementation of protected areas of international conventions obligations • Providing technical support by ITU experts	• Provide financial support to support the implementation of protected activities • Providing capacity building programs for protected workers • Providing technical support by international experts
German Foundation for International Cooperation	Providing technical and financial support to the reserves	Old collaboration	1	• Implementation of protected areas of international conventions obligations	• Provide financial support to support the implementation of protected activities • Providing capacity building programs for protected workers • Providing technical support by international experts
Italian Cooperation Authority	Providing technical and financial support to the reserves	Old collaboration	4	• Implementation of protected areas of international conventions obligations	• Provide financial support to support the implementation of protected activities • Providing capacity building programs for protected workers • Providing technical support by international experts
Food and Agriculture	Depends on the existence of financial allocations in	Old collaboration	1	• Obtaining the percentage of supervision of projects of international bodies	• Provide financial support to support the implementation of protected activities

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
Organization of the United Nations	the Global Environment Facility and donors			• Implementation of protected areas of international conventions obligations	• Providing capacity building programs for protected workers • Providing technical support by international experts
League of Arabic States	The State implements the decisions of the Council of Arab Ministers of Environment	A very old collaboration	1	• Implementation of protected areas of international conventions obligations	• Providing capacity building programs for protected workers
Local stakeholders					
Counsil of Ministers) Cabinet	Providing public policies required to be implemented by the state	A very old collaboration	5	• Diversify and increase sources of income and achieve financial sustainability to reduce the burdens on the government regarding the annual reserve budget • Supporting the tourism sector to achieve ecotourism to alleviate pressures on natural resources	• Showing greater flexibility towards amending existing laws and legislation to facilitate the reserves to achieve greater financial returns as well as facilitate the methods of spending on the reserves. • Guidance to various ministries to increase cooperation with the Ministry of Environment. • Adoption of the recommendations contained in the national reporting reports of international conventions
Ministry of Tourism	Variable relationship (cooperative and/or competitive)	A very old collaboration	5	• Providing the appropriate infrastructure to provide basic services in the reserves • Ceding some protected areas to expand the establishment of tourist hotels	• Work to improve the tourism product and the quality of the tourist to relieve pressure on the reserves • Stop hunting tourism

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
					• Adopting ecotourism concepts in developing future plans for the tourism industry • Rethinking the creation of concrete forests (resorts and tourist hotels)
Ministry of Agriculture	Variable relationship (cooperative and/or competitive)	A very old collaboration	3	• Relaxation of the standards adopted by the Ministry of Environment regarding the application of Libya obligations under the Cartagena Protocol on Biosafety and the Nagoya Protocol on the Equitable Sharing of Benefits Arising from the Utilization of Genetic Resources • Ceding some protected areas to expand agricultural reclamation projects and establish fish farms	• Work to upgrade agricultural products using modern technologies more environmentally friendly in order to reduce pressure on reserves • Legalization of Issuing Hunting Permits to Individuals and Institutions • Adopting the concepts of organic agriculture in developing future plans • Rethinking the establishment of tree forests within reserves • Re-treatment of wastewater used to irrigate trees and some crops • Approval of biosafety laws and the law regulating access to biological resources • Stopping the implementation of agricultural reclamation and fish farming projects in reserves
Ministry of Interior	Cooperation in the field of prevention and liberation of environmental	A very old collaboration	3	• Providing sustainable mechanisms for the Ministry to pay rewards to police officials	• Increasing cooperation with protected areas in stopping environmental violations and

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
	violations in protected areas			for participating in the implementation of the provisions of environmental violations in protected areas • Providing suitable places to provide security personnel at the entrances to the reserves to secure tourist groups	removing encroachments on protected areas • Signing a memorandum of understanding with the Ministry of Interior outlining the mechanisms of cooperation within the reserves • Providing mechanisms for reporting environmental violations to the Ministry that are issued by the Environment Police
Ministry of Defense	Cooperation regarding securing protected areas – tourist permits – grant approvals	A very old collaboration	4	• Limiting cooperation with international bodies regarding nature reserves • Using the capabilities available in the reserves to help combat cross-border smuggling crimes • Ceding some protected areas in order to expand development projects (quarries, etc.) • Implementation of capacity-building programs for nature reserves and biodiversity	• Quick response regarding the implementation of foreign projects within the reserves • Easing the security measures followed in some reserves that attract large numbers of tourists • Increasing cooperation with protected areas in stopping environmental violations and removing encroachments on protected areas • Signing a memorandum of understanding with the General Secretariat of the Ministry of Defense outlining the mechanisms of cooperation within the reserves with all branches of the Ministry of Defense

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders

Ministry of Foreign Affairs	Follow up on the sector's implementation of donor projects	A very old collaboration	3	• Implementation of protected areas of international conventions obligations	• Increase coordination with donors to:
					  ○ Provide financial support to support the implementation of protected activities
					  ○ Providing capacity building programs for protected workers
					• Providing technical support by international experts

Ministry of Finance	Providing and following up the implementation of the disbursement of financial allocations in the state budget	A very old collaboration	3	• Diversify and increase sources of income and achieve financial sustainability in order to reduce the burdens on the government regarding the annual reserve budget	• Showing greater flexibility towards amending existing laws and legislations in order to facilitate the reserves to achieve greater financial returns as well as facilitate the methods of spending on the reserves.
Ministry of Justice	Issuing provisions related to environmental violations in reserves	A very old collaboration	3	• Unifying the format of technical reports supporting environmental violations • Implementation of capacity-building programs for nature reserves and biodiversity	• Showing greater flexibility towards amending existing laws and legislation in order to facilitate the reserves to achieve greater financial returns as well as facilitate the methods of spending on the reserves. • Speedy issuance of rulings regarding environmental violations in protected areas • Accuracy in the selection of experts of the Ministry of Justice regarding environmental violations within the

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
					reserves, due to the lack of such expertise at the national level • Establishment of environmental courts specialized in environmental violations only
Ministry of Planning	Providing and following up the implementation of the disbursement of financial allocations in the state budget	A very old collaboration	3	• Diversify and increase sources of income and achieve financial sustainability in order to reduce the burdens on the government regarding the annual reserve budget	• Showing greater flexibility towards amending existing laws and legislation in order to facilitate the reserves to achieve greater financial returns as well as facilitate the methods of spending on the reserves. • Implementation of capacity programs for protected workers regarding administrative aspects at the national level
National Oil Corporation	Competitive relationship with protected areas	A very old collaboration	3	• The Ministry of Environment eases restrictions and standards imposed on development projects (oil extraction - quarries) • The approval of the Ministry of Environment on the requests of investors regarding the assignment of some protected areas in order to expand development projects (oil extraction - quarries)	• Reviewing the Ministry's current policies regarding the tendering of petroleum extraction and quarrying projects so that they are reviewed and approved by the Ministry of Environment (especially projects located in reserves) before being approved. • Increasing attention to the environmental dimension and reserves in the implementation of oil extraction projects and quarries in order to reduce pressure on natural resources in reserves

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
					• Legalizing the processes of issuing concession permits for oil exploration and quarries within the reserves, after reviewing them with the Ministry of Environment • Implementation of measures related to the restoration of the efficiency of natural resources degraded as a result of oil extraction, mining or quarrying • Signing a memorandum of understanding with specifying the mechanisms of cooperation within the reserves (concessions for exploration and extraction of petroleum - quarries - mining - etc.)
Ministry of Electricity and Energy	Cooperation relationship regarding new and renewable energy, especially in the Jabal Al-Zayt region	Modern collaboration	4	• The Ministry of Environment eases restrictions and standards imposed on wind energy and electricity transmission projects • The approval of the Ministry of Environment on the Ministry's requests regarding the assignment of some protected areas to expand development projects (electricity transmission towers)	• Review the Ministry's current policies regarding the tendering of wind energy and electricity transmission farm projects so that they are reviewed and approved by the Ministry of Environment (especially projects located in reserves) before being approved. • Increasing attention to the environmental dimension and reserves in the implementation of wind farms and electricity transmission projects

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
					• Implementation of measures related to the restoration of the efficiency of natural resources degraded because of wind farming and electricity transmission projects • Effective implementation of memorandums of understanding signed with the Ministry of Environment regarding wind power and electricity transmission farm projects
Ministry of Communications and Information Technology	A relationship related to the establishment of mobile towers in reserves and/or electronic transformation in the management of reserves	Modern collaboration	3	• Electronic application for all protected area activities (issuance of permits - entrance fees to reserves - implementation of monitoring programs - etc.)	• Supporting the efforts of the Ministry of Environment regarding the electronic application of the system of permits to practice activities in reserves and the electronic payment of fees to enter the reserves • Greater flexibility towards providing greater coverage of different mobile networks in remote areas of the reserves • Supporting the efforts of the Ministry of Environment for direct tracking surveillance of marine and land activities in protected areas
Ministry of Water Resources (MWR	Limited cooperative relationship regarding	Modern collaboration	3	• Ministry of Environment eases restrictions and standards on	• Work to improve the efficiency and quality of irrigation for the purpose of agriculture using modern

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
	water allocations and drilling wells			irrigation projects within protected areas • The approval of the Ministry of Environment on the Ministry's requests regarding the assignment of some areas of reserves in order to expand development projects (construction of canals - dams - etc.)	techniques more environmentally friendly • Legalization of the processes of issuing permits to drill water wells in reserves • Re-treatment of wastewater used to irrigate trees and some crops • Stopping the implementation of agricultural reclamation and fish farming projects in reserves
Ministry of Health	Limited cooperation in the field of medicinal plants	Modern collaboration	3	• Providing picnics for residents and tourists	• Providing ambulances in the reserves to provide first aid to visitors to the reserves
Civil Society Organizations and NGOs	A relationship that depends on the provision of grants to these associations and/or in the event of external support, the reserves are invited to attend events where there is only media coverage	Modern collaboration	2	• Providing cars and accommodation for workers of NGOs to carry out joint activities in the reserves • Providing financial support to NGOs to implement environmental projects in protected areas	• NGOs include priorities for the conservation of natural resources and reserves in the projects implemented by these associations
Private Sector	Competitive relationship with protected areas	Modern collaboration	3	• The Ministry of Environment eases restrictions and standards imposed on development projects • The Ministry of Environment approves investors' requests regarding the waiver of some	• Increasing attention to the environmental dimension and protected areas in the implementation of development projects in order to reduce pressure on protected areas • Interest in the implementation of projects concerned with investment

Key stakeholders	Relations with key stakeholders (environment only)				
	Nature of the relationship	Time Range of Cooperation	Relationship Level*	The expected return from the Ministry of Environment	Expected return from stakeholders
				protected areas in order to expand development projects • Reserves provide portfolios for investment projects in reserves	in the field of rehabilitation of degraded natural resources

*** Relationship level: excellent relationship = 6, very good relationship = 5, good relationship = 4, medium relationship = 3, weak relationship = 2, very weak relationship = 1, no relationship = 0**

Chapter Two: The Importance and Pressures on Biodiversity

I.Oil & Gas

Oil was first discovered in Libya in 1955, and exploration began in Libya after the issuance of the oil law in 1958, and production began in 1961, and oil constitutes about 94% of the country's resources and the most important characteristic of the abundance of wells extracted from them, and its proximity to export ports. Since oil exploration began in Libya, about 2,000 exploration wells have been drilled, leading to about 550 oil discoveries, and although many of these discoveries were very small, the number of discoveries that were put on production amounted to 165 discoveries, and there are 185 other discoveries, each containing more than 10 million barrels of oil that have not yet been produced, and the total oil in the discovered sites is about 130 billion, of which 30.4 billion have been produced so far, This represents 23% of the total oil discovered under the ground. In Libya there are 29 large fields, each containing more than one billion barrels of oil, and these fields contain 68 percent of the total oil discovered so far in the country. Oil recoverable from fields of this size can reach from 30% to 55%. As for the proven reserves, Libya has until the end of 2019 a proven reserve of crude oil of 48.4 billion barrels, and it ranks first in terms of proven reserves at the level of Africa, fifth at the level of the Organization of Arabic Petroleum Producing Countries, seventh place at the level of the Organization of Petroleum Exporting Countries, and ninth place globally (43.39.37.m). The average daily production in Libya of crude oil during the period (1961-2019) was about 1.424 million barrels, and reached its peak in 1970 at a rate equal to 3.318 million barrels per day, and in 2010 the daily production rate was 1.487 million barrels (44 m) and Figure (4.10) shows that the general trend of production tends to decline, and this decline is related to production capacity and demand in global markets, and political events (Khalid bin Mahmoud, 2021).

Libya also plays an important role in the natural gas markets of all kinds, due to its distinguished geographical location, as recent studies have shown that Libya has huge reserves of natural gas, amounting to about 55 trillion feet^3, which is almost double the reserves of the Egyptian Zohr field, which was recently discovered, and

this made it the eighth place among the Arabic countries in terms of natural gas reserves. As for shale gas, its reserves have tripled, from 55 trillion feet³ to 177 trillion ft³, adding 122 trillion ft³ of recoverable reserves of rock, making it the second Libya in Africa (8 trillion m³) after South Africa (13 trillion m³) and before Algeria (6.5 trillion m³) (Khalid bin Mahmoud, 2021).

The amount of solar radiation reaching the Earth is 1.36 (kWh/m), of which 50% is reflected in space, 15% is reflected on the surface of the Earth, and 35% is absorbed by air, water and soil, and the total amount of solar energy reaching the Earth is very large, as only 1% of the Earth's area is sufficient to collect solar energy that covers the needs of the entire world of electricity (Khalid bin Mahmoud, 2021).

The oil sector provides most of Libya's foreign income, accounting for about 80 percent of the national GDP and about 97 percent of exports. Libya is classified as a middle- to high-income developing country, with GDP per capita reaching US$42,914 in 2008 and increasing to an estimated US$18,000 in 2010. In 2008, the total population was 6.3 million, 84.8 percent of whom lived in urban areas. Population growth over the past thirty years has averaged 2.9 percent. Unemployment rate - Youth unemployment is particularly high: although there are problems with the reliability of available data (there is no single ministry to collect comprehensive data), this figure is at least 14 percent (as in neighboring countries), with reports of up to 30 percent (European Commission, 2009). As of 2010, industry (including the oil sector) contributed 64 percent of Libya's GDP, while the services sector accounted for 33 percent, and agriculture. 3 percent (FAO, 2019) Libya Investment Climate Assessment report states that the oil and gas sector accounts for more than 70 percent of GDP (in nominal terms), more than 90 percent of government revenues, and 95 percent of export earnings (UNDP and FAO, 2022).

The 2011 civil war had an unprecedented impact on Libyan economy, with oil production falling from 1.49 million barrels per day in January 2011 to 22,000 barrels by July 2011 as a result of the then conflict. By the end of 2011, GDP growth had fallen by 60 percent, and oil production had fallen to an average of 500,000 barrels per day. Non-oil production growth also fell by 50 percent as economic activities came to a halt. Nearly 600,000 migrant workers fled Libya during the 2011 civil war, making it the biggest migration crisis since the first Gulf War in 1991. In

addition, food and cash shortages have been reported in different parts of the country (World Bank, 2021).

II. Agriculture

Libya is located in North Africa on the Southern coast of the Mediterranean, bordered to the north by the Mediterranean coast, with a population of more than 6 million. The desert forms a large part of Libya, characterized by very high temperatures and scarce rainfall. Libya can be divided into four different climatic regions: (1) coastal plains along the Mediterranean Sea with dry summers and relatively wet winters; (2) northern mountains overlooking the coastal plains, including the Nafusa Mountains in the west and the Green Mountain in the east, benefiting from increased rainfall and lower temperatures; (3) internal depressions in the central part of the country with desert and semi-desert climates; and (4) southern and western mountain ranges with limited annual rainfall. Due to climate and soil conditions, the most important agricultural areas are the coastal plains, northern mountains, Kufra, southern mountain, and the Jafara plains. About half of all crops are grown in the Green Mountain, while the other half is grown in the Nafusa Mountains, Kufra, and the southern desert mountains. (UNDP and FAO, 2022).

Agriculture was considered an important economic sector in Libya until oil was discovered in the early sixties of the last century. Oil exports suddenly became the main driving force of the country's economy, dwarfing her government's interest in developing agriculture, which in turn led to the import of huge quantities of food. Agricultural production has declined over the past few years, contributing 2.83 percent of GDP on average between 2000 and 2018. However, the growing threats of food insecurity over the past three decades have led to some attention to agriculture, and recent policy changes since February 2011 have affected Radical impact in all sectors, including agriculture. Instability and insecurity over the past decade have halted the meagre progress that had been made before. Many foreign workers, who had been living in Libya for years, have also left the country due to the armed crisis and the COVID-19 pandemic, which has affected agricultural and food production (UNDP and FAO, 2022).

The total agricultural land is estimated at 15.4 million hectares, consisting mainly of pastures (13.3 million hectares). Arable land constitutes 2.2 million hectares, equivalent to only 1.7 percent of the country's total area. Of the total arable land, 52 percent is grown with permanent crops such as olives, fruit trees, citrus fruits and fodder, while 42 percent is allocated to annual crops, including wheat, barley, vegetables, potatoes and pulses. Most of the arable land is located in Libya along the Mediterranean coast of the Eastern Zone. Cereals, fodder crops and some fruits are grown in relatively small rainfed areas, while the coastal irrigated area is used to grow vegeTables (potatoes, onions, tomatoes), fruits (watermelons, oranges, dates, grapes, olives) and cereals (wheat and barley). The average area under vegetable cultivation in Libya is 18,069 hectares and the average annual vegetable production is about 1,270,600 tons. Most farms are small, ranging in size from 5 to 20 hectares. Only 5 percent of the land receives more than 100 mm of rainfall annually. Only 19 percent of Libyan households own agricultural land, while another 7 percent own other land. Family farm holdings suffer from disintegration and fragmentation (45 percent of farmers own less than 10 hectares, only 25-30 percent have more than 30 hectares (Porter and Yergin, 2006). Similarly, WFP and FAO found (during 2011) that agricultural land consisted of 90 percent smallholdings of less than 20 hectares, and 9 percent of medium farms (20-100 hectares) and only 1 percent of large farms (more than 100 hectares). The average size of the farm was about 11 hectares,

although many were broken down into small, non-adjacent plots. The World Bank (2021) noted that Libya is the only country surveyed in the region so far, with land representing the largest constraint to private sector growth (UNDP and FAO), 2022).

Water scarcity is one of the biggest constraints to agricultural production, as Libya is one of the driest countries in the world, with limited annual rainfall, high evaporation, and scarce surface water resources. Non-renewable groundwater provides the bulk of the country's water needs, resulting in a decrease in groundwater levels due to over-irrigation, which in turn creates a long-term environmental threat (World Bank, 2021). More than 20 percent of Arable land (470,000 hectares) for irrigation, with the introduction of an estimated irrigation potential of 750,000 hectares and the full development of which depends mainly on the use of fossil water. About 196,000 hectares can be irrigated in coastal areas and another 113,000 hectares in the Southern and central regions. In 2006, a total of 309,000 hectares were estimated to be irrigated (Porter and Yergin, 2006), mainly through groundwater extraction, far exceeding the capacity to supply water in coastal areas. In 2011, 240,000 hectares of land were irrigated, with irrigated areas in the Southern parts of Murzuq and Kufra. For example, it is largely state-run (50,000 hectares), while the rest is privately owned. Half of cereal production, 90 percent of fruit (excluding dates and olives) and vegetable production are produced on irrigated land. The Government began to realize this in 1976 and took measures to discourage the cultivation of citrus fruits and tomatoes, as both require large amounts of water. However, the stricter measures required to provide coastal water resources – namely regulating irrigation and changing the land tenure system to fundamentally improve water use efficiency – run counter to the government's concept of economic justice, which preferred intensive irrigated farming of small, family-grown plots (UNDP and FAO, 2022).

As mentioned earlier, agriculture currently accounts for only 2-3 percent of GDP, compared to 25 percent before the onset of the oil boom in the sixties. Today, agricultural products account for less than 3 percent of the country's exports (European Commission, 2009). Moreover, more than 75 percent of total food is imported, including about 1.5 million tons of wheat, equivalent to 80 percent of the country's wheat consumption. Despite the investment In agriculture, growth was

modest at 2.4 percent, which is lower than population growth (3.2 percent) (Porter and Yergin, 2006).

