

Conflict/Synergy Among Different Uses on Land and at Sea and land-sea Interaction in Blue Growth

Djerba scale, Tunisia





Analysis of Threats and Enabling Factors for Sustainable Tourism at Pilot Scale

Conflict/Synergy among different uses on land and at sea and Land-sea interaction in Blue Growth

Djerba scale, Tunisia



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OVERVIEW

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REVIEW

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Abstract

Djerba is one of the most important tourist areas. These tourist activities have a positive and/or negative effect on the development of other coastal and maritime activities. On the one hand, tourism activities have an important role in enhancing the heritage sites of Djerba, and on the other hand, their interaction with other activities such as fishing and agricultural activities, maritime transport and urbanization has led to a demographic evolution of the island that has resulted in a strong increase in population and energy consumption, as well as an increase in the demand for fish, which has become mainly provided by coastal boats, fixed fisheries and fishing on foot. Thus, increasing the pressure on environmental and natural resources. However, the reduction of the aquaculture area is due to the large size of the continental shelf and the repetitive phenomena of blooms, which are the main causes of the failure of the exploitations. Therefore, several plans and programs have been developed that aim to regulate and restrict development in the area to conserve and protect the natural capital and prevent fragmentation of the inland coastal area.

I. Introduction

According to the World Tourism Organization, tourists are defined as people who travel and stay outside their usual environment for less than one successive year, and the main purpose of travel is for leisure, business and the transportation sector, travel agents, food and accommodation, infrastructure, are crucial components for the tourism sector.

Tourism as an economic activity has offered tremendous growth all around the world. It has the potential of generating huge revenue as well as the capacity to improve the standard of wellbeing of the local community by providing jobs, building required infrastructure, and integrating the local economy with the rest of the world.

However, some of the countries in Africa like Tunisia have suffered immensely from economic recession.

Tunisia is largely dependent on the tourism sector and can be understood by potential conflicts. More than any other sector, tourism is more susceptible to stress. Due to the increase of economic trouble in conflict zones, the government is increasingly coming up with strategies to negate or decrease the effect of conflict on tourist activity.

This report aims to analyze Conflicts and Synergies between the tourism sector and other marine activities in Djerba Island. Firstly, it illustrates the different maritime activities in relation to tourism in Djerba. Then, it represents the cumulative interactions and the conflicts on various factors that impact tourism. Finally, it provides some policies and strategies to improve the tourism sector in this zone.

II. Coastal and Maritime activities

Maritime activities are all jobs and economic activities directly or indirectly related to the sea (Varachaud, 2012). According to FAO, activities are classified into the following seven categories (FAO, 2019):

- Monitoring and surveillance.
- Food, nutrition, and health: This category covers fishing, aquaculture, and biotechnology activities.
- Ship and building and water project: This category is generally intended for shipbuilding and repair activities.
- Energy and materials of the seabed: It encompasses the activities of oil and gas exploitation into the sea, renewable energies of the oceans, aggregates, and deep-sea mining, with desalination activities.
- Coastal protection: It is interested in activities aimed at protecting the coastline and adapting to climate change.
- Maritime transport: It is presented by transport in deep sea or short sea, transport of passengers and inland navigation.
- Recreation and tourism: Present cabotage activities, cruises, yachting / marinas, and sports and hobbies activities.

In Djerba Island there are five major maritime activities. Fishing and agriculture activities both belong to the first category of FAO classification, and Maritime transport, Urbanization, and Tourism.

II.1. Tourism

In Tunisia and according to Widz, three phases of Tourism development were identified *i.e.*, exploration, involvement, and development (Widz and Brzezinska-Wójcik, 2020).

The first phase, exploration, lasted until the 1960s, before the appearance of stable tourism investments. The involvement phase (1960–1985) was characterized by a substantial increase in the number of tourists. The mass-scale development of tourism noted after 1985 initiated the development phase. In this phase, the number of hotel beds was increased, and many jobs were created. A noticeable increase in tourist traffic was reported at the turn of the 20th and 21st centuries. This generated increasing tourism-related income and infrastructure development.