The agricultural sector employs 6-8 percent of the workforce, while the oil sector employs 2 percent, industry 8 percent, health 12 percent, education 27 percent, and other public sector bodies 16 percent (Food Program).
Global and FAO, 2011), as estimated by USAID, 2011), employment in agriculture at 18 percent. This is especially true in rural areas, including in the south of the country. It is estimated that 30 percent of the total labor force is women, rising to 70 percent in rural areas (UNDP and FAO, 2022).

The agricultural sector cannot meet the growing demand for food in the country, nor will it meet it or contribute to economic development.
Overall desired, given its current composition and modest performance levels. Agribusiness development will require cultivating the capacity for innovation. These two aspects are interrelated: on the one hand, we have individual capacity building in the short and long term, including skills development (e.g. language, communication, facilitating participatory and multi-stakeholder approaches), and on the other hand, we have knowledge building around specific priority topics). such as water, gardening, post-harvest crop processing and how to market them). Current capacity-building can be properly implemented through higher education programs, as well as short courses, capacity-building programs, train-the-trainer programs, farmer field schools, and other means. Building organizational capacity, such as appropriate human resource development strategies and providing incentives and opportunities for career development, is crucial. In addition to individual and organizational capacity-building, institutional capacities also need to be developed. This can be achieved through the development of effective interaction between different categories of actors in the innovation ecosystem, through multi-stakeholder platforms such as public-private research partnerships, international cooperation (especially in education, the involvement of universities and vocational training institutes), and with the private sector, such as joint ventures on rich investments.
by knowledge). Capacity building never succeeds without applying newly acquired knowledge and skills. In this regard, youth and women in the agriculture sector need opportunities beyond the local production of traditional goods (UNDP and FAO, 2022).

III. Livestock Production

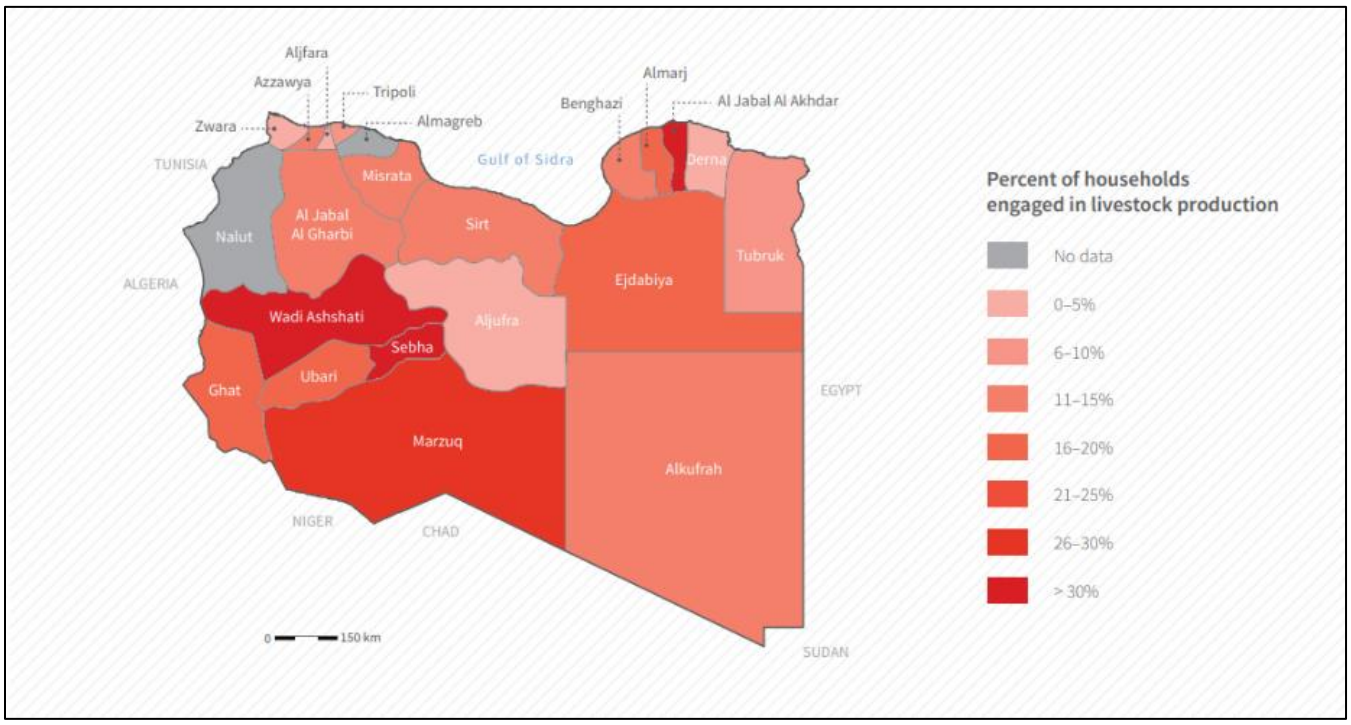
In the 1980s, cattle constituted the largest income-producing element in Libyan agriculture. The government implemented several measures to achieve self-sufficiency in meat, poultry, and dairy products. Sheep, cattle, and poultry numbers grew slowly, while goat and camel herds declined. The largest animal herds were in the Kufra Settlement Project, using modern grazing management practices to prevent overgrazing and optimize pasture use. Thousands of hectares of coastal land were fenced for livestock breeding and fattening pens.

The main animal products in Libya are chicken (meat and egg), beef and small ruminants (meat and milk). In 2010 there were 24.8 million chickens, 5.1 million sheep, 1.9 million goats, 210,000 cattle and 71,000 camels (WFP and FAO, 2011). The national livestock sector is important and meets local requirements for dairy products, eggs and meat, but is constrained by poor grazing quality and feed production, and therefore the sector relies heavily on subsidized imports of animal feed. On the coast, there are about 15,000 small-scale fishermen working part-time or full-time in artisanal fishing. This activity has developed strongly since the

eighties with strong support from the government. Many trading companies are involved in exporting tuna to Japan and Korea, based on fishing and fattening for several months. Sardines and deep-water fish are exported to neighboring countries. The fish sector accounts for 9% of agricultural GDP (WFP and FAO, 2018).

Nationwide, 12 percent of households are engaged in animal production, with the highest percentages observed in Sabha (50 percent), Wadi al-Ashati (40 percent) and Jabal al-Akhdar (31 percent). Livestock production predominates in some inland regions of the country, while it is less common along the coast. Small ruminants were the most common cattle holdings, with sheep being more common followed by goats. In most locations, the majority of households involved in livestock production have fewer than 10 small ruminants (sheep and goats), although larger herd sizes (more than 50 heads) were common in Jabal Akhdar (for sheep and goats) and Ubari (for sheep). (WFP and FAO, 2018).

Map 12: Map showing the percentage of households working in livestock production



Source: (FAO, 2018)

IV.Water Resources

With limited permanent water resources, Libya relies almost entirely on fossil and non-renewable groundwater resources (Libyan Ministry of Water Resources, 2014 - Environment and Development Centre for the Arabic Region and Europe, 2014). There are no perennial rivers in Libya, only seasonal rivers or wadis. The major natural lakes include the Obari Lakes in the Sand Sea in the south, including Gabron, Mandara, Mafo Akis, Awaw En Namu Protected Area, and Lake 23 July or Benghazi Lake, which are in fact lagoons. There are two Ramsar sites since 2000: Ain Al Shakikah and Ain Al Zarga with a total area of 83 hectares. The Tertiary Basin in northwest Libya is below sea level and covered by temporary lakes, salt flats, and saline marshes. Large other salt pans include the nearby Al Heisha near the coast near Gulf of Sidra, Shinen and Ghazil in the northeast. There are also many natural springs in Libya, especially in the northern parts of the country, many of which have good water quality. Some major sources are Ain Al Zayaneh, Ain Kaam, Ain Dubosya, and Ain Tajoura (Sedari, 2014 - FAO, 2016).

Five main aquifers are located under Libyan territory, with the first and second reservoirs interconnected and forming the western aquifer. Only the coastal aquifers, Jafara in the northwest and Jabal Akhdar in the northeast are shallow and are naturally recharged from the rainfall, as well as part of the aquifer in Hamada. Part of the aquifers at Hamada, Marzouq and As-Sarir/Kufra, south of latitude 29°N, belongs to the Great Sedimentary Basins which are fossil water reserves where water was stored during the Quaternary era. The Sarir/Al Kufra Aquifer is part of the Nubian Sandstone Aquifer System (NSAS), the largest groundwater reservoir in the world covering an area of approximately 2 million square kilometers in Libya, Chad, Sudan, and Egypt. The Hamada Aquifer System is part of the groundwater system northwest of the Common Desert with Algeria and Tunisia, consisting of shallow aquifers of sandstone and limestone, and intermediate deep continental groundwater reservoirs (Food and Agriculture Organization, 2016).

Table 21: Major Groundwater Basins in Libya

No.	Groundwater Basins	Area within Libyan Territories (km^2)
1	Hamada Basin: Jebel Nefusa, Ghadamis, Red Hamada Sub-Basins	215,000
2	Jafara Plain Basin	18,000
3	Green Mountain Basin	145,000
4	Murzuq Basin	350,000
5	Kufra/ Sarir Basin	700,000

Source: FAO, 2016

Before the 1960s, it was possible to extract water from shallow coastal aquifers through wells and traditional tools due to the high-water table of shallow groundwater. Since the 1960s, pumps have been necessary due to the declining water table coinciding with the discovery of oil in Libya. During the oil exploration of the 1950s and 1960s, deep fossil aquifer layers were discovered. Groundwater from these reservoirs was first used to develop agricultural projects in the desert near wells. However, water scarcity and intense population concentration in the northern coast necessitated the long-distance transfer of groundwater, leading to the commencement of the Man-Made River Project (MMRP) in 1984. Despite the estimated cost exceeding USD 30 billion, Libya relied solely on national funding, particularly from the oil sector. Upon completion of the project's five phases, its primary objective was to transport 5-6 million cubic meters of water per day to

northern cities via over 500 wells, each 500 meters deep, and approximately 4,000 kilometers of pipelines. The first phase was completed in 1991, capable of transporting up to 2 million cubic meters/day of water over 1,600 kilometers to reservoirs in Benghazi and Sirte. The second phase provided an additional 2.5 million cubic meters/day along 1,227 kilometers to Tripoli from 1997. The third phase enabled the transport of an additional 1.68 million cubic meters/day from the Sirt Basin to Tobruk via a 621-kilometer pipeline. The fourth phase expanded the distribution network from the Jebel Nefusa and Jafara Basin aquifers to the western coast of Tripoli, while the fifth phase aimed to integrate both eastern and western systems into a unified network. However, civil unrest halted further work and NATO bombing destroyed some reservoirs. 98% of the water conveyed by the Man-Made River Project is allocated for municipal use, with estimates of fossil water availability varying greatly: between 50 years and over 4,000 years, depending on actual water extraction and sources (Food and Agriculture Organization, 2016).
Renewable internal surface water resources are estimated at 200 million cubic meters/year, and renewable groundwater resources at approximately 600 million cubic meters/year, but 100 million cubic meters/year are considered overlapping between surface and groundwater, giving a total of approximately 700 million cubic meters/year in renewable internal water resources, or 111.5 cubic meters/year per capita in 2015. Thus, Libya is below the absolute water scarcity threshold of 500 cubic meters/year per capita. Currently, there are 19 operational dams, including a secondary dam on the Qatara Valley, with a total storage capacity of about 390 million cubic meters. However, the average annual storage capacity of these reservoirs does not exceed 61 million cubic meters, and in reality, due to reduced surface water flow records or damages to some dams, it is estimated not to exceed 30 to 40 million cubic meters/year. Approximately 20 additional dams are planned, representing an additional storage area of 136.6 million cubic meters and an average additional annual storage of 45 million cubic meters (Food and Agriculture Organization, 2016).

Water desalination in Libya began in the early 1960s, reaching a production capacity of 226.3 million cubic meters/year in 2006 from over 400 desalination plants, including 17 large plants, with thermal desalination plants directly integrated into power generation facilities. Libya also owns 79 wastewater treatment plants as of 2010 with a total capacity of 74 million cubic meters, all designed to produce treated

wastewater suitable for irrigation. However, out of 504 million cubic meters of municipal wastewater produced in 2012, only 40 million cubic meters were treated and used directly for irrigation on 2,900 hectares (Food and Agriculture Organization, 2016).

In 2000, total water withdrawals were estimated at 4,268 million cubic meters, with 83% used for agricultural purposes, 14% for municipal purposes, and 3% for industrial purposes. More than 30% of municipal water demand was met through the Man-Made River Project (MMRP). In 2012, total water withdrawals were estimated at about 5,830 million cubic meters, including 4,850 million cubic meters or 83% for agriculture, 700 million cubic meters or 12% for municipalities, and 280 million cubic meters or 5% for industries. Groundwater (including fossil groundwater) provides more than 95% of the total water withdrawn, or 5,500 million cubic meters in 2012. The remainder is divided between surface water, with a controlled total volume of 170 million cubic meters/year (Sedary, 2014), desalinated water, and treated wastewater. The National Sustainable Development Strategy for 2008 stipulated that "sustainable" groundwater extraction should not exceed 3,650 million cubic meters/year, although only 650 million cubic meters/year comes from renewable groundwater, and 3,000 million cubic meters/year actually comes from fossil water, as follows: from the Jafara Plain (25 million cubic meters), Green Mountain (25 million cubic meters), Kufra/Sirt (1,300 million cubic meters), Hamada (150 million cubic meters), and Murzuq (1,500 million cubic meters). Due to the fact that fossil groundwater is not included in renewable water resources, current withdrawals exceed eight times annual renewable water resources. Over half of local water supplies in 2012 came from the Great Man-Made River. Rural areas largely depend on private water supply wells, rainwater reservoirs, and springs. A large number of industries, such as chemical, petrochemical, steel, textile, and power generation industries, also rely on private water sources, including seawater desalination (Sedary, 2014).

Irrigation Infrastructure

The history of irrigation in Libya dates back at least 500 years BCE with the Garamantes, the Berber desert inhabitants of the Fezzan region (southwestern Libya), who used an advanced underground irrigation system to cultivate oasis crops in the desert. These subterranean channels, known as "Foggara," directed water from

aquifers to their farms through thousands of kilometers of tunnels, while regular vertical wells facilitated the maintenance of these underground channels. During the Roman era, Libya served as the breadbasket of the empire, utilizing runoff irrigation derived from rainfall. In the 9th century, the Aghlabid Islamic rulers restored the Roman irrigation systems, leading to prosperity from agricultural surplus. In the early 20th century, the Italians attempted to develop agriculture during their colonization of Libya, but greater sums were spent on irrigated agriculture after its independence in 1947. Consequently, intensive irrigated agriculture developed rapidly from the 1960s onwards using shallow groundwater along the coast, yet it remained subsistence farming by the end of the 1960s. Significant efforts and funds were invested in the 1970s and 1980s to develop irrigation using local aquifers in coastal areas. Notably, two research projects (the wheat projects in Kufra and Jifara) used pressurized irrigation and water from primary aquifers but were abandoned in the late 1970s. In 2000, the total area equipped for irrigation was approximately 470,000 hectares, with an estimated 316,000 hectares actually irrigated, although this figure may be an underestimate. Nearly the entire area was equipped with sprinkler irrigation systems, utilizing groundwater in 99 percent of the area, with limited use of treated wastewater and surface water in the remaining areas. With the total irrigated harvested area estimated at 406,000 hectares in 2000, the cropping intensity was 129 percent (FAO, 2016).

There were three different categories of farming in the irrigation subsector (FAO, 2016):

- **Private irrigation**, generally on areas of 1 to 5 hectares, receiving substantial state support for water and energy equipment and agricultural inputs. This type of farming is predominantly concentrated in traditional development areas such as Jafara Plain, Jabal al-Akhdar, and Murzuq Basin, with an actually irrigated area of approximately 257,000 hectares in 2000, accounting for 81% of the total actually irrigated area (FAO, 2016).
- **Government agriculture** is extensive and located mainly in the Southern regions, where new irrigation systems have been established based on high-

yielding deep wells that supply water into divided blocks and into small plots of land and cultivated by small farmers.

- **Large-scale government agriculture** is located mainly in desert areas (usually pivot systems), run by technicians and government workers.

In 2008, although the total area equipped for irrigation decreased to 400,000 hectares, the irrigated area had already increased to 335,000 hectares, and there was a decrease in the area irrigated by conventional methods on the coast as a result of: (Sidari, 2014):

- Water scarcity near the coast due to poor water quality and declining groundwater levels.
- Neglect and deterioration of many large-scale public irrigation projects.
- Urban encroachment at the expense of irrigated areas aimed at agriculture.

On the other hand, the private sector is developing new irrigation using large pivots and drilling its own wells, reaching depths of up to 1000 meters (CEDARE, 2014). Apart from public supply wells associated with government production and settlement projects, all other wells are privately owned in so-called "settlement projects," with each well serving several farms through an integrated irrigation network (CEDARE, 2014). The private agricultural sector is growing rapidly and is responsible for more than 80 percent of irrigated agriculture. There are also model farms of 50 hectares or more, well-equipped with modern irrigation techniques and well-adapted to the local market (FAO, 2016).

Regarding agricultural drainage in Libya, it is estimated that only about 9,000 hectares were equipped with some form of drainage in 2000. This is primarily due to the lack of expertise in the country and the resulting high cost of drainage installation. Despite the fact that most irrigated areas use sprinkler irrigation, the extent of the salinization problem was 190,000 hectares in 1998 and likely higher with increasing groundwater salinity, necessitating more widespread drainage systems (FAO, 2016).

The Role of Irrigation in Agricultural Production, Economy, and Society

Due to the arid nature of much of Libya, irrigated farming systems have been crucial in generating a significant portion of the country's agricultural production. About 50 percent of cereal production and approximately 90 percent of fruit and vegetable production come from irrigated farming. Food security is a moral imperative for Libyan leaders, and considerable efforts were made in the 1970s and 1980s to develop irrigated agriculture based on local water resources, and in the 1990s to create conditions for the rehabilitation and development of coastal agriculture through water transfer from the south to the north. However, food security clearly differs from food self-sufficiency, which is now impossible and increasingly difficult to achieve in Libya. The question arises as to whether irrigation, which largely depends on costly water transfer, remains justified in conditions of water scarcity where the only source of water is non-renewable groundwater, and where economic returns from other sectors (oil industry) more easily allow access to the international food market (FAO, 2016).

Water Management, Policies, and Legislation Related to Water Use in Agriculture

The General Water Authority (GWA) was previously responsible for water resource management since its establishment in 1972. In 2012, a new ministry was created, the Ministry of Water Resources (MWR), incorporating all institutions dealing with water at the national level, including (FAO, 2016):

General Water Authority (GWA): Responsible for managing conventional water resources, both surface and groundwater, but not desalinated water or wastewater or water from the Great Man-Made River Project (MRP). It is also responsible for water resource assessment and monitoring, and overseeing irrigation and drainage projects within Libya. It consists of six general directorates: Planning, Monitoring and Statistics; Water Resources; Dams, Irrigation and Drainage; Soil; and Financial and Administrative Affairs.

Man-Made River Authority: Supervises the use of water transported by the Great Man-Made River Project (MRP) for agricultural purposes.

General Company for Water and Wastewater (GCWW): Established in 2008 to operate and maintain water supply and wastewater systems.

General Company for Water Desalination (GCWD): Established in 2007, previously under the Ministry of Electricity, oversees non-thermal desalination plants, i.e., non-thermal and non-power generating desalination plants.
Additionally, several other ministries overlap in water resource management in Libya (FAO, 2016):
Ministry of Environment: Directly under the Prime Minister's Office, defines pollution levels in drinking water and wastewater, and monitors water quality.
Ministry of Housing and Utilities: Implements water supply and wastewater plans through the Housing and Infrastructure Board.
Ministry of Agriculture and Livestock: Oversees agricultural activities and land uses. According to land use forecasts and corresponding water requirements, water quotas for the sector are negotiated with the Ministry of Water Resources.
Ministry of Energy and Electricity: Manages all power plants using thermal desalination plants.
The water pricing strategy is based on the fact that water is a public commodity shared by all citizens for different uses. As a result, tariffs vary according to uses and are subsidized by the state, particularly for the poorest users. Despite the fact that water fees cover only one-third of the total cost of water production, the recovery rate is low, also due to an irregular and not always existent billing system. Since independence, the state has also funded all infrastructure projects, both construction and operation, and maintenance. A decision issued in 1994 under No. 218 determined water pricing for the first phase of the program with substantial subsidies for agriculture and municipalities as follows: (1) 0.048 Libyan dinars/m^3 for agricultural use; (2) 0.080 dinars/m^3 for urban use; (3) 0.796 Libyan dinars/m^3 for industrial use. Currently, farmers are only charged for the energy used to produce water, and energy is also subsidized (CEDARE, 2014).

Threats and Pressures on the Irrigation Sector

- **Overexploitation of Groundwater and Use of Fossil Aquifers**: Before the 1960s, large-diameter wells could easily extract shallow groundwater aquifers. Since the 1960s and the rapid development of oil production, the rate of groundwater extraction has accelerated to the point where pumps became necessary to deal with the declining groundwater levels (Sidari,

2014). Coastal aquifers, the Jifara plains, and groundwater reservoirs in the Green Mountain are now overexploited, leading to the primary reason for exploiting deep and non-renewable aquifers in the south of the country (FAO, 2016).

- **Water Quality**: Water quality is deteriorating due to untreated municipal wastewater, but the main concern regarding water quality is the intrusion of saline water into coastal aquifers where population and agricultural activities are concentrated. Uncontrolled mining of groundwater for agricultural purposes and declining groundwater levels in coastal reservoirs lead to seawater intrusion, with the front advancing up to 2 kilometers inland in the Jifara plains, increasing salinity levels from 150 ppm to over 5000 ppm between 1950-1990 (FAO, 2016).
- **Soil Salinization**: Irrigation with increasingly saline groundwater has led to soil salinization in certain areas. For example, in the Jifara plains, two irrigation lines built in the 1970s using artesian wells were converted to pumped wells, resulting in some saline and waterlogged soils. Salinization increases irrigation water demand while crop yields decline. Other examples are found in the southwestern part of Libya and in the Murzuq Basin due to inadequate drainage (Sidari, 2014).

Studies on groundwater basins over the past decades in Libya indicate that the water is largely non-renewable, with substantial horizontal and vertical extensions. The water accumulated during rainy periods thousands of years ago, dating back to the Paleozoic and Mesozoic eras. The estimated exploitable quantity from these basins is about 3000 million cubic meters/year. The non-renewable water resources in the Libyan desert are part of the following major shared basins with neighboring countries: (Khaled Bin Mahmoud, 2021).

a. Ghadames Basin

Located in northwest Libya, this basin extends from the Tunisian and Algerian borders in the west to the Black Mountains and the Hun depression in the east, from the Western Mountain range (Nafusa) in the north to the Murzuq Basin in the south, covering approximately 240,000 km². The Hamada al-Hamra covers the southern part of the basin, characterized by simple plateaus, dry valleys, and partially flat elevations covered with calcareous crust, sand, and gravel, with minimal or no natural vegetation. Groundwater in this basin is found in several reservoirs, including the shallow groundwater reservoirs like the Mizda, Nalut, and Kikla reservoirs. The latter (Kikla Reservoir) is of economic importance in the Libyan desert, especially in Hamada al-Hamra, extending westward into southern Tunisia and the Algerian desert. It is a shared reservoir composed of thick sandstone layers interspersed with clay, silt, and shale layers from the Middle Jurassic and Lower Cretaceous periods, at depths ranging from 600 to 1500 meters, decreasing toward the Western Mountain (Nafusa). Wells drilled to exploit this reservoir exhibit artesian flow in the northwest and southeast areas of the basin, at significant depths up to 350 meters in Hamada al-Hamra. The productivity of wells is very high, exceeding 170 m³/hour in the northeast areas, gradually decreasing to less than 50 m³/hour in the Zahr al-Jabal areas. The water quality does not exceed 1.5 grams/liter, and the water temperature ranges from 40 to 85°C (Khaled Bin Mahmoud, 2021).

b. Murzuq Basin

Located in southwest Libya, the Murzuq Basin covers an area of approximately 350,000 km², bordered by the Nigerien border to the south, the Algerian border to the west, the Ben Ghanima and Al-Haruj Al-Aswad Mountains to the east, and the Hamada al-Hamra to the north. The basin is a desert covered with sand dunes and gravel (desert pavement or serir), surrounded by mountainous elevations to the west,

east, and northeast, ranging from 750 to 1200 meters above sea level. Most of the population (over 90%) resides in oases scattered throughout the basin, with the most populous in Sabha and the oases of Wadi Al-Shati and Wadi Al-Haya, where agriculture and livestock (sheep and camels) are predominant. The Murzuq Basin is one of the most important water basins in the Libyan desert, containing groundwater reservoirs with good potential in terms of quantity and quality, identified through exploratory drilling and hydrogeological studies. The basin contains two main groundwater reservoirs (Khaled Bin Mahmoud, 2021).

c. Al-Sarir Basin

Located in central eastern Libya, this basin covers an area of about 520,000 km². The basin features salt flats in the north, gradually rising southwards to an elevation of about 500 meters above sea level, with Quaternary period deposits covering the area, including gravel cover (Khaled Bin Mahmoud, 2021).

d. Kufra Basin

The Kufra Basin is located in southeastern Libya, extending into Egypt, Sudan, and Chad (a shared reservoir), covering an area of about 380,000 km² in Libya. The surface of the basin is a flat desert, mostly covered by Nubian sandstone rocks, with elevations ranging from 230 to 550 meters above sea level, except for mountainous areas where elevations range from 1000 meters at the eastern edge of the Tibesti Mountains to over 1800 meters at the summit of the eastern Jebel Al-Uwaynat. Hydrogeologically, based on studies and water data, it is clear that there is a major groundwater reservoir widely exploited for various purposes (agriculture, drinking, industry). It is one of the most important groundwater reservoirs in Libya, the Nubian sandstone aquifer (Khaled Bin Mahmoud, 2021).

V. Fisheries

1) FMarine Fisheries

Libya is one of the Mediterranean countries, with a coastline along the Mediterranean Sea of about 1970 kilometers, a continental shelf area of approximately 63,695 square kilometers, and Libyan territorial waters covering around 348,833 square kilometers (FAO, 2022). These data suggest a significant opportunity for fishing in Libyan territorial waters compared to other Mediterranean countries. However, due to the poor nutrient content (phytoplankton and zooplankton) and increased overfishing rates, the fishery yield is considered low (Sacchi, 2011). The European Environment Agency confirmed that over 65% of the fish stocks in the region are beyond safe biological limits, with most economically important fish species threatened with extinction. There is clear evidence of a decline in fishing rates, with larger, longer-lived species disappearing in many areas. In the Near East and North Africa, a decline in fish stocks has been observed compared to the high production rates achieved in the past. This decline is attributed to overfishing, particularly of surface fish stocks. Some statistics indicate that the total fish production from Libyan waters was 50,000 tons in 2000, consisting of approximately 21,000 tons of small pelagic fish such as sardines, mackerel, and anchovies, about 2000 tons of bluefin tuna, and around 24,000 tons of other fish. However, production declined significantly between 2000 and 2013, with Libya's marine fisheries production amounting to about 41,700 tons (Asma Abu Shuwayka, 2021).

2) Aquaculture

Aquaculture does not have a long history in Libya. It began to cultivate different species of freshwater fish in the early seventies. Due to the scarcity of freshwater resources, dams and small lakes were used for semi-intensive cultivation of various carp species (common carp, grass carp, bighead carp, silver carp) imported from China and catfish. The initial attempts were successful, with good growth rates for most species. However, freshwater aquaculture did not continue due to the lack of consumer demand for farmed fish. In the early 1990s, Nile tilapia (Oreochromis niloticus) was introduced to Libya. This species was well received by local consumers due to its acceptable appearance and good taste. Consequently, tilapia production increased rapidly using agricultural irrigation water. Marine aquaculture

began in the early 1990s with the establishment of a government farm in Ain El Ghazala. European seabass fingerlings (*Dicentrarchus labrax*), seabream (*Sparus aurata*) and mullet (Mugil spp.) were collected from the natural environment and then raised in small cages in the Lagoon of Ain El Ghazala (FAO, 2022).

Approximately 220,000 carp fingerlings (ordinary - silver - grass) have been cultured in fresh water in the Wadi Al-Mejnine Dam Lake. Nile tilapia and carp species have also been cultured in the lake of Wadi Kaam Dam and farming attempts have been successful. The growth rate was good in most species. However, freshwater fish farming has not continued due to the lack of demand for this type of fish by local consumers (FAO, 2017). In 1991, a program of freshwater shrimp hatchery and breeding began, but this project was interrupted due to lack of expertise that led to the death of this type of shrimp. In 1994, attempts were made to hatch shrimp again, and about 35,000 fry units were produced. In 1996, shrimp fry production increased to 400,000 units. Shrimp fry produced from these hatcheries were cultured and their growth rates were weakened and their mortality rate was high, which led to the cessation of this program.

Production remained low, ranging from 30-40 tons until the end of the nineties, when new farms were established. Seabream and sea bass fingerlings were imported from Europe by the Government and sold to the private sector at subsidized prices. In 2004, the production of these species amounted to 231 tons. Northern bluefin tuna (*Thunnus thynnus thynnus*) began in 2003 by two private sector companies. Production was about 350 tons in 2003 and 150 tons in 2004 (FAO, 2022).

There is no historical information on human resources in the aquaculture sector, but the number of permanent employees currently stands at around 140. This information is derived from a survey conducted by the Biology Research Center.
Navy in 2004. This employment includes a number of specialists working in hatcheries. The majority of workers in this sector are currently male. Women working in this field work at the Marine Biology Research Centre. With the establishment of the Department of Aquaculture at the Faculty of Agriculture at the University of Tripoli (the largest university in Libya) in 1996, assistance in training workers in this field became possible (FAO, 2022).

Fish farms and hatcheries for both freshwater and marine species are distributed along Libyan coast. Freshwater fish farms (Nile tilapia) using water from agricultural irrigation canals are abundant on the coast in rural areas as well as in Southern Libya. Some government agricultural projects are also used for freshwater fish farming. The main marine species farmed in Libya on a commercial scale are seabream, European sea bass and Northern bluefin tuna and all of these species are endemic to the Mediterranean region. Farmed freshwater fish include many species of carp: common carp, bighead carp, grass carp, silver carp and catfish. Carp was farmed mainly in reservoirs and small lakes, but the practice ceased in 1992, leaving stocks of these species to live on natural food. As for Nile tilapia and red tilapia, they are the most important types of freshwaters farmed in Libya, as they are widely raised in irrigation ponds in field farms along the coast and in rural and Southern areas of the country. As a result of the good growth of tilapia, its ease of breeding and its tolerance to a wide range of environmental conditions, a large farm has been established in the south of the country, consisting of a large hatchery and 78 concrete ponds. No freshwater species are native to Libya; all farmed freshwater species were introduced between the 1970s and 1990s (FAO, 2022).

The current marine hatcheries use closed systems with biofilters, sand filters, and UV systems. Light intensity and temperature are also controlled, allowing larval production outside the breeding season as well as avoiding the problems associated with natural reproductive cycles. This system enables continuous fish farming and encourages farmers to capitalize on higher market prices. Intensive production takes place in ground-based systems in concrete ponds and earthen basins. Local materials are available for constructing concrete ponds. There are vast unpolluted coastal areas in Libya with favorable climate and environmental conditions. Groundwater can be accessed near the surface through drilling. Cages are primarily used in the eastern coastal region due to a lack of protected areas along the coast. There are also a few open-water cages in various coastal areas (FAO, 2022).

There is no significant local market for aquaculture products in Libya, and per capita consumption is very low. Farmers therefore prefer to export all their production abroad. The main aquaculture products, sea bass and seabream weighing between 350-500 g, are frozen (refrigerated) and then exported fresh to Tunisia in the first place, and some production is exported to Egypt. Fish exported from farmers are

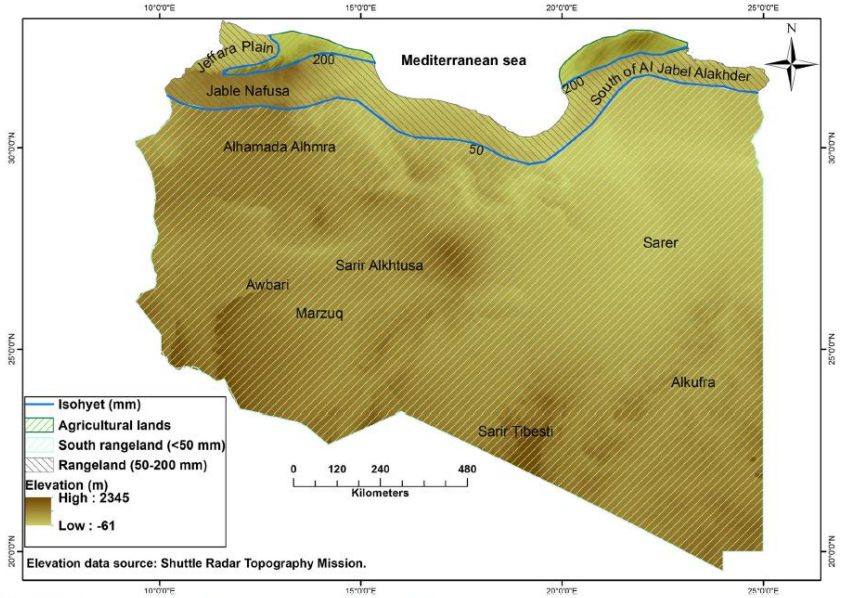
sold directly to local Tunisian traders. The current price of seabream and sea bass on the farm ranges from US$4-6/kg, while tilapia is US$2-3/kg. All bluefin tuna production is exported, but there is no information on its prices. Tilapia is consumed locally and sold fresh from the farmer directly to the consumer. The weight of the fish varies between 0.5-1 kg (FAO, 2022).

VI. **Rangelands**

Libyan rangelands are a crucial support for the national economy, covering approximately 13.3 million hectares, or over 70% of the country's land area. These rangelands are classified into four regions by the Rangeland Development Authority (1980): western, central, eastern, and southern regions (Bukhari et al., 2018).

Rangelands play a significant role in environmental protection, preventing soil erosion from water and wind, thereby reducing desertification effects. They also serve as recreational resources, providing firewood, aromatic and medicinal plants, and non-traditional foods. Additionally, many Libyans work in rangeland-related sectors. Rangelands contribute significantly to the dietary needs of large grazing animal populations, estimated at 562,000 tons of annual feed requirements (Rangeland Development Project 2008). They also contain the largest soil seed banks among Libyan rangelands (Bukhari et al., 2018).

Map 13: Map of the distribution of pastoral lands and their correlation to rainfall rates and altitudes



Source: Bukhari et al., 2018

However, vegetation cover in Libyan rangelands has changed qualitatively and quantitatively over the past four decades due to various factors including low rainfall, overgrazing, poor agricultural practices, mismanagement, misuse, seasonal fires, recurrent droughts, wind, water erosion, and human activities. Rangeland degradation affects biodiversity sustainability and reduces the potential for future uses of rangeland ecosystems. Land use decisions, livestock types and numbers, grazing seasons, and stocking densities all have profound impacts on rangeland balance and sustainable land use. Major threats include the loss of permanent grass cover and the increase of unpalatable annual species. The three main threats to rangeland ecological processes are invasive species, land conversion, and severe productivity decline due to soil degradation from intense erosion and overgrazing (Bukhari et al., 2018).

The region can support approximately 2.5 million animals, but actual numbers have risen to nearly 7.5 million. The increase in grazing animals and unregulated rangeland use has led to vegetation decline and environmental degradation, worsening rangeland conditions in Libya. Population growth in some rangeland areas has also led to the exploitation of these lands for irrigated crops, reducing rangeland areas. For example, in western rangelands and Ben Mansoura, large areas receiving 200 mm of rainfall have been converted to crop fields. Additionally, animals have moved to areas with lower rainfall, leading to overgrazing, plant extinction, erosion, and surface rock exposure, particularly in highlands and slopes. Southeastern rangelands of Jebel Akhdar suffer from overgrazing due to increased animal numbers and concentration, reduced natural rangeland area, and seasonal migration of herders. In 1987, the total number of animals (sheep, goats, cattle, camels) in this area was 89,079 heads. By 2002, this number had increased to 202,386 heads. Grazing now concentrates near water sources, reducing rangeland productivity due to overgrazing and excluding seed sources from pasture plants. This has caused a feed unit deficit in the western part of the eastern rangelands, estimated at 285 feed units per hectare annually to feed 908,199 sheep, camels, and goats. Grazing on trees and shrubs has degraded palatable species and led to the loss of many others. This has reduced or eliminated the biomass quality of several perennial plants with high nutritional value. Rainfall variability can reduce vegetation quality

and quantity, affecting forage availability for grazing animals. Continuous drought years decrease animal numbers due to feed shortages and farmers' inability to provide supplementary feed due to high costs. These perennial plants ensure rangeland sustainability during drought years but have been replaced by poorer, less nutritious rangeland types. Vegetation cover degradation increases the cost for herders to provide supplementary feeding, impacting overall rangeland health (Bukhari et al., 2018).

VII. Threats to Biodiversity

Although Libyan biodiversity is relatively low due to the continental climate, many species are found in very limited habitats. Consequently, biodiversity is exposed to numerous threats such as population growth pressure, overhunting of animals, removal of many plants, especially medicinal plants, tree cutting in many critical environments, globalization and its negative impacts on the extraction of living resources, limited human and financial resources, environmental degradation due to pollution from agricultural and industrial activities, and habitat fragmentation due to development projects and road construction. In addition, many agricultural plants and animals have been introduced to Libya over the past two centuries, and have become of great economic importance, particularly in agriculture such as fruits, animal races, including fish, poultry, livestock and cattle, this led to the neglect of Libyan species and thus some of them began to deteriorate or almost disappear (agricultural genetic assets). On the one hand, numerous plant and animal species have arrived in Libya, either intentionally (to boost agriculture and livestock and fishery sectors) or unintentionally (through trade, bird migration), resulting in the presence of many invasive alien species that have negatively impacted the agricultural environment. Therefore, Libyan biodiversity currently faces numerous threats due to the introduction of invasive species.

From the above, it can be concluded that all Libyan ecosystems, habitats, and plant species are no longer in ecological balance. All Libyan environments, whether aquatic, agricultural, desert, mountainous, or marine, especially the deep Mediterranean Sea regions, have been affected by human activities, leading to significant deterioration in ecosystems, habitats, and biodiversity. The following tables illustrate the main risks and threats facing biodiversity in Libya.

Table 9 The main threats and threats to biodiversity in Libya

No.	Threats and Risks	Root Causes	Threat Severity
Threats to the forest area			
1	Fires	- Natural fires due to drought and high temperatures	Low
		- Spontaneous arson due to the negligence of hikers	Medium
		- Arson for the purpose of turning forest areas into farms	High
2	Logging forests	- Logging for the purpose of coal production	Medium
		- Logging for the purpose of converting the forest land into farms	High
		- Logging for construction	Medium
		- Logging for the purpose of opening roads	Low
3	Overgrazing	- Raising large numbers of animals beyond the capacity of the forest to regenerate	Medium
		- Introduction of animals of a destructive nature into the forests	Low
4	Invasive and Alien Species	- Introduction of animals that may cause damage to forests	Low
		- The use of plants introduced in forest afforestation and road decoration	Medium
5	Pollution	- Do not control the smoke of factories and cars near the forests	Medium
		- Lack of effective treatment of solid waste	Low
		- Sewage pouring into forests without processing	Medium
6	Drought	- High temperatures with low rainfall rates	High
7	Misuse of plants	- Excessive use of plants of medical importance	Medium
Non-forest areas			
1	Overgrazing	- Grazing large numbers of animals in limited areas	High
		- Failure to organize grazing operations to allow pastures to recover	High
		- Devouring plants before the date of flowering and fruiting, which causes the scarcity and decay of the original vegetation cover and encourages many exotic and exotic plants unpalaTable to invade these pastures	High
		- Destruction of the natural habitats of wild animals, represented by burrows and tunnels that shelter them	Medium
2	Degradation of vegetation	- Logging for the purpose of coal production	High
		- Conversion of land into farms	Medium
		-Drought	High
		- Urban sprawl	Low
		- Hiking and the resulting destruction of plants	Low
		- Overgrazing	High

No.	Threats and Risks	Root Causes	Threat Severity
4	Introduced and invasive species	- Introduction of animals that may cause harm to the wild environment	Medium
		- Use of plants introduced in pastoral and agricultural areas	Medium
5	Pollution	- Not controlling the smoke of factories and cars	High
		- Contamination from pesticides used in pest control	Low
		- Lack of effective treatment of solid waste	Medium
6	Overfishing	- Hunting wild animals that threaten their existence	High
Aquatic and marine environment			
1	Habitat destruction	- Use of trawls	High
		- Use of explosives in fishing	Medium
		- Backfilling beaches	Low
		- Agricultural expansion	Medium
		- Urban expansion	High
		- Exploitation of beach sand as a building material	Low
2	Pollution	- Water pollution with solid waste	Low
		- Sewage pouring into water bodies without treatment	High
		- Pollution of the sea with oil due to the pouring of ballast water	High
		- Pollution from offshore oil fields	High
		- Pollution from pesticides and nutrients used in agriculture	Medium
3	Overfishing	- Unregulated fishing of aquatic organisms	Low
		- Use of fishing methods harmful to aquatic organisms	Medium
4	Invasive introduced species	- Entry of species of objects that do not already exist in the local environment	Medium
5	Drying up of internal water bodies	- High temperatures with low rainfall	Medium

Source: Authors after the fourth national report 2010

1) **Degradation and Fragmentation of Ecosystems**

Unplanned agricultural development policies resulted in an increase in the quantities of agricultural drainage water, which led to an increase in the percentage of pollutants from heavy metals, agricultural pesticide residues and nutrients from chemical fertilizers in the water bodies and groundwater in various basins in Libya. Additionally, urban expansion activities and oil extraction in marine and coastal areas have increased the concentrations of pollutants and heavy metals in the bottom soil and waters of lagoons. This has also increased the biological concentrations within the tissues of marine organisms and fish, negatively impacting the biological processes of ecosystems within the lagoons and marine areas. Consequently, this has led to the degradation of fish stocks and a decline in the attractiveness of its beaches for tourism. Thus, the Ministry of Environment has conducted field surveys to assess the state of biodiversity and the extent of its degradation.