In 2011–2015, there were two sharp declines in the number of visitors. The first was reported during the first three months of 2011 due to the “Jasmine Revolution” when the number of tourist arrivals decreased by 44% compared to 2010, consequently the tourism industry losses amounted to over 620 million USD. Another decrease was noted in August 2015 after Bardo and Sousse terrorist attacks when only 4.2 million tourists came, which was 24% less than in the corresponding period of 2014 and the

number of tourists from Europe decreased by 50%. The decline in the tourist traffic resulted in a reduction in hotel beds numbers from 242,100 to 240,000 in 2013 and from 241,400 in 2015 to 235,000 in 2016. In 2018, the number of tourists increased again to reach 8.3 million, and the number of hotel beds increased to 237,600. Even higher tourist traffic (9.4 million visitors) was recorded in Tunisia in 2019. In fact, it accounted for a 13.6% increase compared to 2018. This was mainly associated with the greater number of tourists coming from European countries, an increase by almost 2.8 million (15.9%) and from North African countries by almost 5 million (15.5%).

Finally, and due to the worldwide Covid pandemic, another decrease in the number of tourist arrivals was noted in Tunisia and in Djerba 2020.

Those last crisis showed that this activity is a very volatile market and Tunisian wellbeing was affected.

With three administrative boundaries, the island of Djerba is composed by:

- The municipality of Ajim (118.56 km²), further behind the tourist dynamic, has 13950 inhabitants.
- The town of Houmet Souk is the “capital” of the island and has 64,892 inhabitants. With a total area of 176.54 km², the commune of Houmet Souk comprises 4 municipal districts.
- The town of Midoun (194.38 km²) is the closest center for tourist activities and has 50,459 inhabitants.

The last two municipalities, Houmet Souk and Midoun, encompass more than 99% of the total tourist activity of the island of Djerba (Fig.1).

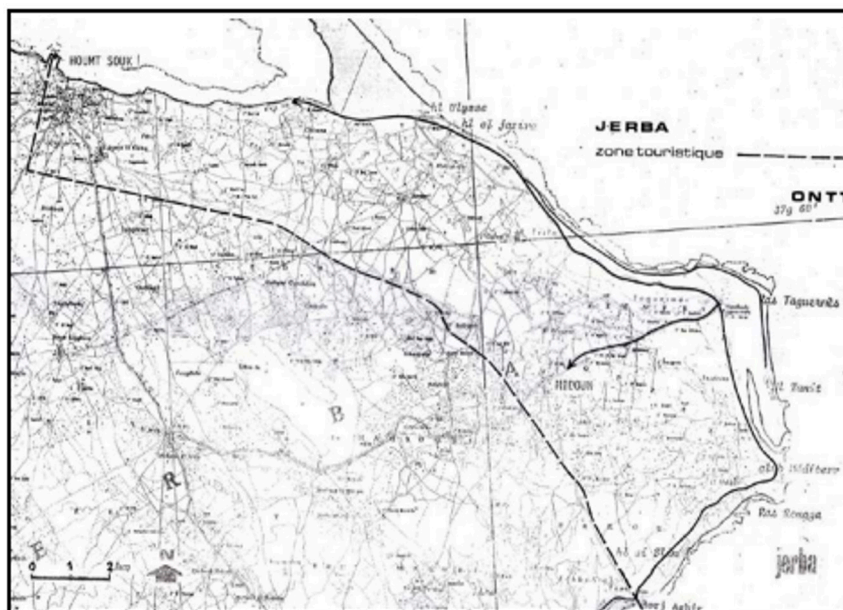


Figure 1. Tourism delimitation in Djerba Island (Plan bleu, 2011)

Djerba has about twenty kilometers of sandy beaches, located mainly at the eastern end of the island, hence its nickname “the island of golden sands”. The total area is estimated at 371.31 km² and the total population is 130,850 inhabitants (2009 estimate) (Chapoutot, 2011).

The most beautiful beaches are in the North-East (Sidi Hacchani, Sidi Mahrez and Sidi Bakkour), in the East (between Sidi Garrous and Aghir), in the South (near Guellala) and in the West (Sidi Jamour). Until the early 1950s, these were visited only during visits (ziara) that residents paid to marabouts. The first tourist company was the Mediterranean Club, in 1954 characterizing the first phase of tourism on the island whose beaches were more and more frequented.