The continued use of traditional methods in irrigating agricultural crops, especially in the desert oasis areas, combined with the weakness of the current agricultural drainage systems, led to an increase in the percentage of salts and their concentrations in the soil in the areas of agriculture and agricultural reclamation, which led to the negative impact of biological processes on the soil, as well as the decrease in the number of microorganisms useful for agriculture in the soil and the emergence of the problem of soil salinization, which resulted in a decrease in agricultural productivity of various crops in those areas, which contributed to increasing the deficit in food stocks annually. Agriculture by conducting research studies to develop new types of genetically modified crop strains that are used in agriculture and have a high ability to tolerate high concentrations of soil salinity.

Land reclamation activities for agriculture and related services, along with increasing horizontal agricultural expansion in recent years, have led to an increase in cultivated areas in desert regions. New roads and waterways have been created to serve agricultural development purposes, causing the degradation and fragmentation of some natural environments, particularly in lowlands, oases, and natural springs. These areas previously hosted some wild plants and animals, leading to the destruction of natural feeding and breeding habitats for these organisms. As a result, these organisms have migrated to new locations lacking vital resources, reducing their numbers and exposing them to the risk of extinction.

In addition, ongoing unregulated urban development has prompted institutions, agencies, and individuals to reclaim and annex vast areas of water bodies in coastal regions to increase urban expansion space for accommodating population growth. This has led to the shrinkage of water bodies in some lagoons, causing the

degradation of biological and ecological processes and the death of many organisms and fish due to increased population density in water bodies and reduced food and oxygen availability.

One of the threats that affect biodiversity is oil and gas exploration and extraction activities, as well as mining operations from both marine and terrestrial areas, pose significant threats to biodiversity. Oil companies use advanced technology to locate oil reserves and, once identified, build camps, pumps, and conduct quality tests. The environmental impact of oil exploration and extraction includes oil spills, destruction of natural ecosystems, long-term effects on wildlife (especially birds and marine organisms), and the displacement of organisms from their natural habitats. Additionally, oil extraction involves the use of large amounts of water, which becomes polluted and is discharged back into the environment, causing further environmental and groundwater pollution. Marine pollution is a significant consequence of the oil industry, as even small quantities of oil can have severe and long-lasting effects on marine life, compromising the sustainability of marine biodiversity. Marine pollution often results from cleaning the tanks of large oil tankers, where the residual oil mixed with cleaning water is discharged into the sea, threatening marine life and ecological balance.

Currently, it is observed and confirmed that marine environments and their biodiversity are threatened due to illegal fishing along the coast. Various forms of illegal fishing, such as the use of unauthorized fishing gear and dynamite, have become widespread, especially after 2011. This has led to the loss and degradation of marine resources, including the destruction of habitats that cannot be compensated for or rebuilt. Another problem is pollution from sewage, which is also present along the coast (Libyan coastal cities). It is almost certain that there is no treatment for the sewage discharged into the sea, as all treatment plants are non-operational. Additionally, there is a new phenomenon in Libya involving the establishment of numerous waste dumps in coastal wetlands. Once water levels rise due to rain or valley water, all this waste and garbage will reach the sea.

It is certainly true that there are vast areas far from urban and human settlements, particularly the central region (Gulf of Sidra), which are supposed to be free from pollution and human activities. However, due to Libya being an oil-producing country with many ports and oil terminals, especially in the central region, the area suffers from pollution due to ballast water and oil. This negatively affects marine organisms living in the area, whether they are fish, whales, sharks, sea turtles, or seabirds. Therefore, it can be said that some environments require urgent measures to protect them, as they are the foundation for forming populations in marine

habitats. Seagrasses, especially Posidonia and Cymodocea, should be urgently protected and prioritized in conservation strategies. Furthermore, the hotspots for these species, such as Farwa, Ain Ghazala, Ain Zayana, Bardi, and Tobruk Bay, need to be addressed wherever these species are threatened along the coast.

Another important issue is coastal wetlands, which serve as the frontline defense for the marine environment, especially lagoons, as they provide shelters and breeding sites for many fish, mollusks, and other marine organisms, as well as water birds. This requires a comprehensive study of these sites to identify and investigate their issues, followed by policy formulation for their protection and conservation (RAS/SPA, 2017).

Critical impacts, whether on the environment or biodiversity, refer to disasters causing permanent destruction of ecosystems, along with significant impacts on their natural components. Some of these disasters result from human activities, even if indirectly, while others are natural disasters beyond human control. In cases where natural disasters and human intervention overlap, the situation becomes complex, significantly affecting natural ecosystems and their biotic and abiotic components. For example, the island of Farwa, a biodiversity hotspot, faces risks from erosion and strong marine currents that eliminate Posidonia grass. This is due to recent climate changes and irrational human activities, such as altering the natural opening on the east side of the island to establish the Abu Kammash petrochemical plant. Unfortunately, in the past four years, the erosion rate has exceeded 10 meters. The area was rich in species such as octopus and many types of fish, with mullet being the most common. Currently, all fishermen complain about the lack of fish and the problem of excessive Posidonia accumulation in the western opening of the lagoon along the valley course, which is losing its natural depth.

In eastern Libya, known for oil exports with many ports and oil terminals, especially Tobruk Bay, which is rich in marine biodiversity, the presence of a commercial city, oil port, and desalination plant negatively affects biodiversity due to ballast water. It is also worth noting that the area is highly susceptible to the spread of invasive species due to its proximity to the eastern Mediterranean. Another negative impact arises from illegal fishing, which affects most coastal marine areas, such as using dynamite, which causes habitat loss and destruction. Although there is no significant negative impact from tourism along the Libyan coast, there is one area negatively affected, namely the Bardi site, characterized by the convergence of valleys with seawater, forming a natural estuary. However, before 2011, a tourist hotel was established in the area where the valleys meet the sea, contributing to a barrier preventing or reducing the natural flow of water from the valleys into the sea. This area is important for seabirds and the spawning of certain fish species.

Since 2011, the absence of government due to political conflicts has led to neglect in guarding territorial waters, allowing foreign fishing vessels with advanced fishing

techniques to enter. This has adversely affected fish stocks and biodiversity in general. There are many wetlands along the Libyan coast, diverse in terrain and characteristics depending on their location, such as coastal lagoons, salt flats, small islands, tidal zones, marshes, and small bays. These habitats are crucial for the marine environment and its biodiversity. Human activities leading to the degradation and disturbance of these ecological systems have been identified, such as urban expansion, overfishing within lagoons, sewage discharge into them, and the establishment of strategic factories producing waste that exceeds the area's capacity. Shallow lakes (such as Farwa and Ain Zayana in Benghazi) are also affected. Waterfowl, which use these areas for stopovers or breeding, are hunted, especially in lakes and bays in the eastern region, such as Ain Ghazala, bays near the city of Derna, and salt flats in the central region, such as Ben Jawad and Sultan salt flats, extending east to Sirte (RAS/SPA, 2017).

2) Climate change

Recent studies have shown that the climate in Libya has changed dramatically over the past years, it is expected that temperatures will rise in all four seasons, moving from the south to the Northern parts of Libya, in the next 100 years, which will lead to a reduction in arable land area and a shift in agricultural cycles' timings, resulting in changes in crop production systems that will be under increasing pressure to meet the growing future food demand. Consequently, this will lead to a decrease in protein levels in some leguminous crops.

The effects of climate change in mountainous areas have been documented by observing its impact on the disappearance of living organisms that inhabit mountain peaks due to rising temperatures. Annual temperature changes have exerted pressures on mountain wild plants, leading to a decrease in the flowering rate of some plants in the Green Mountain and Nafusa Mountain regions. Additionally, the rise in temperatures due to climate change has caused changes in the patterns, presence, and growth of many plant and animal species, resulting in a decline in these species as they migrate from their natural habitats.

3) Invasive and Exotic Species

A total of 29 species of invasive alien organisms have been documented in Libyan plants, belonging to 25 genera and 13 families. Among these, 12 families belong to dicotyledons with 22 genera and 26 species, and one family belongs to monocotyledons with three genera, each represented by one species. The dominant families are Asteraceae with seven species, followed by Amaranthaceae with five species. The Solanaceae, Fabaceae, and Poaceae families each have three species, while the remaining families are represented by one species each. The majority of invasive exotic plant species are of American origin, with 16 species, including seven from tropical America, six from North America, one from South America, one from Central America, and one from both North and South America. An analysis of life cycles showed that herbaceous species dominated with 22 species, while shrubs were represented by three species and trees by four species (Makhlouf, 2019 – Bolayah and Michael, 2021).

Table 23: list of Invasive and Exotic plant species in Libya

No.	Family	Scientific name	Nativity	Invasiveness	Habit
1	Aizoaceae	*Tetragonia tetragonoides* (Pall.) O. Kuntze	New Zealand	Moderate	Herb
2	Amaranthaceae	*Amaranthus blitoides* S. Watson	North America	New	Herb
2	Amaranthaceae	*Amaranthus retroflexus* L.	Central America	Moderate	Herb
3	Amaranthaceae	*Beta vulgaris* L.	South Europe and West Asia	Moderate	Herb
5	Amaranthaceae	*Chenopodium album* L.	Europe	High	Herb
6	Amaranthaceae	*Chenopodium murale* L.	Tropical America	High	Herb
7	Apiaceae	*Anethum graveolens* L.	West Asia	Moderate	Herb
8	Asteraceae	*Artemisia vulgaris* L.	America	New	Herb
9	Asteraceae	*Bidens pilosa* L.	Tropical America	Moderate	Herb
10	Asteraceae	*Erigeron bonariensis* L.	South America	High	Herb
11	Asteraceae	*Erigeron canadensis* L.	North America	Moderate	Herb
12	Asteraceae	*Sonchus oleraceus* L.	Mediterranean	High	Herb
13	Asteraceae	*Symphyotrichum subulatum* (Michx.) G.L. Nesom	North America	Moderate	Herb
14	Asteraceae	*Verbesina encelioides* (Cav.) Benth. & Hook. f. ex A. Gray	Mediterranean	High	Herb
15	Euphorbiaceae	*Ricinus communis* L.	Africa	High	Shrub
16	Fabaceae	*Acacia cyanophylla* Lindely	Australia	High	Tree
17	Fabaceae	*Leucaena leucocephala* (Lam.) de Wit.	Tropical America	High	Tree
18	Fabaceae	*Parkinsonia aculeata* L.	Tropical America	High	Tree
19	Heliotropiaceae	*Heliotropium curassavicum* L.	East and South Europe, West and North Africa	Moderate	Herb
20	Meliaceae	*Melia azedarach* L.	India	Moderate	Tree
21	Onagraceae	*Oenothera laciniata* Hill.	North America	New	Herb
22	Poaceae	*Cenchrus spinifex* Cav.	North America	High	Herb
23	Poaceae	*Chloris gayana* Kunth.	Tropical America	New	Herb
24	Poaceae	*Eleusine indica* (L.) Gaertner	Tropics and subtropics	Moderate	Herb

No.	Family	Scientific name	Nativity	Invasiveness	Habit
25	Solanaceae	*Nicotiana glauca* R.C. Graham	Brazil	High	Shrub
26	Solanaceae	*Solanum elaeagnifolium* Cav.	North America	High	Herb
27	Solanaceae	*Solanum rostratum* Dunel.	Neotropics and southwest USA	New	Herb
28	Verbenaceae	*Lantana camara* L.	Tropical America	Moderate	Shrub
29	Zygophyllaceae	*Tribulus terrestris* L.	Tropical America	Moderate	Herb

Source: (Makhlouf, 2019 – Bolayah and Michael, 2021)

These documented species were classified according to their invasion severity and spread capacity into three categories: 12 species were found to have a high invasion rate (highly invasive) and are widespread, 12 species have a moderate invasion rate (moderately invasive), and six species were classified as (newly invasive). These six latter species were recently introduced and recorded in the Encyclopedia of Libyan Plants. These invasive plants have been recorded as invasive in many regions worldwide: Chloris gayana, Oenothera laciniata, Solanum rostratum, Amaranthus blitoides, Artemisia vulgaris, and Verbesina encelioides. These species have the potential to spread and invade natural and agricultural habitats in Libya, necessitating early monitoring and surveillance plans to prevent their spread and harmful effects (Makhlouf, 2019 – Bolayah and Michael, 2021).

Several species of invasive origin have been documented as having a weak invasion rate (weakly invasive) in Libyan environments, as they cannot spread widely and some disappear early while others remain fragmented and confined to small areas due to unfavorable environmental conditions or the inability to compete with native species. Some of these plants are Prosopis juliflora, Acacia occidental, and Acacia farnesiana, among others. Therefore, these latter plant species pose no threat or danger to ecosystems and cannot be considered invasive in Libyan environments. The species were also classified according to their impact and significance, with the majority of recorded exotic species classified as harmful (17 species), eight species introduced as ornamental plants, and food and forage species each represented by two species (Makhlouf, 2019 – Bolayah and Michael, 2021).

Table 24: Classification of invasive species according to their importance and source

No.	Family	Scientific name	Importance	Source
1	Aizoaceae	*Tetragonia tetragonoides*	Noxious	Jafri and El-Gadi (1976–1989)
2	Amaranthaceae	*Amaranthus blitoides*	Noxious	Mahklouf et al. (2016)
3	Amaranthaceae	*Amaranthus retroflexus*	Noxious	Jafri and El-Gadi (1976–1989)
4	Amaranthaceae	*Beta vulgaris*	Food	Keith (1965)
5	Amaranthaceae	*Chenopodium album*	Noxious	Jafri and El-Gadi (1976–1989)
6	Amaranthaceae	*Chenopodium murale*	Noxious	Jafri and El-Gadi (1976–1989)
7	Apiaceae	*Anethum graveolens*	Food	Keith (1965)
8	Asteraceae	*Artemisia vulgaris*	Noxious	Abouhadra et al. (2016)

No.	Family	Scientific name	Importance	Source
9	Asteraceae	*Bidens pilosa*	Noxious	Jafri and El-Gadi (1976–1989)
10	Asteraceae	*Erigeron bonariensis*	Noxious	Jafri and El-Gadi (1976–1989)
11	Asteraceae	*Erigeron canadensis*	Noxious	Keith (1965)
12	Asteraceae	*Sonchus oleraceus*	Noxious	Jafri and El-Gadi (1976–1989)
13	Asteraceae	*Symphyotrichum subulatum*	Noxious	Newly reported
14	Asteraceae	*Verbesina encelioides*	Ornamental	Sharashy (2016)
15	Euphorbiaceae	*Ricinus communis*	Ornamental	Jafri and El-Gadi (1976–1989)
16	Fabaceae	*Acacia cyanophylla*	Ornamental	Keith (1965)
17	Fabaceae	*Leucaena leucocephala*	Ornamental	El-zunni and Bayoumi (2006)
18	Fabaceae	*Parkinsonia aculeata*	Ornamental	Jafri and El-Gadi (1976–1989)
19	Heliotropiaceae	*Heliotropium curassavicum*	Noxious	Jafri and El-Gadi (1976–1989)
20	Meliaceae	*Melia azedarach*	Ornamental	Keith (1965)
21	Onagraceae	*Oenothera laciniata*	Noxious	Mahklouf (2016b)
22	Poaceae	*Cenchrus spinifex*	Noxious	Jafri and El-Gadi (1976–1989)
23	Poaceae	*Chloris gayana*	Fodder	Erteeb and Sharashi (2015)
24	Poaceae	*Eleusine indica*	Fodder	Keith (1965)
25	Solanaceae	*Nicotiana glauca*	Ornamental	Keith (1965)
26	Solanaceae	*Solanum elaeagnifolium*	Noxious	Sherif et al. (1990)
27	Solanaceae	*Solanum rostratum*	Noxious	Mahklouf (2016a)
28	Verbenaceae	*Lantana camara*	Ornamental	Jafri and El-Gadi (1976–1989)
29	Zygophyllaceae	*Tribulus terrestris*	Noxious	Jafri and El-Gadi (1976–1989)

(Makhlouf, 2019 – Bolayah and Michael, 2021)

Regarding marine invasive species in Libya, the first marine invasive species documented was a type of crab (Percnon gibbesi) in the Henia area of the Green Mountain in 2006. It is the most invasive crab species in the Mediterranean Sea, first recorded in 1999 in the Balearic Islands and Sicily, and has since spread from Spain to Turkey. Additionally, 63 exotic species were recorded along the Libyan coast, and nine invasive exotic species were recorded from the Al-Kouf National Park and surrounding areas in the Green Mountain, namely: Rhodophyta [Asparagopsis taxiformis (Delile) Trevisan de Saint-Léon], Chlorophyta [Caulerpa racemosa var. cylindracea (Sonder) Verlaque, Huisman & Boudouresque], the sally lightfoot crab (Percnon gibbesi H. Milne-Edwards), the bluespotted cornetfish (Fistularia commersonii, Rüppell), the dusky spinefoot or (Libyan name) batata (Siganus luridus, Rüppell), the marbled spinefoot (Siganus rivulatus Forsskål), the Vanikoro sweeper (Pempheris vanicolensis Cuvier), the silver-cheeked toadfish (Lagocephalus sceleratus Gmelin), and the yellowtail barracuda (Sphyraena flavicauda Rüppell). In 2013, three green algae species (Caulerpa racemosa var. cylindracea, Caulerpa taxifolia, and Codium fragile) were documented as invasive in the Mediterranean Sea. In 2017, researcher Shaqman and others recorded seven first records of invasive species from different origins in the Libyan marine

environment: the longfin yellowtail (Seriola rivoliana), lesser amberjack (Seriola fasciata), blunthead puffer (Sphoeroides pachygaster Müller & Troschel), round herring (Etrumeus golanii Golani), blue swimmer crab (Portunus segnis), bigfin reef squid (Sepioteuthis lessoniana), and green alga (Caulerpa taxifolia). The first three species are widely spread and seem to be expanding their range in the Mediterranean Sea. The Indo-Pacific fish (E. golanii) and blue crab (P. segnis) have recently reached the Mediterranean region, currently flourishing in Tunisian waters near the western Libyan border. Additionally, the bigfin reef squid (S. lessoniana) has been reported in several locations in the eastern Mediterranean. Furthermore, C. taxifolia has been recorded in Libyan waters as one of the invasive marine algae on the Tripoli coast. In total, 73 exotic marine species have been recorded in Libyan waters, with fish constituting the highest percentage at over 32.88%, followed by aquatic plants and algae at 21.92%, mollusks at 16.44%, crustaceans at 13.70%, and exotic parasites at over 9% (Makhlouf, 2019 – Bolayah and Michael, 2021).