As early as 1975, tourism increased sharply and in the 1980s it really took off to become the main economic activity of the island. The spaces allowing the construction of large hotel units reached an average occupancy rate of around 68% in 1999, placing Djerba in second position among tourist sites in Tunisia (Bernard, 2002). Djerba has become one of the main tourist regions of Tunisia thanks to the island’s multiple assets, in particular its coasts offering many sites favorable to the installation of hotel units, but also the strong diversity and cultural and landscape richness. The presence of the Djerba-Zarzis international airport and road infrastructure contributes to making it an important tourist center and a generator of economic growth for the region.

In 2005, the tourist area stretched for more than 20 km between Aghir in the south and Houmet Souk in the north. However, many beds are only used during the summer and the excessively low prices induced by competition do not allow good maintenance of the aging hotel stock, leading to a decline in clientele. To maintain and develop tourism, local players are in favor of enriching the offer by creating new activities (golf course, casino, museum, thalassotherapy, or amusement parks). The activities offered are tennis, recreational fishing, and scuba diving, *etc.* while several water resorts offer water skiing, jet skiing or parasailing. A marina also allows the mooring of pleasure boats (Neifar, 2005).

In 2018, the increase in the number of overnight stays compared to the previous year amounted to more than 3 million for the Djerba-Zarzis region (Hanachi, 2018).

In 2019, Djerba had 135 hotels (compared to 48 in 1987) with a capacity of around 37,000 beds for just under 7.5 million overnight stays; the loyalty rate of customers (those who stay there several times) is around 45 percent. The sector employs some 76,000 people, although the number of direct and permanent jobs only corresponds to some 15,000 jobs, which are often insecure because they are seasonal.

II.2. Fishing activities around Djerba

The fishing sector is a potential sector in Tunisia. It represents around 9% of the value of agriculture, which represents 12.5% of GDP, so fishing contributes around 1.4% to GNP. Indeed, Tunisia is widely open to the sea with a coastline that exceeds 1300 km.

Around the island of Djerba, fishing is a very old activity whose main techniques used primarily target coastal species. Nowadays, this activity is provided mainly by coastal boats, fixed fisheries (Zroub: charfia; Picture1) and by foot fishing (mainly clam).

Many fishing gears are used, nets (gill and trammel), fishing with gargoyles (Fig.2), traps and longlines. Fish catches generally fluctuate between 2000 and 3000 tons per year.



Figure 2. Aerial photo of Zroubs de Djerba (April 2021)

II.2.1. History of fishing

Archaeological research carried out since 2004 in Djerba has brought to light some remains testifying to fishing activity on the island during the Punic period located in the south-east of the island.

The archaeological data concern cabane remains, net steelyards, some ichthyological remnants and shellfish. Three species of fish have been recognized: mullet, with perhaps two different species; a sparid and a serranid.

The scarcity of fishing-related objects could be explained using techniques that have left no mark, such as fixed fisheries” Zroubs” .

These empirical fixed fisheries are still now used in the north part of Djerba (in Melita and Jilich).

II.2.2. Infrastructure

The fishing activity is favored by an important port infrastructure. Currently, two coastal ports are functional: Houmet Souk and Ajim (Fig.3). Since 2017, the port of Aghir, situated in the east of the island, is no longer functional.

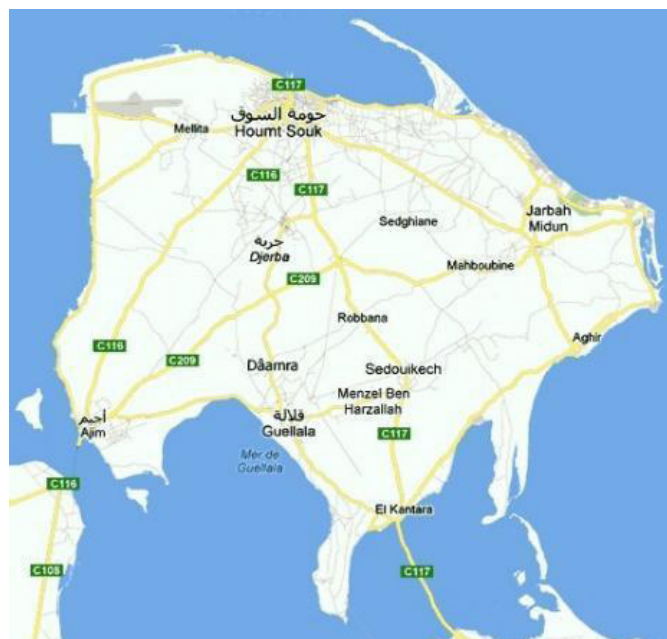


Figure 3. Fishing ports in Djerba island

II.2.3. Statistics

In 2020, the catches in Djerba amounted to 4643 tons for a total value of 43986 million TD (Fig.4). These quantities represent 2.8 percent of total catches at the national level and 7.5 percent of catches in Gabes Gulf.

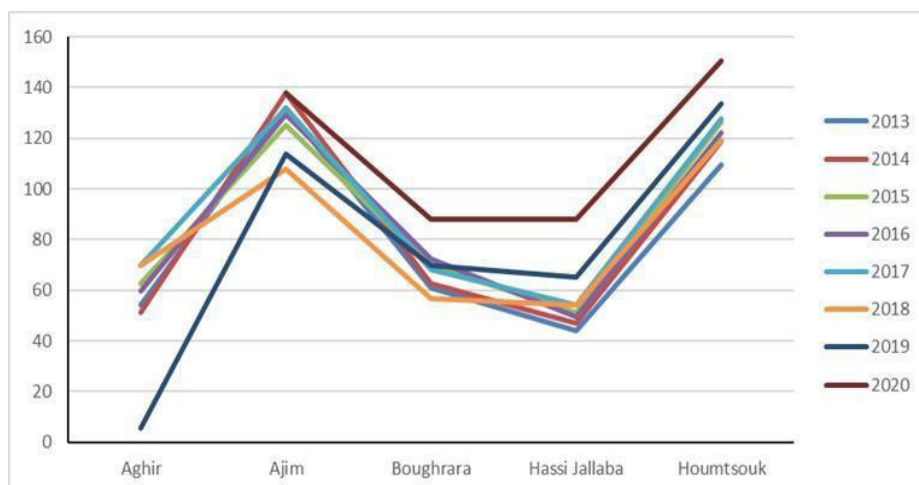


Figure 4. Catches evolution in different ports around Djerba island 2013-2020

On the island, most landings are made by coastal fishing about 4503 tons (97 percent). Lampara and clam fisheries are responsible for the rest of the catch.

Benthic fishes (sparidae, mugilidae) and cephalopods are the main species (Fig.5). The vegetal cover of the area of Djerba is nursery to many species of fish such as *Pomatoschistus tortonesei*, *Sciaena umbra*, *Fistularia commersonii*, *Kyphosus sectator*, *Parexocoetus mento*, *Pisodonophis semicinctus*, *Sphyrna chrysotaenia*, *Helicolenus dactylopterus*, *Conger conger*, *Merluccius merluccius*, *diplodena heliognus merluccius*, *diplodena mulenaisus annius*, *Mullus barbatus*, *Mullus surmuletus*, *Solea aegyptiaca*, *Mugil cephalus*, *Liza aurata*, *Liza saliens*, *Liza ramada*, and groupers (*Epinephelus marginatus*, *Epinephelus caninus*).