Table 25: Exotic marine species recorded in Libyan waters (as of March 2019)

Species	location and year	Status	Establishment	Distribution	References
Foraminifera					
Amphisorus hemprichii Ehrenberg, 1839	E – 2004	AL	Unknown	E	Langer (2008)
Amphistegina lobifera Larsen, 1976	E – 1979	CR	Est.	E	Blanc-Vernet et al. (1979)
Coscinospira hemprichii Ehrenberg, 1839	E – 2004	CR	Unknown	E	Langer (2008)
Phaeophycae					
Padina boergesenii Allender & Kraft, 1983	E – 1974	AL	Est.	A	Nizamuddin (1981)
Padina boryana Thivy, 1966	E – 1974	AL	Est.	A	Nizamuddin (1981)
Stypopodium schimperi (Kützing) M.Verlaque & Boudouresque, 1991	E – 1977	LA	Est.	A	Nizamuddin (1981)
Rhodophyta					
Acanthophora nayadiformis (Delile) Papenfuss, 1968	1888	CR	Est.	A	De Toni and Levi (1888)
Anotrichium furcellatum (J.Agardh) Baldock, 1976	2015	CR	Est.	E	Verlaque et al. (2015)
Chondria coerulescens (J.Agardh) Falkenberg, 1901	W – 1989	CR	Est	W	Godeh et al. (1992)
Lophocladia lallemandii (Montagne) F.Schmitz, 1893	1918	AL	Est.	A	Petersen (1918)
Polysiphonia atlantica Kapraun & J.N.Norris, 1982	E – 1989	CR	Cas.	E	Godeh et al. (1992)
Chlorophyta					
Caulerpa cylindracea Sonder, 1845	1990	AL	Est.	A	Nizamuddin (1991)
Avrainvillea amadelpha (Montagne) A.Gepp & E.S.	2012	AL	Est.	E	Verlaque et al. (2017)
Gepp, 1908					
Cladophora herpestica (Montagne) Kützing, 1849	E – 1986	AL	Ques.	E	Nizamuddin (1988)
Codium fragile subsp. *atlanticum* (A.D.Cotton) P.C. Silva, 1955 = *Codium fragile* subsp. *fragile*	1984	AL	Est.	A	Nizamuddin (1991)
Codium taylorii P.C.Silva, 1960	1977	AL	Est.	A	Nizamuddin (1991)
Ulva fasciata Delile, 1813	1979	CR	Est. Est.	A W	Nizamuddin et al. (1979)
Caulerpa taxifolia var. *distichophylla* (Sonder)	W – 2017	AL			Shakman et al. (2017), Mahklouf
Verlaque, Huisman & Procaccini, 2013					Talha (2018)
Magnoliophyta					
Halophila stipulacea (Forsskål) Ascherson, 1867	2009	AL	Est.	A	RAC/SPA (2009)
Amphipoda					
Hamimaera hamigera (Haswell, 1879)	E – 1972	AL	Cas.	E	Ortiz and Petrescu (2007)

Species	location and year	Status	Establishment	Distribution	References
Cirripedia					
Tetraclita squamosa rufotincta Pilsbry, 1916	E – 2007	AL	Cas.	E	Zaouali et al. (2007a)
Copepoda					
Euchaeta concinna Dana, 1849	E – 1990	AL	Cas	E	Halim (1990)
Decapoda					
Percnon gibbesi (H. Milne-Edwards, 1853)	W – 2004	AL	Cas.	W	Elkrwe et al. (2006)
Plagusia squamosa (Herbst, 1790)	S – 2006	AL	Est.	A	Zaouali et al. (2007b)
Portunus segnis Forsskål, 1775	E – 2017	AL	Est.	A	Shakman et al. (2017)
Eucrate crenata (De Haan, 1835)	1999	AL	Est.	A	Zgozi et al. (2002)
Isopoda					
Apanthura sandalensis Stebbing, 1900	E – 1976	AL	Est.	E	Negoescu (1981)
Paradella dianae (Menzies, 1962)	E – 2001	AL	Cas.	E	Zgozi et al. (2002)
Stomatopoda					
Erugosquilla massavensis (Kossmann, 1880)	E – 2002	AL	Est.	E + S	Zgozi et al. (2002)
Bivalvia					
Malleus regula (Forsskål in Niebuhr, 1775)	2001	AL	Est.	A	Giannuzzi-Savelli et al. (2001)
Pinctada imbricata radiata (Leach, 1814)	1913	AL	Est.	A	Monterosato (1917)
Fulvia fragilis (Forsskål in Neibuhr, 1775)	1997	AL	Est.	A	Zgozi et al. (2002)
Gastropoda					
Bursatella leachii Blainville, 1817	E – 2000	AL	Cas.	E	Zgozi et al. (2002)
Cellana rota (Gmelin, 1791)	E – 2007	AL	Cas.	E	Zaouali et al. (2007b)
Clypeomorus bifasciata (G.B. Sowerby II, 1855)	E – 1994	AL	Cas.	E	Giannuzzi-Savelli et al. (1997)
Conomurex persicus (Swainson, 1821)	2006	AL	Est.	A	Ben-Souissi et al. (2007)
Conus fumigatus Hwass in Bruguière, 1792	E – 1976	AL	Cas.	E	Röckel (1986)
Erosaria turdus (Lamarck, 1810)	2007	AL	Est.	A	Ben-Souissi et al. (2007)
Haminoea cyanomarginata Heller & Thompson, 1983	W –2018	AL	Cas.	W	Rizgalla et al. (2018)
Nerita sanguinolenta Menke, 1829	E – 1994	AL	Cas.	E & S	Giannuzzi-Savelli et al. (1994)
Cephalopods					
Sepioteuthis lessoniana Férussac, 1831	W – 2015	AL	Cas.	W	Shakman et al. (2017)
Echinodermata					
Ophiocoma scolopendrina (Lamarck, 1816)	E – 2007	AL	Ques.	E	Zaouali et al. (2007b)
Fishes					
Siganus luridus Rüppell, 1829	E – 1968	AL	Est.	A	Stirn (1970)
Siganus rivulatus Forsskål, 1775	E – 1968	AL	Est.	A	Stirn (1970)
Sphyraena flavicauda Rüppell, 1838	E – 1998	AL	Est.	A	Ben Abdallah et al. (2003)
Sphyraena chrysotaenia Klunzinger, 1884	E – 1968	AL	Est.	A	Stirn (1970)
Herklotsichthys punctatus Ruppell, 1837	E – 2005	AL	Est.	E & S	Shakman and Kinzelbach (2007c)
Saurida lessepsianus Russell, Golani, Tikochinski, 2015	1982	AL	Est.	A	Zupanovic and EL-Buni (1982)
Hemiramphus far Forsskal, 1775	E – 2006	AL	Est.	A	Shakman and Kinzelbach (2006)
Fistularia commersonii Ruppell, 1838	E – 2004	AL	Est.	A	Ben Abdalha et al. (2005)
Atherinomorus forskali (Rüppell, 1838)	E – 1929	A	Est.	A	Norman (1929)
Alepes djedaba Forsskal, 1775	E – 1990	L	Est.	A	Ben Abdalha et al. (2005)
Upeneus pori Ben-Tuvia & Golani, 1989	E – 1994	A	Est.	A	Ben Abdalha et al. (2005)
Upeneus maluccensis Bleeker, 1855	E – 1968	L	Est.	A	Stirn (1970)
Crenidens Forsskal, 1775	E – 1999	A	Ques.	A	Al-Hassan and El-Silini (1999)
Pempheris rhomboidea Kossmann and R Cuvier, 1831	E – 2004	L	Est.	A	Ben Abdallah et al. (2004)

Species	location and year	Status	Establishment	Distribution	References
Liza carinata Valenciennes, 1836	E – 2005	AL	Est.	A	Shakman and Kinzelbach (2007c)
Scomberomorus commerson Lacepède, 1800	E – 2003	AL	Est.	A	Ben Abdallah et al. (2003)
Stephanolepis diaspros Fraser-Brunner, 1940	E – 1965	AL	Est.	A	Zupanovic and EL-Buni (1982)
Parexocoetus mento Valenciennes, 1847	E – 1966	AL	Est.	E	Ben Tuvia (1966)
Sargocentron rubrum Forsskål, 1775	E – 1968	AL	Ques.	E	Stirn (1970)
Lagocephalus suezensis Clark & Gohar, 1953	E – 2009	AL	Est.	A	Kacem-Snoussi et al. (2009)
Lagocephalus sceleratus Gmelin, 1789	E – 2009	AL	Est.	A	Kacem-Snoussi et al. (2009)
Etrumeus golanii DiBattista, Randall & Bowen, 2012	W – 2017	AL	Est.	A	Shakman et al. (2017)
Torquigener flavimaculosus (Hardy & Randall, 1983)	E – 2017	AL	Cas.	E	Al-Mabruk et al. (2018)
Pterois miles (Bennett, 1828)	E – 2019	AL	Cas.	E	Al-Mabruk and Rizgalla (2019)

Source: (Makhlouf, 2019 – Bolayah and Michael, 2021).

1) Consumption and overuse

Due to the increasing population, most of whom are concentrated near the Libyan coast, there has been an excessive and unplanned exploitation of available natural resources, accompanied by weak technologies and lenient application of regulations and laws, resulting in numerous environmental challenges and issues. In the desert and oasis areas, water misuse and rapid loss occur due to surface irrigation practices in agriculture, leading to soil salinization as a result of waterlogging, causing the gypsum (calcium and sulfur) layer to fragment and resulting in soil structure collapse. This renders the land barren and susceptible to sand encroachment, leading to sand dunes reaching cities and oases. Additionally, overgrazing and converting grazing lands into seasonal rain-fed agricultural lands further exacerbate the soil degradation in these areas.

Water erosion occurs as rainwater and runoff from highlands flow into limited-space valleys with steep slopes towards low-lying coastal areas, causing floods. Most of this water is lost to the sea or valley floors after stripping the soil of organic matter and nutrients during its movement. This process is exacerbated by the scarcity of vegetation cover and overgrazing in these areas. The main factors contributing to land degradation in desert areas are overgrazing and varying degrees of vegetation cover erosion due to increased grazing pressure and livestock numbers. Additionally, large areas of natural grazing lands are converted into rain-fed agriculture, leading to soil degradation due to the loss of natural vegetation cover. This results in the migration of Bedouins and inhabitants to large cities in search of other job opportunities, creating an economic burden.

Urban expansion along the coasts has destroyed most of the lands on the coastal strip, which had been cultivated with rainwater for many years. The expansion of coastal cities has also led to the loss of important coastal habitats that serve as homes for some fish, crustaceans, and marine grasses. This has resulted in the removal of dense vegetation cover along these coasts, thereby eliminating many dependent

living organisms and reducing biodiversity in these areas, negatively impacting eco-tourism.

Chapter III: National Biodiversity Strategy and Action Plan

I. Introduction

Libya signed the United Nations Convention on Biological Diversity in 1992 and ratified it under Law No. 11 of 2001. The convention emphasizes the importance of national-level efforts in conserving, protecting, and sustainably using biodiversity. Article 6 of the convention obliges the parties to develop national strategies or action plans for the conservation and sustainable use of biodiversity. Additionally, Article 26 requires parties to submit periodic national reports to the Conference of the Parties, detailing progress in implementing national biodiversity programs, strategies, and action plans, and the extent to which the convention's provisions are being applied at the national level.

Based on Law No. 7 of 1982 and the amended Law No. 15 of 2003 regarding the protection and improvement of the environment and its executive regulations, and considering the tasks and responsibilities assigned to the Ministry of Environment according to its establishment decision, the Ministry has recognized the importance of biodiversity conservation and the threats posed by various activities. These threats include vegetation degradation, sand encroachment, unplanned urban expansion, overfishing, misuse of pesticides, loss of local breeds, and the critical climatic conditions due to heat and drought. The shrinking natural habitats that provide food and shelter for wildlife further underscore the urgent need for ecosystem and species protection.

Consequently, the Ministry of Environment has taken on the responsibility of preparing the national biodiversity strategy and action plan. The ministry initiated the strategy development program by engaging with relevant Libyan institutions and stakeholders directly or indirectly related to biodiversity, inviting them to provide data and scientific studies. This collaborative approach established the framework for the strategy, enabling the formulation of the national action plan's content and objectives.

Through this strategy, the Ministry of Environment aims to raise societal awareness of the critical need for a sound scientific foundation for managing Libya's natural resources and using them sustainably within the framework of comprehensive development. This encompasses various sectors, including agriculture, industry, mining, tourism, and housing, ensuring these resources are preserved for future generations.

II. Guiding Principles

The National Biodiversity Action Plan adopts a framework that places Libyan citizen and biodiversity at the heart of the government's priorities as it moves forward in the development process of Libyan state, which is based on the principles of sustainable development as well as the post-2020 global biodiversity framework, as follows:

1) Equity:
   - Ensure social coherence and harmony through the impartial distribution of natural resources and provide different sectors of society with equal access to development opportunities and benefits today and in the future. No individual or social group should be denied access to natural resources, while ensuring equal rights and opportunities for men and women.

2) Solidarity and shared responsibility:
   - Recognize that sustainable development is a shared and inseparable collective responsibility that requires institutional structures based on a spirit of solidarity, convergence and cooperation among different stakeholders.
   - Recognize that because communities residing within or adjacent to a particular ecosystem will be the most accurate in feeling the positive and negative impacts of human activities on that ecosystem, they must be empowered to access and control shared natural resources, such as water and ecosystem services.
   - The protection of natural resources is a shared and indivisible responsibility of all individuals, families, communities and other institutions in Libyan society.
   - Follow up on the conservation and promotion of biodiversity through the direct engagement of local communities and indigenous peoples and expand support for institutional initiatives, including the coordination of national and local biodiversity policies, legislation and programs.

3) Environmental Safety:
   - Recognize nature as our common heritage, thus respecting the limited carrying capacity of its ecosystems, and mainstreaming the integrity of

nature in the development process to ensure the right of present and future generations to this heritage.

- The continued degradation of natural resources and ecosystems and their resilience should not be allowed, but should be preserved, protected and mainstreamed into the development processes of different sectors.
- Libya has rich vital resources and many of them are now threatened, and some are already extinct. The future development of the country must therefore be a sign of the intrinsic value of landscapes, highlands, ecosystems, habitats, populations, species and genes.

4) Environmental Knowledge and Technology:
    - The biological boundaries of ecosystems are subject to continuous scientific research, recognizing them as one of the main foundations and indicators of strategic policy decision-making on the societal use of the natural resources of Libyan state.
    - Conduct periodic reviews of the assessment, prepare proposals for appropriate modification of the strategy, and the strict application of environmental laws by communities and government institutions.

5) Spiritual values:
   - Islam directs us to look for plants, animals and other creatures that live with us and to consider them as living communities, just like humans. Allah created the earth and all living things on it in the appropriate standard proportions, so the protection, preservation and development of the environment and natural resources is a mandatory religious duty that everyone must avoid any deliberate damage to the environment and natural resources while stopping any form of corruption towards the environment, which belongs to all, in accordance with what the religion of Islam directs us to do by all individuals, at all levels, to protect, preserve and use the environment and natural resources in a sustainable manner.

   - Sustainable use of natural resources: --Protect biodiversity resources from the risk of degradation or loss through the establishment and improvement of natural protected area networks, conducting scientific research and studies, and adopting basic monitoring and assessment measures.
   - Ensure the sustainable management and use of nature protected areas and promote biodiversity conservation.
   - Preserving natural values and minimizing negative environmental impacts on nature reserves.
   - Ensure that each reserve is appropriately managed to improve income generation without compromising the natural values for which it was protected, and this income is used for the improvement and development of other parks.
   - Promote the conservation and sustainable use of wild resources outside national protected areas in consultation and, where possible, in collaboration with rural communities and user groups.

III. Key Considerations

The current strategy represents an ethical commitment made by the present generation to their children and grandchildren to conserve and protect the environment and all its components. The strategy's features for future years include:

1) Scientific management and proper planning of natural resources to ensure the continuation of the ecological balance and the preservation of

ecosystems from degradation and their living organisms from decline and extinction:

- Ensure the preservation of environmental processes (soil fertility - availability of water - the ability of the ecosystem to recycle nutrients and analyze excess substances) in addition to the ability of living organisms to perform their natural role.
- Preserving the biological wealth represented in all forms of life in the environment, including plants and animals at all taxonomic levels, believing in the importance of each of them because they were not created in vain, while following up on modern developments and applications such as genetic engineering without harming the endemic species of the state.
- The exploitation of plant and animal wealth should be within the limits of the species' ability to reproduce and compensate, so that the matter does not reach the stage of depletion and severe degradation that eventually leads to extinction and the difficulty and high costs of resettlement.

2) **Developing local scientific capacities in the fields of nature protection and biodiversity and developing a program for research and studies in this field:**

- National institutions, such as research centers, scientific and executive bodies, universities, specialized institutes and other national expertise houses, have a key role in the success of research programs, scientific studies, monitoring and observing programs for various environmental phenomena related directly or indirectly to biodiversity, human development and building specialized national human beings, in addition to providing the necessary facilities such as scientific laboratories, renewable data and other research supplies to serve as the scientific guarantee for the advancement of this important sector in Libya.
- The development of a national program that identifies future priorities after studying and reviewing the available information on the biodiversity situation in Libyabeing one of the most important objectives of this strategy to reach the building of a national database on the elements of biodiversity and to be among the developed countries in this field to preserve the existing and reintroduce and resettle the extinct plant and animal species.

- All this requires the provision of studied budgets, the amendment of some legislation and greater coordination between the various institutions and bodies related to this subject.

3) Formation of a National Committee for the Protection of Biodiversity:

- The success of any national action plan depends mainly on the participation of all relevant authorities, bodies and individuals in its implementation and follow-up of its results, and therefore these authorities are committed to what they approved in the implementation phase later, and this of course will need the efforts of experts and the efforts of the Ministry of Environment as well as other relevant bodies and institutions through all media in highlighting the urgency and the and significance of this project, without ignoring the essential role that must be played by NGOs working in the field of the environment and all the various media and educational institutions, to form a broadly representative national committee from all these bodies to follow up the implementation of the national strategy for biodiversity.

4) Developing environmental legislation in the field of biodiversity and providing economic and social incentives to support the implementation of the national strategy for the protection of biodiversity:

- The legislative authority has issued many decisions and laws related to the protection of the environment in general and biodiversity and its elements in particular, including Law No. 15 of 2003 on the protection of the environment, which included chapters on the protection of wildlife, vegetation and the marine environment, as well as its executive regulations that explained the spirit of this law, in addition to Law No. 14 of 1989 on the regulation of the exploitation of marine wealth. Law No. 5 of 1982 on the protection of rangelands and forests and the decision of the People's Committee for Agrarian Reclamation and Land Reconstruction No. 3 of 1984 on measures necessary for the protection of pastures and forests, as well as laws and decisions in the field of agriculture, pastures, green areas, reserves and national parks. However, these laws and regulations need to be developed and amended to suit the developments that occur in this field, along with determining the responsibility for the application of these laws and the penalties imposed when violating them. These points need to be taken into consideration and appropriate decisions need to be issued .
- As for economic incentives, the strategy for the conservation of biodiversity will be implemented by a large number of national

institutions and bodies, hence incentives, rewards and honoring those who excel in work will increase the demand of people in these various bodies to work hard and participate actively in the implementation of the work program of the strategy in its various stages.

5) Integrating National Efforts with Regional and International Efforts in Biodiversity Conservation:

- The Ministry of Environment has developed the draft of this strategy as a national commitment to the provisions of the International Convention on Biological Diversity, which was signed by Libya at the Earth Summit held in Rio de Janeiro in 1992, and this national commitment is a regional commitment and by virtue of the strategic geographical location of Libya and its location in Africa, and this commitment extends to the global level by virtue of signing and ratifying many international conventions and protocols in the field of conservation. The regional and international cooperation framed by these agreements provides a great field for cooperation, exchange of information and benefit from training programs in the field of building national capacities to be qualified to implement programs to preserve biodiversity and the environment in general.

6) Current Capacities and Institutions for Biodiversity Management:

- Many institutions and agencies interested in managing biodiversity from regulatory and research bodies, including the Ministry of Water Resources and the Ministry of Agriculture through their competent departments and research centers affiliated to the Agricultural Research Center, the Marine Biology Research Center, the Livestock Research and Studies Center and others, as well as the National Authority for Scientific Research and through the research centers that follow it, such as the Biotechnology Research Center and others, and these institutions include many researchers and workers in related fields. However, these institutions and centers lack precise scientific disciplines in the various fields of biodiversity, and therefore institutions need to build the capacity of their employees in various fields of biodiversity, considering that these sciences are new interests that have begun to receive attention, whether at the global or national level.
- It is worth noting that many university colleges, higher institutes and other relevant educational institutions seek to integrate the environmental dimension into their curricula, focusing especially on

issues related to biodiversity conservation, natural resource management and biosafety, but we find that these curricula are still below the required level.

- At the level of civil work, there are a small number of NGOs interested in biodiversity, and these associations are predominantly specialized in nature, such as the protection of wildlife and the protection of trees, and they still have not worked effectively to ensure the effective participation of all segments of society.
- At the level of raising environmental awareness, the Ministry of Environment assigns priority to the issue of spreading culture and environmental awareness on the list of its concerns, including the issue of preserving natural resources and protecting them from degradation and depletion, through the issuance of a magazine concerned with environmental affairs and the allocation of an environmental program in the audio-visual radio broadcasted weekly. Some other parties participate in such awareness campaigns through their audio, visual or written programs supervised and supported by environmental NGOs.

IV. Vision & Mission

1) Vision

"By 2030, biodiversity in Libya will be assessed and urgent and innovative measures along with actions will be taken across Libyan society to conserve and sustainably use biodiversity and ensure the fair and equitable sharing of benefits arising from the utilization of genetic resources, for the sustainable use of present and future generations."

2) Mission

"By 2030, Libya will undertake effective and innovative actions to reduce biodiversity loss to ensure that ecosystems continue to serve all Libyans as well as ensure that pressures on biodiversity are reduced, with the sustainable use of biological resources and the sharing of benefits arising from the use of genetic resources in a fair and equitable manner, and work to effectively mainstream biodiversity issues, appropriate values and policies through a participatory approach with all."

V. National Biodiversity Action Plan " Alignment with the Kunming Montreal Global Biodiversity Framework"

The natural resources of Libya are undoubtedly the core of the national economy. The depletion or degradation of these resources represents not only a loss of national capital but also undermines the sustainability of the economy. During the process of preparing the strategy and national biodiversity action plan, several environmental issues of national interest were identified and analyzed to determine their priority and inclusion in the action plan. This section describes the priority actions for implementing the strategy. Given the large number of issues included in the strategy, a set of criteria was established to prioritize actions and projects contributing to the implementation of the current strategy, which are:

I. Geographic impact: Actions that have the potential to have a cross-cutting geographical impact at the national level and are more urgent than actions with a local impact (municipal level).

II. Alignment with the objectives of the three Rio conventions: Actions related to the implementation of the Rio conventions that indirectly affect biodiversity are less important than actions that directly affect biodiversity.

III. Priority: Action is the most important priority when addressing highly degraded ecosystems, and where a large number of people or resources are under immediate threats or risks.

IV. Sequence: Actions/projects/programs are arranged in chronological sequence when one action/project output/program output is the starting point or prerequisite for performing another action. According to this standard, actions/projects/ programs that address gaps in data, policies and legislation are identified prior to the implementation of forest protection programs, prior to rehabilitation programs.

V. Alignment with National Conditions: Projects that preserve the overall interest of the state and fall within the priorities of the government are more applicable than projects of a purely global nature. Such projects are politically supported by the government and have many opportunities for funding from national sources, including government, NGOs, the private sector and local communities.

VI. Multifaceted and multi-impact: Particular priority is given to actions/projects/ programs that seek to address the issues of negative impacts on biodiversity, climate, freshwater and desertification, e.g. actions for the rehabilitation of natural resources and ecosystems, the establishment of protected areas and sustainable environmental practices in development sectors, examples of this type of multi-impact action.

VII. Achievability and Availability of Financial Resources: Projects with clearly defined objectives and adequately funded activities supported by an intersectoral and comprehensive management mechanism are sure to be more successful in achieving their planned outputs in an effective and successful manner.

1) National Strategic Targets and Objectives

The strategy includes three strategic axes and twenty strategic objectives that have been prepared to comply with the post-2020 global biodiversity framework, so that no update of the strategy will be carried out after the adoption of the global framework by the end of 2022, as follows:

I. First Theme: Reducing Biodiversity Loss

- **Target 1:** By 2027, integrated spatial planning for biodiversity (terrestrial and marine) is integrated into national efforts to regulate the use of state land and territorial waters to ensure the retention of existing healthy land and marine areas.

- **Target 2**: By 2030, a full assessment of the state of Libya's ecosystems (terrestrial, marine , and freshwater) is carried out, and 20% of degraded ecosystems are restored.

- **Target 3:** By 2030, expand the existing network of national protected areas to cover 30% of Libyan territory, focusing on areas important for biodiversity at the national level, and implement mechanisms and procedures to ensure that the network of national protected areas (terrestrial and marine) is effectively managed, linked with areas with other effective conservation measures, and mainstreamed into the wider terrestrial and seascape.

- **Target 4**: By 2030, develop and implement actions to manage and conserve the biodiversity of wild species, especially endemic, endangered and migratory species, within and outside the network of national reserves, and work to restore degraded species through sectoral or site-related plans.

- **Target 5:** By 2030, an effective and universally recognized national framework for harvesting, sustainable use and trade in wild species to ensure human health is identified and implemented.

- **Target 6:** By 2030, inventory, identify and implement national mechanisms and actions aimed at reducing the rate of introduction of alien and invasive species into the country by 50%, with the implementation of national programs to monitor and manage the spread pathways of these species that work to combat and eliminate them with a focus on priority species within the network of protected areas.

- **Target 7:** By 2030, update existing mechanisms and programs and implement innovative new measures to reduce pollution (terrestrial – marine) from all sources, with the aim of reducing environmental pollution with organic nutrients to 50%, pesticides by 60%, and completely eliminating the dumping of plastic waste into terrestrial and marine environments.

- **Target 8:** By 2030, reduce the impacts of climate change on biodiversity by 25%, through the implementation of programs and projects that apply nature-based solutions and contribute to mitigating and adapting to the negative impacts of climate change on biodiversity.

II. Second Theme: Sustainable Use of Biodiversity

- **Target 9:** By 2030, sustainable management of terrestrial (terrestrial-marine-aquatic) species to achieve food security and livelihoods for people, especially communities and the poorest.

- **Target 10:** By 2030, develop and implement national actions and programs aimed at achieving sustainable farming methods for 40% for existing agricultural and forested areas, as well as implementing sustainable aquaculture methods for 50%, in order to support their resilience to the impacts of climate change.

- **Target 11**: By 2030, identify and implement plans and tools aimed at protecting air and water quality, with rapid response programs to disaster risks and natural phenomena.

- **Target 12:** By 2030, mainstream the principles of sustainable urban planning into national urban expansion plans, with the aim of achieving human health and the environment, especially in densely populated areas.

- **Target 13:** By 2030, update existing procedures and national legislation to ensure the effective operation of the Biosafety Protocol (Cartagena Protocol) and the Protocol on the Equitable Sharing of Benefits Arising from Genetic Resources (Nagoya Protocol) (under consideration for signature), as well as the documentation of traditional knowledge on the uses of natural and genetic resources.

III. Third Theme: Implementing, Mainstreaming, and Evaluating the Strategy

- **Target 14:** By 2030, biodiversity values are identified and mainstreamed into sectoral policies and national planning processes, ensuring that environmental impact assessments (strategic, site-level) are applied to all development projects (governmental, private).

- **Target 15:** By 2030, develop and implement national plans and programs for the sustainable production and use of natural resources and ecosystem services targeted by development projects, with effective follow-up mechanisms to ensure that the negative impacts of such projects on biodiversity are minimized.

- **Target 16:** By 2030, national, sectoral and local programs to raise public awareness regarding biodiversity conservation and 50% reduction in food and non-food waste are planned and implemented to change public behavior regarding excessive consumption of natural resources and food, linking all of this to national poverty reduction efforts.

- **Target 17:** By 2030, national, sectoral and local capacity-building programs for technology transfer and scientific research are developed and implemented, focusing on the negative impacts of biotechnology on biodiversity and human health, as well as how to control and reduce those impacts.

- **Target 18:** By 2030, formulate and implement a national strategy to redirect (especially the most harmful incentives) incentives harmful to biodiversity, and convert 50% of those harmful incentives to incentives with a positive or neutral impact on biodiversity.

- **Target 19:** By 2030, develop and implement a national strategy for resource mobilization and regulation of financial flows aimed at effective national financial planning for biodiversity conservation efforts.

- **Target 20:** By 2030, ensure equitable and effective participation in biodiversity decision-making by communities and the most vulnerable, as well as women, girls and youth.

2) National priorities linked to strategic targets and objectives

I. First Theme: Reducing Biodiversity Loss

Target 1: By 2027, integrated spatial planning for biodiversity (terrestrial and marine) is integrated into national efforts to regulate the use of state land and territorial waters to ensure the retention of existing healthy land and marine areas.	
National priorities:	**Timelines for implementation**
1) Establish a National Committee on Climate Change and Biodiversity to ensure synergy between national efforts to mitigate the impacts of climate change and protect biodiversity.	2023
2) Establishing a joint unit between the Ministries of Planning and Environment specialized in spatial planning and remote sensing, whose objective is to put all available data on development projects i 3) n the country as well as data related to biodiversity on digital Maps and analyze that data to support the decision-making process at the national level.	2023
4) Identification of terrestrial (terrestrial, marine and aquatic) sites important for biodiversity conservation.	2025
5) Preparing a Map of the uses of state lands and for development and urban projects, while determining their proximity to areas important for terrestrial and marine biodiversity.	2026
6) Prepare a country Map identifying key ecosystems and habitats at the national level.	2027
Indicators: 1) Number of land-important biodiversity sites signaled on digital Maps annually. 2) Number of ecosystems and major habitats signaled on digital Maps annually.	

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
Ministry of Planning – Ministry of Environment	2027	$2.5 Million

Target 2: By 2030, a full assessment of the state of Libya's ecosystems (terrestrial, marine , and freshwater) is carried out, and 20% of degraded ecosystems are restored.	
National priorities:	**Timeline**
1) Implementation of national surveys and programs to monitor and assess the status of biodiversity components at the national level: a. A program to assess the state of terrestrial ecosystems b. Program to assess the state of marine ecosystems	2025 2025
2) Identify environmentally degraded land (land, marine and water) sites that need rehabilitation programs.	2025
3) Implementation of a program for the restoration of terrestrial ecosystems	2030
4) Implementation of a program for the restoration of marine ecosystems	2030
5) Implementation of a wetland ecosystem restoration program	2030
Indicators: 1) Number of terrestrial and marine ecosystems assessed at the national level annually. 2) Number of terrestrial and marine ecosystems whose efficiency and natural balance have been restored annually.	

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
Ministry of Environment – Ministry of Agriculture – Ministry of Planning – General Authority for Scientific Research	2030	USD 40 million

Target 3: By 2030, expand the existing network of national protected areas to cover 30% of Libyan territory, focusing on areas important for biodiversity at the national level, and implement mechanisms and procedures to ensure the effective management of the network of national protected areas (terrestrial and marine), linking them with areas that apply other effective conservation measures, and mainstreaming them into the wider terrestrial and seascapes.	
National priorities:	**Timeline**

1) Issuing and implementing a new law on reserves that clarifies their dependency, mechanisms for declaring and managing them, and setting strict penalties to reduce encroachments on the protected area.	2023
2) Preparation and implementation of a national strategy for the network of national protected areas (terrestrial - marine)	2024
3) Conduct a national survey to identify sites that comply with the standards of other effective conservation measures.	2024
4) Develop and activate a national program to evaluate the effectiveness of the management of declared reserves (evaluation at the level of the network of reserves - evaluation at the level of reserves).	2024
5) Prepare and implement management plans for the existing network of protected areas (15 reserves) in accordance with international standards.	2025
6) Declaration of new protected areas (terrestrial and marine) to increase the representation of ecosystems in the network of national reserves.	2030
7) Developing the infrastructure of current and future reserves, managing and operating them to receive visitors and facilitate conservation efforts in those reserves.	2030
8) Develop an effective national mechanism to update data on the network of national protected areas and the network of other conservation sites and the results of the effectiveness assessments of protected areas management, to report and update national data in international databases of protected areas.	2030

Indicators:

1) The area declared as nature reserves and its percentage compared to the area of the country annually
2) The area declared as sites applying other effective conservation measures and its percentage compared to the country area per year.
3) Number of protected areas with approved and applied management plans annually
4) Number of protected areas whose infrastructure has been developed annually
5) Number of protected areas whose management effectiveness has been evaluated annually.

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Environment	2030	USD 20 million

Target 4: By 2030, develop and implement actions to manage and conserve the biodiversity of wild species, especially endemic, endangered and migratory species, within and outside the network of national reserves, and work to restore degraded species through sectoral or site-related plans.	
National priorities:	**Timeline**
1) Preparation and dissemination of the Red List on the status of endemic species at the national level, according to the standards of the International Union for Conservation of Nature (IUCN).	2025
2) Preparation and dissemination of the Red List on the Status of Plant Species at the national level, in accordance with the standards of the International Union for Conservation of Nature (IUCN).	2027
3)Preparation and publication of the Red List on the status of animal species at the national level, in accordance with the standards of the International Union for Conservation of Nature (IUCN).	2028
4) Develop and implement conservation plans for endemic and endangered species within the network of national reserves.	2030
5)Develop and implement national programs for the restoration of endemic and endangered species within the network of national reserves.	2030
6) Develop and implement sectoral programs to implement effective protection activities for endemic and endangered species outside the network of protected areas.	2030
7) Establishment of a gene bank for the conservation of genetic origins, genetic Maps and digital-genomic sequencing of wild species (plant and animal).	2030

Indicators:

1) The number of wild species (plant and animal) evaluated and published annually in accordance with IUCN international standards.
2) The Number of species management plans prepared and implemented annually.
3) The Number of wild species (plant and animal) whose genetic Maps and genetic sequences have been preserved in national genebanks.

Responsibility for implementation	Timeframe		Implementation cost(USD)
Ministry of Environment – Universities and Research Centers	2030		USD25

Target 5: By 2030, an effective and universally recognized national framework for harvesting, sustainable use and trade in wild species to ensure human health is identified and implemented.	
National priorities:	**Timeline**
1) Preparation and implementation of a national strategy to regulate the hunting, sustainable use and trade in wild species (plant and animal).	2024
2) Develop guidelines that distinguish between hunter-tolerant and non-hunt-tolerant wildlife species to identify species that can be sustainably hunted.	2024
3) Enhance cooperation and coordination between those responsible for enforcing wildlife trade laws, and enable them to effectively enforce national legislation against cases of poaching and trafficking of wild species.	2030
4) Building the special capacity of workers responsible for enforcing wildlife trade laws, especially regarding environmental laws and policies, in order to increase their awareness and capacity in addressing illegal wildlife crime.	2030
5) Design and implement a national program to monitor and track the impacts of hunting wild species and wild plant aggregation, and assess the effectiveness and impacts of implementing policies that limit hunting and overharvesting of wild species.	2030
Indicators: 1) Number of wild species (plant and animal) for which harvest and/or hunting values (quota) have been determined annually. 2) Number of employees from the concerned authorities who receive training to build their capacity annually. 3) Number of annual cases and judgments carried out against hunting and illegal trade in wild species (flora and fauna).	

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Environment – Ministry of Agriculture	2030	USD 5 million

Target 6: By 2030, inventory, identify and implement national mechanisms and actions aimed at reducing the rate of introduction of alien and invasive species into the country by 50%, with the implementation of national programs to monitor and manage the spread of these species that work to combat and eliminate them, with a focus on priority species within the network of reserves.	
National priorities:	**Timeline**
1) Preparation and implementation of a national strategy for the control of alien and invasive species, with a focus on the following aspects of such a document: a. Determine a national list of terrestrial, marine and aquatic alien and invasive species (plants - invertebrates - vertebrates - microorganisms) at the national level, as well as determine their entry and spread paths and distribution on digital Maps. b. Identify current and future hazards caused by these species, with a focus on the environmental losses they cause.	2024
2) Assess the ecological thresholds of alien and invasive species, as well as determine the magnitude of the changes they cause (positive - negative).	2025
3) Identify and monitor the direct and indirect drivers responsible for increasing the number and effects of invasive alien species, focusing on the following topics: a. Movement of goods and other materials by sea, air and land. b. Trade and agricultural policies.	2025
4) Conduct a national-level assessment to determine the environmental, economic and social costs of invasive alien species, with particular emphasis on their impact on biodiversity and ecosystem services, and cultural, social, shared, recreational, scientific, spiritual, aesthetic and health values.	2027
5) Establish a national program that provides early warning systems for invasive alien species, as well as develop and	2030

implement national rapid response mechanisms to prevent, eradicate and combat their spread in order to conserve biodiversity, linking all of this to the impacts of climate change.	
6) Establishing a specialized unit specialized in the management of alien and invasive species at the Ministry of Environment to be responsible for implementing the previous procedures, as well as establishing and maintaining a database of alien and invasive species.	2030

Indicators:

1) Number of alien and invasive species registered on the National List of Alien and Invasive Species annually.
2) The number of alien and invasive species for which ecological thresholds have been determined annually.
3) Number of paths and drives (direct – indirect) of alien and invasive species, which are determined annually.
4) Number of alien and invasive species for which environmental, economic and social costs have been determined annually.
5) Number of early warnings and responses related to the control of alien and invasive species annually.

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Environment – Ministry of Agriculture	2030	USD 6 million

Target 7: By 2030, update existing mechanisms and programs and implement innovative new measures to reduce pollution (terrestrial-marine) from all sources, with the aim of reducing environmental pollution with organic nutrients to 50%, pesticides by 60%, and completely eliminating the dumping of plastic waste in terrestrial and marine environments.

National priorities:	Timeline
1) Conduct periodic national assessment of pollution within different ecosystems with a focus on the most fragile ecosystems.	2023
2) Develop standards to monitor pollution within the network of reserves and associated buffer zones.	2023
3) Update the national greenhouse gas inventory and take action to reduce greenhouse gas emissions.	2024
4) Update and enforce minimum national standards for soil, water, air quality as well as occupational health.	2030

5) Develop and implement a national capacity-building program related to research and development in pollution control.	2030
6) Implement national public awareness campaigns to raise public awareness regarding "reduce", "reuse" and "recycling", in order to reduce quantitative and qualitative sources of pollution.	2030

Indicators:

1) The number of sources of pollution that are recorded in different ecosystems (outside and within the network of reserves) annually.
2) Number of projects whose attributive emissions are inventoried annually.
3) Number of employees from the concerned authorities who receive training to build their capacity annually.
4) Number of individuals raised annually and implemented effective reuse and recycling activities.

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Environment – National Oil Corporation	2030	USD 8 million

Target 8: By 2030, reduce the impacts of climate change on biodiversity by 25%, through the implementation of programs and projects that apply the concepts of nature-based solutions, and contribute to mitigating and adapting to the negative effects of climate change on biodiversity.

National priorities:	Timeline
1) Conduct a national assessment to identify the most resilient and climate-resilient ecosystems, as well as to identify the most climate-resilient ecosystems.	2024
2) Conduct a national assessment to determine the genetic diversity of wild species (plant - animal) and economic species (crops - livestock - fisheries - poultry) that can withstand and adapt to the effects of climate change, and achieve maximum productivity, to protect them and ensure food security.	2024
3) Consider climate change impacts on biodiversity and ecosystem services in relevant sectoral policies regarding possible mitigation and adaptation options and review agricultural expansion programs to take into account the potential for land degradation in climate-change-affected areas.	2024
4) Capacity building and raising the community awareness of climate change impacts on biodiversity and nature-based solutions at different levels.	2025

5) Preparing and implementing projects to protect ecosystems by increasing their resilience to adapt to the effects of climate change and adopting nature-based climate solutions to protect fragile, rare and most affected environments.	2029
6) Develop systems, programs and policies to protect the rural community and support its ability to adapt to the expected trend in land use change, plant and animal production, and internal migration due to climate change.	2030
7) Adopt and dissemination educational modules that include curricula on the impact of climate change and adaptation options on biodiversity within educational institutions at diffrent levels.	2030

Indicators:

1) The number of ecosystems that are most resilient and adapted to the impacts of climate change and assessed annually.
2) Number of projects implemented annually to protect against the degradation of terrestrial and marine environments that apply the standards of nature-based solutions under the effects of climate change.
3) A percentage of the of employees in the various relevant departments may receive training in the field of climate change.
4) Number of relevant institutions that consider climate change policies and action plans.
5) Number of climate stations and early warning systems to monitor climate change that have been established.
6) Change in educational curricula that include options for solutions to the scope of climate change.