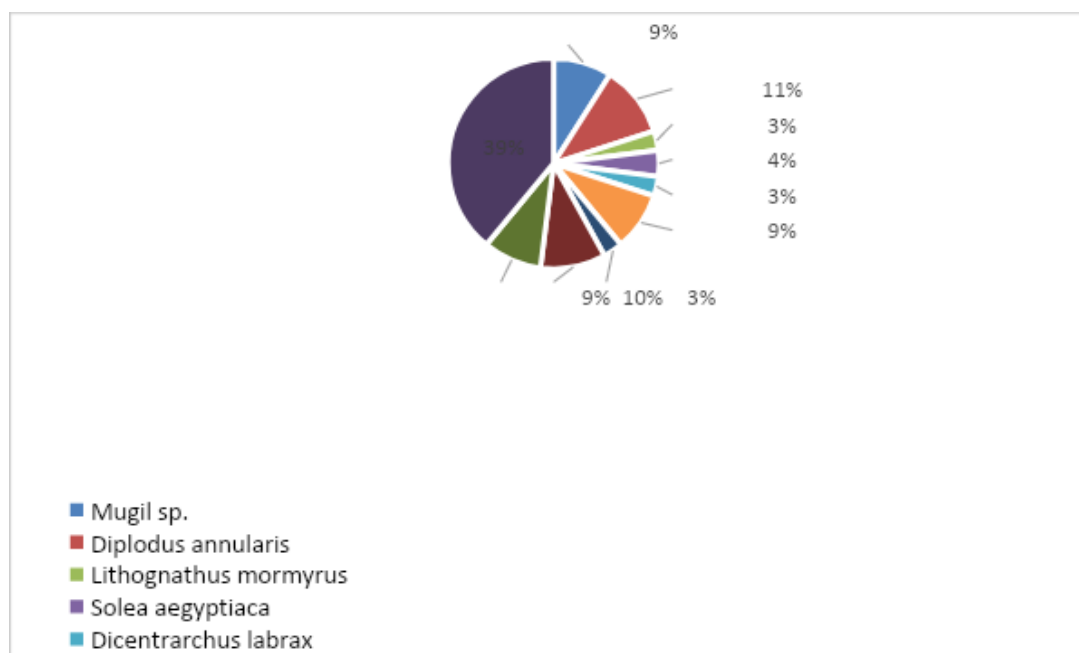


Figure 5. Main species landing in Djerba ports

This distinguished ecosystem is also home to offshore aquaculture sites that produce two species *Sparus aurata* and *Dicentrarchus labrax* (Hattour and Ben Mustpha, 2015).

Seabeds are characterized by a significant number of bivalve species. The most important ones are *Ruditapes decussatus*, *Cerastoderma glaucum*, *Musculista senhousia*, *Pinna nobilis*, *Fulvia fragilis* and the non-native species *Pinctada radiata* as well as the two gastropods *Luria lurida* and *Erosariatardus* (Lakhrech et al. 2018; Hattour and Ben Mustapha, 2015).

Other crab species such as *Maja squinado* have been reported in this area (Hattour and Ben Mustapha, 2015). The blue crab *Portunus segnis* has intruded around the island and is the subject of trap fishing since 2015.

Two species of cephalopods the most sought after in the fisheries of the Gulf of Gabès, namely the cuttlefish *Sepia officinalis* and the common octopus *Octopus vulgaris* are also present and are exploited in the various fishing ports around the island of Djerba.

Decapod shrimps are represented by the native species *Penaeus kerathurus* and the two non-native species *Metapenaeus monoceros* and *Trachysalambriapalaestiniensis*.

II.2.4. Maritime population

In 2019, fishing activity at the national level was carried out by 50621 fishermen, 71 percent of whom are inshore fishermen.

In Djerba the breakdown of this population by fishing method is presented in Table 1.

Table 1. Distribution of fishing gear per year (2009-2019)

Fishing gear Year	Coastal fishing	Trawl fishing	Purse seine	Tuna fishing	Other	Total
2009	34,275	5,460	5,506	567	6,993	52,801
2010	34,847	6,298	5,891	624	6,428	54,088
2011	36,115	6,063	5,521	693	6,302	54,694
2012	35,224	6,210	5,051	622	6,674	53,781
2013	35,442	4,962	5,396	538	6,908	53,372
2014	34,366	4,881	5,586	469	7,708	53,114
2015	35,336	5,032	5,708	445	7,756	53,977
2016	34,352	4,886	4,843	365	6,815	51,261
2017	35,625	5,176	5,651	428	4,685	51,565
2018	36,632	5,330	5,501	564	2,174	50,201
2019	35,941	5,300	5,502	564	3,314	50,621

II.3. Aquaculture

Aquaculture started around Djerba in 1984 and the first aquaculture farm was in elJorf “AST: Aquaculture de sudTunisien”. The terrestrial area was 32ha, and the sea concession was 2.5ha. The mortality of fish due the phytoplankton bloom in1993 achieved after the abandonment of offshore aquaculture. The AST produces 5 million larvae of sea bass and sea bream on an area of 22 ha with 30 basins.

“PecherieJerba” is the second farm created in Ajim in1990 and the species are *Dicentrarchuslabrax* and *Sparus aurata* (Fig.6).