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
National Committee for Climate Change - National Center for Meteorology - Ministry of Education - Ministry of Higher Education - Ministry of Environment –Ministry of Agriculture- Libyan Center for Remote Sensing - Ministry of Marine Resources - Ministry of Planning - Universities - Research Centers	2030	USD 75 million

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II. Second Theme: Sustainable Use of Biodiversity

Target 9: By 2030, sustainable management of terrestrial (terrestrial-marine-aquatic) species to achieve food security and livelihoods for people, especially communities and the poorest.	
National priorities:	**Timeline**
1) Develop and implement a national program to monitor, assess the status and trends of pollinators and manage them sustainably to support agricultural development, especially in the poorest areas.	2030
2) Develop and implement a national program to monitor and evaluate soil safety and implement actions to restore degraded soil types in support of food security.	2030
Indicators: 1) Number of annual programs implemented to protect natural pollinators. 2) Number of annual programs implemented to restore soil integrity.	

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
Ministry of Agriculture – Ministry of Environment – Universities – Research Centers	2030	USD 4 million

Target 10: By 2030, develop and implement national actions and programs aimed at achieving sustainable farming methods for 40% for existing agricultural and forestry areas, as well as applying sustainable aquaculture methods for 50%, in order to support their resilience to the effects of climate change.	
National priorities:	Timeline
1) Develop and implement a national program for the digitization, inventory, Mapping and documentation of forest status and trends, identify the underlying causes of deforestation and forest degradation, and analyze the environmental dimensions of those forests including their impacts on climate and climate change.	2030
2) Develop and promote methodologies and guidelines on the best sustainable use of forests and methods of harvesting, processing, trade and marketing related to wood and non-wood products and bioenergy.	2030
3) Develop and implement sectoral mechanisms for the conservation of agricultural biodiversity, aimed at improving the	2030

capacity to restore and conserve agricultural biodiversity and fisheries.	
4) Establishment of a database on agricultural biodiversity and fisheries and the Red List of Economic Plants and Domesticated Animals.	2030
5) Develop and implement a national research program for the conservation of wild relatives of local agricultural species and varieties.	2030
6) Develop and implement a sectoral plan for the use of solar energy in the agricultural sector.	2030

Indicators:

1) Number of partners involved in forest assessments per year.
2) Number of entities using and applying guidelines for sustainable forest use per year.
3) Number of agricultural areas and aquaculture sites that apply international standards for sustainable management annually.
4) Number of annual research and studies issued by wild relatives of local agricultural species and varieties, and methods of conservation

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Agriculture – Ministry of Water Resources – Universities – Research Centers	2030	USD 15 million

Target 11: By 2030, identify and implement plans and tools to protect air and water quality, with rapid response programs to disaster risks and natural phenomena.

National priorities:	Timeline
1) Develop and implement a national strategy for the transition towards renewable energy through the establishment of solar power plants and wind farms.	2030
2) Expanding the establishment of stations for real-time monitoring of air and water quality at the national level.	2030
3) Develop and implement a sectoral plan to develop the transport sector by enhancing mass transportation and improving fuel quality.	2030

4) Develop and adopt guidelines to reduce emissions from power and water plants and provide incentives for more effective measures in the industrial sector.	2030
5) Develop and implement a sectoral plan to expand park and garden sites, establish green belts and increase green spaces, to improve air quality.	2030
6) Develop and implement a general national plan to diversify water resources sources and prioritize their use, and take action to monitor the extraction of groundwater resources and reduce their overuse.	2030
7) Develop and implement a sectoral plan to improve wastewater and greywater treatment and promote their reuse in the forest sector for timber production.	2030
8) Preparing and promoting guidelines to reduce water demand in the agricultural sector through sound food safety management , crop composition improvement and infrastructure development to ensure efficient irrigation.	2030

Indicators:

1) Number of solar power plants and wind farms constructed and operated annually.
2) Number of real-time monitoring stations to monitor air and water quality, which are installed and operated annually.
3) Number of power production and water desalination plants that pursue policies to reduce emissions in accordance with environmental standards approved annually.
4) Number of sewage treatment plants that apply tertiary treatment and use their treated water to increase the area of forests and tree belts annually.

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Environment - Ministry of Transportation - Ministry of Agriculture - Ministry of Electricity - Ministry of Water Resources - Universities	2030	USD 150 million

Target 12: By 2030, mainstream the principles of sustainable urban planning into national urban expansion plans, with the aim of achieving human health and the environment, especially in densely populated areas.

National priorities:	Timeline
1) Conduct a comprehensive national survey to assess cities for a deeper understanding of the natural environment, land tenure, housing, basic services, and socio-economic data, linking all of this to the environmental situation of those cities and urban areas.	2025
2) Updating the legislative and governance frameworks for urban planning in order to develop a robust context for participatory urban planning and approaches based on resilience and climate change adaptation.	2025
3) Develop and implement urban planning plans for major cities to prevent the aggravation of spatial spaces, urban sprawl, informal settlements and environmental degradation.	2025
4) Preparing and providing guidelines on the construction of energy- and resource-saving buildings, standards for green and environmentally friendly buildings.	2026
5) Develop a national program for capacity building, information exchange and advice to local authorities and relevant stakeholders to develop, rehabilitate and improve inclusive and safe public spaces.	2030
6) Design and implement sectoral strategies to achieve (1) municipal waste management and energy generation from organic waste; (2) wastewater treatment and reuse to increase urban green areas; (3) sustainable urban transport; and (4) emission reduction.	2030

Indicators:

1) Number of cities that have undergone annual assessments related to their urban sprawl.
2) Number of cities with sustainable urban planning plans prepared in accordance with the International Urban Agenda.

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
Ministry of Environment – Ministry of Transportation – Ministry of Agriculture – Ministry of Electricity – Ministry of Water Resources – Universities	2030	USD 20 million

Target 13: By 2030, update existing procedures and national legislation to ensure the effective operation of the Biosafety Protocol (Cartagena Protocol) and the Protocol on the Equitable Sharing of Benefits Arising from Genetic Resources (Nagoya Protocol), as well as the documentation of traditional knowledge on the uses of natural and genetic resources.	
National priorities:	Timeline
1) Establishing and operating a national committee called the "National Biosafety Committee for Genetic Mutation Products", which works to develop national methodologies for tracking genetically modified products in line with scientific progress in this field, and also determine the fees and costs necessary to obtain NOCs for the use of genetic mutation products.	2030
2) Establishing a national register for the registration of reference laboratories in the fields of biosafety studies in biotechnology, and the registration of licenses granted by the National Committee for Intentional Release into the Environment.	2030
3) Establish and operate a national committee to "regulate access to and subsequently access to relevant biological resources and heritage knowledge" and to share the benefits arising from their use.	2030
4) Develop national mechanisms and databases aimed at: • Documenting and following up on requests for access to biological resources and heritage knowledge. • Concluding agreements to activate fair and equitable benefit-sharing, including preserving the rights of the state and the communities concerned to share benefits, determining the duration of these agreements and adhering to them. • Establish and maintain an inventory of national biodiversity and publicly available traditional knowledge, without prejudice to intellectual property rights.	2030
Indicators: 1) Number of licenses granted annually for the use of genetic mutation products. 2) Number of licenses granted annually for access to biological resources and heritage knowledge.	

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**

Ministry of Environment - Ministry of Agriculture - Universities - Research Centers	2030	USD 8 million

III. Third Theme: Strategy Implementation, Dissemination and Evaluation

Target 14: By 2030, biodiversity values are identified and mainstreamed into sectoral policies and national planning processes, ensuring that environmental impact assessments (strategic, site-level) are applied to all development projects (governmental and private).	
National priorities:	Timeline
1) Conducting an economic assessment at the national level of the values provided by the country's ecosystems in accordance with the international assessment standards for the economics of ecosystems and biodiversity.	2025
2) Develop and update guidelines on how to conduct environmental impact assessment studies (strategic – at the project level).	2024
3) Preparation and implementation of projects (national/sectoral) aimed at integrating the concepts and values of biodiversity in the following sectors: (1) oil and gas; (2) mining; (3) agriculture; (4) infrastructure; (5) fisheries and fish farming; (6) tourism; and (7) transportation.	2030
Indicators: 1) Number of ecosystems for which annual economic assessments have been conducted. 2) Number of sectors in which biodiversity concepts and values have been integrated into their development plans annually.	

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
Ministry of Environment – Universities – Research Centers	2030	USD 4 million

Target 15: By 2030, develop and implement national plans and programs for the sustainable production and use of natural resources and ecosystem services targeted by development projects, with effective follow-up mechanisms to ensure that the negative impacts of such projects on biodiversity are minimized.	
National priorities:	Timeline
1) Conduct a review of existing laws and regulations as well as market incentives, assess their impact on sustainable consumption and production and introduce a range of regulatory reforms supported by incentive measures that can promote sustainable consumption and production across sectors.	2024
2) Develop and implement a national program to integrate sustainable consumption and production considerations into strategies, action plans and sectoral programs.	2030
3) Develop and implement legislation for government bodies to ensure the procurement of equipment, supplies and services produced in an environmentally sustainable manner.	2030
4) Launch a public awareness campaign using traditional and modern media, to raise public awareness about the importance and benefits of adopting a sustainable consumption and production approach.	2030
5) Develop and implement a long-term national research strategy for research and development (R&D) to support the transition to a green economy and sustainable consumption and production across sectors.	2030
6) Develop and implement a capacity-building program to enhance consumption and productivity in different sectors.	2030
7) Include the concepts of sustainable consumption and production and green economy in the educational curricula of different disciplines and consider awarding academic degrees in this field.	2030
8) Directing financial institutions to finance projects and investments, especially by SMEs in the field of sustainable consumption and production and green economy, while implementing trade policies that encourage the import and export of environmentally friendly technologies and equipment.	2030
Indicators: 1) Number of sectors carrying out activities that integrate the concepts of sustainable consumption and production annually. 2) Number of research and programs implementing mechanisms for sustainable consumption and production annually.	

3) A number of individuals and institutions whose capacity for sustainable consumption and production has been built annually. 4) The number of educational and academic curricula that are designed to incorporate the concepts of sustainable consumption and production annually.		
Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**
Ministry of Planning – National Oil Corporation – Ministry of Agriculture – Ministry of Water Resources – Ministry of Tourism – Ministry of Finance – Ministry of Environment – General Authority for Scientific Research – Universities – Research Centers	2030	USD 35 million

Target 16: By 2030, national, sectoral and local programs to increase environmental awareness in relation to biodiversity conservation and reduce food and non-food waste by 50%, to change public behavior regarding excessive consumption of natural resources and food, are planned and implemented, linking all of this to national poverty reduction efforts.	
National priorities:	Timeline
1) Preparing a national strategy for awareness, education and education regarding biodiversity, which includes an assessment of the target groups and activities that achieve desired changes in public behavior, and a list of awareness tools and programs targeted for implementation.	2024
2) Develop materials on awareness-raising and training using a package of awareness tools and methods of implementation.	2024
3) Implement awareness-raising activities for target groups, with the distribution and dissemination of public awareness-raising and capacity-building materials.	2030
Indicators: 1) Number of awareness materials developed and implemented on biodiversity annually. 2) Number of activities and events carried out regarding biodiversity annually.	

Responsibility for implementation	**Timeframe**	**Implementation costs (USD)**

Ministry of Environment – Ministry of Education – Universities – Civil Society	2030	USD 5 million

Target 17: By 2030, develop and implement national, sectoral and local capacity-building programs with regard to technology transfer and scientific research, with a focus on the negative effects of biotechnology on biodiversity and human health , as well as how to control and reduce those effects.	
:National priorities	Timeline
1) Modernizing the system of laws, legislation, and regulations governing the management of the scientific research process and its policies, supporting intellectual property issues and professional controls , and supporting investment in scientific research and linking it to industry, development plans, and . community needs	2024
2) Including scientific gaps related to biodiversity in research plans and studies of universities and research centers, especially those related to reducing pressures and threats to the components of .biological and genetic diversity	2030
3) Developing a national program to encourage external scholarships for graduates in cooperation with international universities and research centers in order to carry out research . and studies related to biodiversity	2030
4) Develop and implement a national competition to encourage . scientific research in the field of biodiversity	2030
:Indicators 1) Number of universities and research centers that carry out research and . studies related to biodiversity 2) The number of graduates who are sent on scholarship annually to carry out . studies with international universities in the field of biodiversity	

Implementation responsibility	**time frame**	**Implementation costs ($US)**
The General Authority for Scientific Research - Ministry of Environment Universities - Research centers -	2030	million US dollars 15

Target18: By 2030, formulate and implement a national strategy to redirect incentives that are harmful to biodiversity (especially the most	**:18**

harmful incentives), and transform 50% of those harmful incentives into incentives that have a positive or neutral impact on biodiversity.	
:National priorities	**Timeline**
1) Forming a national team of concerned parties to work on developing a national framework aimed at studying negative incentives and identifying methods that work to reduce the .negative effects of those incentives on biodiversity	2023
2) Conduct a comprehensive assessment to identify neutral incentives, positive incentives, and negative incentives .related to biodiversity at the national level	2024
3) Preparing and implementing a national strategy to redirect negative incentives for biodiversity to reduce their negative impact and transform them into neutral or even positive .incentives	2030
4) Preparing guidelines for all development sectors on how to transform negative incentives for biodiversity into neutral or .positive incentives	2030
5) Develop and implement a capacity-building plan regarding transforming negative incentives for biodiversity into neutral .or even positive incentives	2030
:Indicators 1) Number of negative and positive incentives for biodiversity that have .been evaluated annually 2) Number of guidelines prepared annually on transforming negative .incentives for biodiversity into neutral or positive incentives 3) Number of sectors that implement annual activities aimed at reducing . negative incentives for biodiversity	

Implementation costs (US$)	time frame	Implementation responsibility
million US dollars 9	2030	Ministry of Environment - Ministry of Planning - National Oil Corporation - Ministry - of Agriculture - Ministry of Water Resources Universities - Research Centers

Target 19: By 2030, develop and implement a national strategy for resource mobilization and regulation of financial flows aimed at effective national financial planning for biodiversity conservation efforts.	
National priorities:	Timeline
1) Evaluate government budgets and expenditure for all sectors related to biodiversity in order to determine the volume of spending (government - private sector) that causes negative damage to biodiversity and compare it with the volume of spending aimed at preserving biodiversity.	2023
2) Develop and update legislative or regulatory measures that support the alignment of financial flows (government – private sector) with biodiversity protection objectives.	2024
3) Develop and implement a strategy addressed to high-level decision makers of relevant stakeholders (e.g. Ministry of Finance, Ministry of Planning, etc.) in order to identify the feasibility and socio-economic benefits across different sectors of biodiversity investment.	2030
4) Increase public domestic spending related to biodiversity, while encouraging private sector investment in projects that contribute to the conservation and sustainable use of biodiversity.	2030
5) Promote and implement the conventions on access to genetic resources and the fair and equitable sharing of benefits arising out of their utilization for the conservation and sustainable use of biological diversity, in particular the Nagoya Protocol.	2030
Indicators: 1) Number of annual national financial reports containing accounts related to biodiversity-related (passive-positive) expenditure rates. 2) The number of innovative resources generating new financial resources that contribute to the protection of biodiversity annually.	

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Finance – Ministry of Planning – Ministry of Environment	2030	USD 5 million

Target 20: By 2030, ensure equitable and effective participation in biodiversity decision-making by communities and the most vulnerable, as well as women, girls and youth.	
National priorities:	Timeline
1) Develop regulatory decisions aimed at ensuring that the most vulnerable groups, women and youth have access to the right to own and dispose of biological resources.	2030
2) Increase and promote the meaningful, informed and effective participation and leadership of women and youth at all levels of biodiversity-related decision-making.	2030
3) Develop gender-specific guidelines for the conservation and sustainable use of biodiversity and fair and equitable benefit-sharing and improve understanding and analysis of those impacts.	2030
4) Implement capacity-building programs for women and youth to develop their technical skills and income-generating activities related to the conservation and sustainable use of biodiversity.	2030
5) Establish coordination mechanisms between women's and youth organizations/networks, and ministries responsible for gender and the environment, to enhance the coherence of programs on gender and biodiversity-related issues.	2030
Indicators: 1) Number of women and youth participation in events related to the protection of biodiversity annually. 2) Number of guidelines developed on humanitarian considerations for biodiversity conservation annually.	

Responsibility for implementation	Timeframe	Implementation costs (USD)
Ministry of Environment – Ministry of Youth and Sports – Ministry of Planning – Ministry of Finance – Universities – Ministry of Social Affairs – Ministry of Youth	2030	USD 3 million

Strategy Evaluation

In the absence of mechanisms for review and evaluation, this strategy cannot achieve its objectives, as necessary reviews cannot be conducted to correct the adopted course and align it with the required changes in environmental systems and the economic and social context of the reserves. Some countries measure the effectiveness of their environmental management based on indicators reflecting the financial amounts spent or legislative and law enforcement actions related to biodiversity. However, this type of evaluation no longer aligns with the modern concept of evaluation. Therefore, it is proposed to evaluate the progress made towards achieving the objectives of this strategy by establishing a set of indicators determined through consultation among the stakeholders involved in biodiversity. The evaluation should be conducted annually based on these indicators, with mid-term and end-term evaluations for the strategy (mid-term evaluation by the end of 2026 – end-term evaluation by 2030).

The following steps are proposed for evaluating the strategy:

1. Conduct a detailed desk review of the strategy and the National Biodiversity Action Plan to extract relevant information for the evaluation process.
2. Review the alignment of the strategy and the National Biodiversity Action Plan with national, regional, and international commitments.
3. Distribute questionnaires to: (a) national contact points for international biodiversity-related conventions; (b) representatives of national entities related to biodiversity and the environment.
4. Conduct interviews (formal and informal) with: (a) national contact points for international biodiversity-related conventions; (b) representatives of national entities related to biodiversity and the environment, to discuss the results of the questionnaires and clarify additional information.
5. Conduct interviews (formal and informal) with national experts and regional consultants related to biodiversity strategies and national action plans.
6. Review national reports related to international biodiversity-related conventions.
7. Analyze the effectiveness of national entities in implementing the objectives and activities of the national strategy.