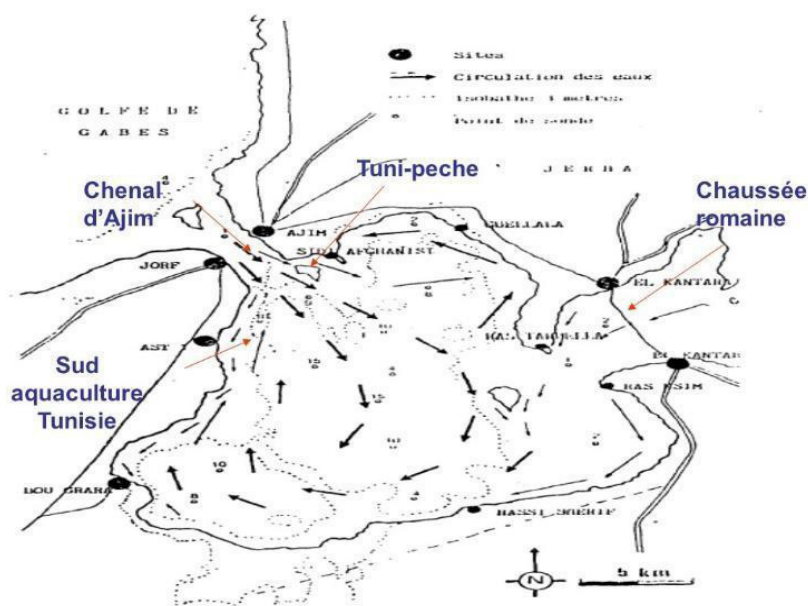


Fig. 3. Lagune de Bougrara.

Figure 6. Aquaculture farms in Djerba SAT and Tuni-pêche

In 2001 the company closed and in 2007 another company “TuniPêche” is created. Despite the diversification of cultivated species: sea bass, sea bream, tilapia, shrimp, the production ranged only from 50 to 100 tons per year to end up with the company closing in 2018.

In this region the reduced aquaculture area is due to the wide extent of the continental shelf and repetitive phenomena of blooms are principal causes of the failure of farms.

Different other projects are starting or already in progress:

- Project of aquaculture in floating cages at 5 nautical miles from the port of Ajim in a depth of 9-10 m.
- Project of shrimp *Penaeus vannamei* aquaculture by French company.
- Spirulina aquaculture at Sedwikech in 2021 by a Tunisian woman investor.
- Project of freshwater fish in Medenine.

II.4. Maritime Transport

The island of Djerba does not have a commercial harbor, yet, Zarzis commercial harbor is the nearest.

The island has a sea ferry transport between Ajim and El Jorf. Its field of activity is the transport of passengers, goods, cars, trucks... between El Jorf and Ajim in both directions. About ten ferries are used to transport 4,000 rolling stock per day.

Fishing activity is favored by an important port infrastructure. Currently, two coastal ports are functional: Ajim and Houmet Souk, while the port of Aghir is no longer functional.

In addition to fishing, the port Houmet Souk is also used by boaters, thanks to a 13,000 m² body of water. A marina has been built and touristic sea excursions are organized especially to the peninsula of the flaming rose, a tongue of sand which serves as a refuge for migrating birds (Fig.7).



Figure 7. Tourist and professional boats in Houmet souk port

II.5. Urbanization

The landscape of Djerba is the result of a slow and methodical organization of space by man, reflecting a very particular way of life and social relations.

The Djerbians had to undergo attacks from the sea, moved away from the coast and dispersed to the island side. The religious buildings reveal an island space deeply marked by the sacred and a population deeply attached to its territory. The buildings are isolated and sparse except for three housing groups. To this dispersion of habitat is superimposed a hierarchical organization of the island space in nested levels, starting from the Menzel which constitutes the basic cell of the spatial organization of the island. Menzels are residential and functional spaces in which families live and organize themselves.

The Menzel, a term which means the house, designates in Djerba the living area of a family. It is made up of one or more houch (housing unit) and elements of economic life: orchards, fields, granaries, wells, and the cistern. The Menzel integrates its population with its agricultural environment. Surrounded by tabias (hedges of earth bristling with agaves, aloe vera and prickly pears, lining tracks and paths and surrounding properties), it is organized as a defensive site. The framework of community life is the houma. For

Hassan Boubakri (1985) “houma is an ethno-spatial term designating a kind of land made up of dwellings, cultivated plots, wells and a social space”, the mosque being the unifying element of the whole. In each houma the traditions differ. Families live in isolation in their houma, a sort of island within an island.

II.6. Energy

In Tunisia, the energy mix for power generation consists of 92.3% natural gas (Tunisia 2nd Biennial Report to the UNFCCC). Tunisia largely imports its primary energy, with 56% of natural gas consumption in 2015 covered by domestic production and the remaining 44% imported (ibid). Power generation for Djerba’s electrification takes place in Gabes.

An oil-based power generator located on the island serves only in emergency situations. The share of renewable energy in power generation in Djerba is nearly zero, even though the island receives around 33,000 hours of sunshine per year: a rate that is one of the highest in the Mediterranean and thus represents an enormous potential for solar electricity generation.

The average electricity demand by the tourism sector in Djerba is lower in winter months due to a low volume of tourists, with tourism’s demand as low as 15.4% of Total Island demand during the month of February. This increases to 56.5% of total island electricity demand in the summer due to a high number of tourists (Fig.8). However, per tourist night electricity use is higher in the winter due to the requirements of the season and largely inefficient hotel operations, due to a low number of guests, reaching 42KWh during the month of January. On the contrary, per tourist night usage is lower during the tourist period, with average demand at 21KWh during the months of August and October due to high occupancy rates and greater economy of scale. (Wood *et al.* 2018).

The annual per tourist night average for 2016-2017 was estimated at 29 kWh. This is significantly higher than previous estimates for the average per tourist night electricity demand in Tunisia, which ranged from 13.7 kWh to 20 kWh per tourist night for 1997-2006 (ANPE, 2010).

Total annual electricity demand by the tourism sector was approximately 88.3 GWh in 2017, which is nearly one third of total annual electricity demand of all consumers on the island. One way to put this into perspective for decision makers is by using the ‘population equivalent’ of tourism which is the ratio of tourist-nights to resident nights over a year. In 2017, tourist nights in Djerba were 4.017 million, hence the tourism population equivalent was roughly 7% or equivalent to 11,000 residents. This means that the equivalent of 7% of the population (tourists) consumes one-third of total electricity and the remaining two-thirds is consumed by the 160,000 residents and other economic sectors.

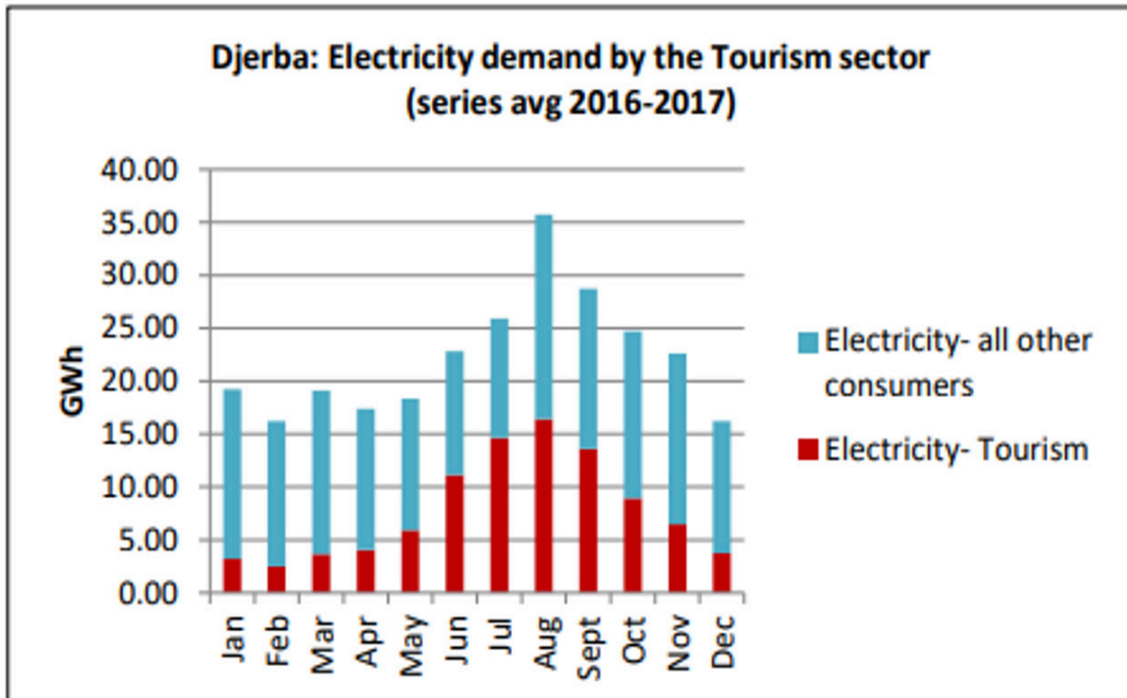


Figure 8. Tourism electricity demand in Djerba (data source: STEG, Airport, Private sector survey)

III. Interactions of tourism with other coastal and maritime activities

Using the trend function models (Widz and Brzezinska-Wójcik, 2020), prognostics indicate an evolution of tourism activity in Tunisia with consolidation phase at the beginning of 2020. In this phase the number of tourists can exceed the number of residents in some touristic zones.