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Appendices

Appendix (1) List of Libyan wetlands

Id	Code	Macroarea	Wetland name	Description	Coordinates	Visited
1	00100010	Farwah - Abu Kammash	Sabkhat Abu Kammash	= Mellahat al Burayqah; only the Libyan part	33 05 02 N 11 35 38 E	✔
2	00100020	Farwah - Abu Kammash	Coast Abu Kammash to Ras Ajdir	Includes Qattayah island	33 06 41 N 11 38 11 E	✔
3	00100030	Farwah - Abu Kammash	Mellahat Bannumah	= Sabkhat Zaltan	33 02 17 N 11 44 01 E	✔
4	00100040	Farwah - Abu Kammash	Sea off Farwah island		33 06 59 N 11 44 55 E	✔
5	00100050	Farwah - Abu Kammash	Farwah Lagoon	Includes Farwa island and Ras et Talga	33 05 17 N 11 45 37 E	✔
6	00100060	Farwah - Abu Kammash	Sabkhat Boubesla	Includes Sab. Khalilah and Sab. Samandin	33 01 14 N 11 50 12 E	✔
7	00100070	Farwah - Abu Kammash	Sabkhat Gatoufa	= Sab. Nuqrat al Batn and Sab. Hisyan Abu Tawil	32 59 10 N 11 55 33 E	✔
8	00200009	Zuwarah - Sabratah	Zuwarah harbour		32 55 23 N 12 07 17 E	
9	00200010	Zuwarah - Sabratah	Sabkhat al Manqub		32 54 34 N 12 07 35 E	✔
10	00200015	Zuwarah - Sabratah	Millitah inner sebkha		32 50 16 N 12 12 44 E	
11	00200020	Zuwarah - Sabratah	Sabkhat Millitah	= Sab. Awlad Hamid	32 49 51 N 12 16 58 E	✔
12	00200040	Zuwarah - Sabratah	Jazirat Sabratah		32 48 29 N 12 28 34 E	✔
13	00400010	Nafusah reservoirs	Wadi at Tut dam		32 07 02 N 12 25 15 E	✔
14	00400015	Nafusah reservoirs	Bir Ayyad dams		32 06 46 N 12 24 25 E	
15	00400020	Nafusah reservoirs	Wadi Zaret dam		32 06 22 N 12 48 12 E	✔
16	00400030	Nafusah reservoirs	Ayn Taqnit		32 07 30 N 12 48 26 E	✔
17	00400040	Nafusah reservoirs	Wadi Ghan dam		32 14 16 N 13 07 51 E	✔
18	00400050	Nafusah reservoirs	Wadi al Mujaynin dam	= Wadi Qadhdhaf Dam	32 17 24 N 13 15 09 E	✔
19	00500005	Tripoli	Janzour Beach		32 50 14 N 13 00 31 E	
20	00500010	Tripoli	Bab al Bahr coast		32 53 48 N 13 09 51 E	✔
21	00500020	Tripoli	Tripoli harbour		32 54 06 N 13 11 31 E	✔
22	00500030	Tripoli	Al Mallahah		32 53 59 N 13 17 13 E	✔
23	00500040	Tripoli	Tajura coast		32 53 45 N 13 22 12 E	✔
24	00600010	Al Qarabulli	Wadi al Masid		32 47 23 N 13 42 17 E	✔
25	00600020	Al Qarabulli	Wadi Turghut		32 47 22 N 13 49 20 E	✔
26	00600030	Al Qarabulli	Wadi Hsun mouth	= Wadi Bsis	32 44 29 N 13 59 30 E	✔
27	00600040	Al Qarabulli	Jazirat Bsis	= Jaz. al Muayqil	32 44 41 N 13 59 41 E	✔
28	00700010	Al Khoms	Al Khoms harbour		32 41 54 N 14 14 55 E	
29	00700012	Al Khoms	Wadi al Yahud dam	= Wadi es Smara dam	32 34 59 N 14 16 50 E	

Id	Code	Macroarea	Wetland name	Description	Coordinates	Visited
30	00700015	Al Khoms	Wadi Suq al Khamis mouth		32 35 24 N 14 21 43 E	
31	00700030	Al Khoms	Wadi Kaam dam		32 23 48 N 14 19 45 E	✓
32	00700040	Al Khoms	Wadi Kaam mouth		32 31 36 N 14 26 47 E	✓
33	00750050	Misratah West	Tunnarat az Zurayqi		32 26 19 N 14 54 03 E	
34	00800002	Tawurgha complex	Misratah sewage farm		32 19 35 N 15 08 43 E	
35	00800005	Tawurgha complex	Misratah harbour		32 22 06 N 15 13 08 E	
36	00800010	Tawurgha complex	Sabkhat Qasr Ahmed (steel factory)		32 21 03 N 15 10 23 E	✓
37	00800020	Tawurgha complex	Sabkhat Qasr Ahmed (East)	Includes Marsa Marzuqah	32 09 37 N 15 19 36 E	✓
38	00800022	Tawurgha complex	Sabkhat al Mimis	Includes Sab. Mattat az Zayt and Sab. at Tawilah	32 14 51 N 15 10 22 E	
39	00800024	Tawurgha complex	Sabkhat Umm at Tibn	Includes Sab. Fam at Tariq	32 07 24 N 15 12 55 E	
40	00800030	Tawurgha complex	Ayn Tawurgha		32 00 50 N 15 06 26 E	✓
41	00800040	Tawurgha complex	Wadi al Amak		32 00 00 N 15 09 00 E	✓
42	00800050	Tawurgha complex	Sabkhat Umm al Ez		31 59 18 N 15 12 04 E	✓
43	00800060	Tawurgha complex	Mellahat al Mesherrek		31 58 00 N 15 08 07 E	✓
44	00800062	Tawurgha complex	Sawfajjin delta	Includes Sab. Sawfajjin	31 52 41 N 15 06 50 E	
45	00800064	Tawurgha complex	Tawurgha central sector		31 57 05 N 15 15 36 E	
46	00800066	Tawurgha complex	Sabkhat Wadi Gharghur		31 48 32 N 15 16 15 E	
47	00800070	Tawurgha complex	Al Hishah	Includes Sab. al Mafruth	31 38 52 N 15 17 27 E	✓
48	00800072	Tawurgha complex	Sabkhat Bir al Manqa		31 39 30 N 15 27 30 E	
49	00800074	Tawurgha complex	Sabkhat al Uwaynat		31 30 51 N 15 29 28 E	
50	00800076	Tawurgha complex	Sabkhat al Washkah		31 25 56 N 15 35 05 E	
51	00900010	Sirt	Sabkhat Wadi Mrah		31 19 12 N 15 48 23 E	✓
52	00900015	Sirt	Wadi Bey al Kebir		31 16 10 N 16 00 46 E	
53	00900017	Sirt	Wadi Tamet		31 14 20 N 16 05 45 E	
54	00900020	Sirt	Sabkhat al Ghbeba		31 12 59 N 16 22 22 E	✓
55	00900025	Sirt	Sabkhat Bir Attagh		31 12 46 N 16 27 14 E	
56	00900030	Sirt	Coast of Sirt town		31 12 39 N 16 35 35 E	✓
57	00900040	Sirt	Al Gardabiya West GMMR Reservoir		31 09 47 N 16 40 44 E	✓
58	00900045	Sirt	Al Gardabiya East GMMR Reservoir		31 08 48 N 16 49 48 E	
59	01000005	Sultan	Wadi al Hunaywah	at Checkpoint 40Km	31 09 09 N 17 01 59 E	
60	01000010	Sultan	Sabkhat Sultan	Includes Sab. al Musayfiq and Sab. al Hamra	31 05 37 N 17 14 02 E	✓
61	01000020	Sultan	Sabkhat Hassila and Wadi al Hamar	= Sab. an Naim and Sab. az Zuhayr (incl. Sab. Ras al Ghur)	31 03 15 N 17 23 53 E	✓
62	01100010	Bin Jawwad - As Sidr	Sabkhat Umm al Qindil	= Sab. al Uwayjah	30 54 18 N 17 50 36 E	✓
63	01100014	Bin Jawwad - As Sidr	Bin Jawwad dam		30 48 01 N 18 04 01 E	
64	01100020	Bin Jawwad - As Sidr	Sabkhat al Waset	= Sab. Kuhaylah, = Sab. Bin Jawwad	30 43 05 N 18 15 05 E	✓
65	01100030	Bin Jawwad - As Sidr	As Sidr oil terminal		30 38 05 N 18 21 46 E	✓
66	01200005	Ras Lanuf	Ras Lanuf harbour		30 29 53 N 18 34 46 E	
67	01200010	Ras Lanuf	Sabkhat Ras Lanuf		30 23 45 N 18 39 57 E	✓
68	01250050	Sabkhat al Kabirah	Sabkhat al Kabirah		30 08 40 N 18 57 33 E	✓

Id	Code	Macroarea	Wetland name	Description	Coordinates	Visited
69	01300010	Al Aqaylah to New Burayqah	Jazirat Bu Shuayfah	= Al Aqaylah island	30 17 29 N 19 07 19 E	
70	01300015	Al Aqaylah to New Burayqah	Marsa al Burayqah harbour		30 24 51 N 19 35 27 E	
71	01300020	Al Aqaylah to New Burayqah	Sabkhat al Aqaylah	= Sab. Qarat as Shakandi	30 15 20 N 19 15 38 E	✓
72	01300030	Al Aqaylah to New Burayqah	Sabkhat Bishr	= Sab. al Muzayyirrah	30 17 00 N 19 22 07 E	✓
73	01300035	Al Aqaylah to New Burayqah	Sabkhat Urqub Jawwah and Marsa al Burayqah airport		30 22 47 N 19 32 20 E	
74	01300040	Al Aqaylah to New Burayqah	Sabkhat Hafirah and Sabkhat al Burayqah		30 15 51 N 19 35 28 E	✓
75	01300050	Al Aqaylah to New Burayqah	Sabkhat Tabilbah	= Sab. al Umaylihat	30 27 37 N 19 42 58 E	✓
76	01300060	Al Aqaylah to New Burayqah	Burayqah Jadida Desalinator		30 28 18 N 19 43 36 E	✓
77	01400002	Ajdabiyah	Jazirat al Bayda	= Isheifa Rock	30 36 07 N 19 49 43 E	
78	01400005	Ajdabiyah	Jazirat al Garah		30 47 25 N 19 54 00 E	
79	01400006	Ajdabiyah	Jazirat er Rish		30 45 00 N 19 52 00 E	
80	01400007	Ajdabiyah	Jemmarish reef		30 46 31 N 19 57 44 E	
81	01400010	Ajdabiyah	Sabkhat Zuwaytinah		30 48 33 N 20 02 56 E	✓
82	01400020	Ajdabiyah	Sabkhat ash Shuwayrib		30 43 25 N 20 07 47 E	✓
83	01400030	Ajdabiyah	Ajdabiyah sewage farm		30 41 41 N 20 15 32 E	✓
84	01400040	Ajdabiyah	Ajdabiyah GMMR reservoir		30 34 48 N 20 20 49 E	✓
85	01500010	Karkurah and Qaminis	Sabkhat al Bedin		31 13 05 N 20 10 01 E	✓
86	01500012	Karkurah and Qaminis	Sabkhat al Hitah		31 15 18 N 20 08 51 E	
87	01500014	Karkurah and Qaminis	Sabkhat al Bashmah		31 18 14 N 20 06 47 E	
88	01500020	Karkurah and Qaminis	Sabkhat Karkurah		31 24 04 N 20 03 18 E	✓
89	01500025	Karkurah and Qaminis	Sabkhat Mutayfia		31 33 10 N 19 59 17 E	
90	01500030	Karkurah and Qaminis	Sabkhat Qaminis and Sabkhat Jaruthah		31 44 43 N 19 56 04 E	✓
91	01550020	Suluq	Omar Elmokthar South GMMR Reservoir		31 43 48 N 20 15 57 E	
92	01550050	Suluq	Omar Elmokthar North GMMR Reservoir		31 51 26 N 20 19 37 E	
93	01550070	Suluq	Al Qattarah dams	Includes two dams	32 01 33 N 20 24 23 E	
94	01600010	Benghazi	Sabkhat al Nakhil		31 55 54 N 19 57 28 E	✓
95	01600020	Benghazi	Sabkhat Qanfudhah		32 00 01 N 19 59 19 E	✓
96	01600030	Benghazi	Sabkhat Fairuz	Sab. Al Muwaylihah	32 02 36 N 20 01 20 E	✓
97	01600040	Benghazi	Sabkhat Qaryunis 1		32 04 02 N 20 02 23 E	✓
98	01600050	Benghazi	Sabkhat Qaryunis 2		32 04 33 N 20 02 46 E	✓
99	01600060	Benghazi	Sabkhat Julyanah		32 05 25 N 20 03 34 E	✓
100	01600070	Benghazi	Benghazi harbours	Includes 23rd July Lake and new harbour	32 06 17 N 20 03 28 E	✓
101	01600080	Benghazi	Assabri beach		32 08 12 N 20 04 22 E	✓
102	01600090	Benghazi	Sabkhat al Thama and Sabkhat Esselawi	Includes 2 El Thama canals to the sea	32 08 58 N 20 06 10 E	✓
103	01600100	Benghazi	Al Maqarin karstic lakes	Includes 5 lakes	32 09 33 N 20 08 19 E	✓

Id	Code	Macroarea	Wetland name	Description	Coordinates	Visited
104	01600110	Benghazi	Bou Dzira	= Buhayrat Bu Jazirah	32 10 06 N 20 07 55 E	✓
105	01600120	Benghazi	Ayn Zayyanah	Includes Al Kuwafiyah sector and Al Wati	32 12 50 N 20 09 20 E	✓
106	01700010	Tukrah	Sabkhat al Kuz	Includes Bu Jarrar sector	32 26 27 N 20 26 00 E	✓
107	01700050	Tukrah	Wadi Zarah dam		32 22 31 N 20 32 41 E	
108	01800010	Al Marj	Al Labadia	= Oum al Mkalee, = remains of Al Garigh Lake	32 30 17 N 20 53 35 E	✓
109	01850010	Ad Dirsiyah	Jazirat ad Dirsiyah		32 43 03 N 20 56 57 E	
110	01900005	Haniyah	Juzur Ougla	7 islets in total	32 47 00 N 21 22 00 E	
111	01900010	Haniyah	Wadi Jarjarummah		32 47 06 N 21 24 21 E	✓
112	01900020	Haniyah	Sabkhat Ayn az Zarqa		32 48 16 N 21 27 33 E	✓
113	01900030	Haniyah	Sabkhat Ayn ash Shaqiqah		32 48 52 N 21 28 47 E	✓
114	01900040	Haniyah	Sabkhat Gfanta	(Zawiyat al Haniyah)	32 49 43 N 21 30 22 E	✓
115	01900050	Haniyah	Sabkhat Umm Sayyad	= Sab. Haniyah	32 50 24 N 21 30 59 E	✓
116	01900060	Haniyah	Juzur al Haniyah	2 islets	32 50 11 N 21 30 23 E	✓
117	01900070	Haniyah	Sabkhat Qasr al Haniyah		32 50 49 N 21 31 24 E	
118	01900080	Haniyah	Juzur al Hamamah		32 55 00 N 21 37 00 E	
119	02000010	Susah	Abrak Nutah lakes		32 54 31 N 21 48 38 E	✓
120	02000020	Susah	Juzur Susah	7 islets	32 54 05 N 21 56 20 E	✓
121	02100010	Ras al Hilal	Ras al Hilal	Includes new harbour	32 54 44 N 22 10 14 E	✓
122	02200010	Darnah West	Karsah cliffs		32 49 13 N 22 28 50 E	✓
123	02200015	Darnah West	Jazirat Karsah		32 50 18 N 22 30 05 E	
124	02200020	Darnah West	Sabkhat ad Dalisi		32 48 07 N 22 31 29 E	✓
125	02200030	Darnah West	Coast of Darnah town		32 46 30 N 22 38 35 E	✓
126	02200035	Darnah West	Darnah harbour		32 45 46 N 22 39 14 E	
127	02300010	Darnah East	Wadi al Khalij	= Oued al Ghabta	32 39 54 N 22 55 29 E	✓
128	02300020	Darnah East	Wadi al Hamsah		32 39 03 N 23 00 09 E	✓
129	02400010	Ras at Tin	Sabkhat Ras at Tin		32 36 33 N 23 07 20 E	✓
130	02400020	Ras at Tin	Umm Hufayn		32 34 12 N 23 05 39 E	✓
131	02400030	Ras at Tin	Umm al Jarami		32 31 28 N 23 05 37 E	✓
132	02400035	Ras at Tin	Hufrat ad Dis		32 28 47 N 23 07 23 E	
133	02500010	Khalij al Bumbah	Sabkhat Bumbah (East)		32 26 34 N 23 08 49 E	
134	02500013	Khalij al Bumbah	Sabkhat Bumbah (West)		32 25 37 N 23 07 55 E	
135	02500020	Khalij al Bumbah	Bumbah sewage farm		32 26 06 N 23 04 24 E	✓
136	02500021	Khalij al Bumbah	Bumbah lagoon		32 25 02 N 23 06 08 E	
137	02500022	Khalij al Bumbah	Jazirat Misratah		32 24 51 N 23 09 16 E	
138	02500023	Khalij al Bumbah	Jazirat Ftiha	= Jezira El Watia	32 23 30 N 23 09 57 E	
139	02500024	Khalij al Bumbah	Jazirat Bardaa		32 22 27 N 23 14 07 E	
140	02500027	Khalij al Bumbah	Wadi Msallaq mouth		32 22 48 N 23 05 08 E	
141	02500030	Khalij al Bumbah	Sabkhat at Tamimi	Includes Tamimi harbour and Sab. Shaul	32 21 33 N 23 04 31 E	✓
142	02500040	Khalij al Bumbah	Tamimi coast		32 21 31 N 23 05 53 E	✓

Id	Code	Macroarea	Wetland name	Description	Coordinates	Visited
183	02900024	Western Jufrah	Wadi al Hawanah and adjacent lakes		29 17 42 N 16 00 03 E	
184	02900030	Western Jufrah	Sabkhat Waddan		29 12 25 N 16 03 32 E	
185	02900035	Western Jufrah	Wadi Hun		29 10 20 N 15 52 07 E	
186	02900040	Western Jufrah	Sabkhat al Aqulah		29 11 11 N 16 05 42 E	
187	02900060	Western Jufrah	Sabkhat al Hammam	Includes artificial pool	29 09 32 N 15 46 39 E	✓
188	02900065	Western Jufrah	Hun salt-lake		29 09 06 N 15 51 21 E	
189	02900070	Western Jufrah	Sowknah pools	– Wadi Mattul artificial pools	29 07 25 N 15 42 23 E	
190	02920010	Zillah	Zillah lakes		28 32 35 N 17 33 26 E	
191	03000010	Western Shati	Mashrua		27 29 48 N 14 20 04 E	✓
192	03000020	Western Shati	Birak sewage farm		27 31 03 N 14 16 47 E	✓
193	03000030	Western Shati	Sabkhat Ashkidah		27 32 12 N 14 28 20 E	
194	03010010	Shati valley	Mahruqah lakes		27 26 31 N 14 04 09 E	
195	03010020	Shati valley	Mahruqah sewage farm		27 29 13 N 14 00 19 E	
196	03010030	Shati valley	Al Qurdah sewage farm		27 28 06 N 13 58 39 E	
197	03010040	Shati valley	Quttah-Barqin lakes		27 32 05 N 13 37 12 E	
198	03010050	Shati valley	Wanzarik East		27 28 17 N 13 19 19 E	
199	03010070	Shati valley	Tmissaan sewage farm		27 28 55 N 13 07 45 E	
200	03020010	Awbari	Awbari lakes	Includes Gabron lake etc.	26 41 35 N 13 18 48 E	
201	03040010	Tmassah	Tmassah lake		26 24 02 N 15 48 45 E	
202	03050030	Sabha	Hijarah lake		27 03 32 N 14 28 15 E	✓
203	03060010	Zawilah - Umm el Aranib	Umm el Aranib marshes		26 07 28 N 14 45 52 E	
204	03060020	Zawilah - Umm el Aranib	Meseqwin salt lake		26 07 32 N 14 50 46 E	
205	03060030	Zawilah - Umm el Aranib	Al Badr salt lake		26 07 38 N 14 57 49 E	
206	03060040	Zawilah - Umm el Aranib	Zawilah sewage farm		26 09 14 N 15 07 22 E	
207	03060050	Zawilah - Umm el Aranib	Al Hufrah ash Sharqyah	– Remains of Al Hufrah ash Sharqyah	26 10 48 N 15 23 03 E	
208	03080010	Murzuq - Taraghin	Shiqwah lake		25 57 25 N 14 00 02 E	
209	03080020	Murzuq - Taraghin	Murzuq lake		25 54 31 N 13 54 21 E	
210	03080030	Murzuq - Taraghin	Al Hufrah salt lake		25 53 03 N 14 19 51 E	
211	03300010	Waw an Namus	Waw an Namus		24 54 62 N 17 45 53 E	✓
212	03400010	Martubah	Wadi Msallaq dam		32 33 10 N 22 32 46 E	
213	03600010	Al Jaghbub	Bouhayrat al Melfa		29 44 64 N 24 47 06 E	✓
214	03600020	Al Jaghbub	Baher al Fazza		29 39 45 N 24 49 22 E	
215	03600030	Al Jaghbub	Baher Hasi ed Duni		29 37 37 N 24 47 11 E	
216	03600040	Al Jaghbub	Salt lakes of Hatiet esh Sheibat		29 36 45 N 24 42 52 E	
217	03600050	Al Jaghbub	Baher al Arrashiya		29 36 38 N 24 51 37 E	
218	03600060	Al Jaghbub	Baher es Sobat		29 36 12 N 24 48 40 E	
219	03700010	Sarir	Sarir government farm		27 44 27 N 22 04 15 E	
220	04000010	Al Kufra	Buwaymah lakes		24 13 19 N 23 21 22 E	
221	04000020	Al Kufra	Al Jawf lake	– Remains of Al Jawf lake	24 12 04 N 23 16 37 E	