Djerba is one of these touristic zones and interactions of tourism with other coastal and maritime activities can be highlighted.

In Djerba, stakeholders of those coastal and maritime activities can be classified in three categories:

- **The administration at regional and central level Energy:**

- APAL: The Coastal Protection and Management Agency is a non-administrative public establishment, created by law n ° 72-95 of July 24, 1995. It is in charge of executing the state policy in the field of protection and development of the Tunisian coastline, as well as protecting the maritime public domain against encroachment and illegal occupations and giving its approval to any development and equipment project on the coast before its execution, including lagoon area.
- Scientific research institutions (National Institute of Marine Sciences and Technologies INSTM and Universities)
- CRDA: The Commissariat of Agriculture Development in Medenine region, particularly the Fishing District in Zarzis. This body represents, at the regional level, the General Direction of Fisheries and Aquaculture (DGPAq).
- The GIPP: The Interprofessional Group of Fishery Products is a public establishment of economic interest endowed with civil liability and financial autonomy. It is an inter-professional body responsible for regulating the market, improving quality, supervising professionals, and promoting exports in the fisheries and aquaculture sector in Tunisia. Indeed, it ensures the link between the different phases through which the products pass. It facilitates consultation between professionals and the administration to set the objectives of the various sectors. It contributes to market balance by using the various appropriate mechanisms in collaboration and coordination with the professional and administrative bodies concerned.
- APIP: The Ports and Port Installations Agency is a public company with legal personality and financial autonomy. Its main responsibilities are the exploitation, operation, maintenance, and development of fishing ports. It is also responsible for the management of the public port domain, the provision of services to boats and participation in construction and extension studies of fishing ports.

- AVFA: The Agricultural Vulgarization and Training Agency is a public administrative establishment placed under the authority of the Ministry of Agriculture, Maritime Fisheries and Hydraulic Resources. As the name suggests, the agency is involved in the training of fishermen in different disciplines. In terms of vulgarization, it is responsible for supporting field extension programs developed by the Regional Agriculture Development Commissions with the aim of improving the level of skills and know-how of extension workers by organizing workshops and the development of popularization materials.
- ONAS
- ANPE National Agency for Environmental Protection.
- **Touristic stakeholders:**
 - Commissariat of tourism
 - Tunisian Federation of Hotels: Federation Tunisienne de L'Hotelleries FTH
 - FTAV: Fédération Tunisienne des agences de voyage
 - FTRT: Fédération Tunisienne des restaurants Tunisiens
- **Local community stakeholders:**
 - Associations: Ajem: Association pour l'Environnement marin; Asidj: Association pour la sauvegarde de l'île de Djerba; Aedj: Association Entretien Djerba
 - Delegations of Midoune and Houmet Souk
 - UTAP, UTICA (Tunisian Union of Industry, Trade and Handicrafts)

III.1. Interaction with urbanization

The interaction of tourism and urbanization has resulted in the island's demographic evolution leading to a sharp increase in the population, especially in the main tourist communities of Djerba: from 139157 inhabitants in 2004, the population reached in 2019. Tourism has therefore transformed an environment that was repulsive into an attractive space. In addition, it is the basis of a new spatiality since the local Djerba population is increasingly attracted to the coast to build individual housing, guest houses.

It has the potential of generating huge revenue as well as the capacity to improve the standard of wellbeing of the local community by providing jobs, building required infrastructure, and integrating the local economy with the rest of the world. Moreover, The Djerbians' patrimony and traditions in marriage, gastronomic food are well known.

On top of all the above, Djerba has been selected to be the capital of la Francophonie in 2021. Thereby, ensuring the reconstruction of many structures and renovation of coastal infrastructures such as the extension in Marina Houmet souk.

III.2. Interaction with urbanization

The interaction between tourism and the environment are both positive and negative. The positive impacts of tourism lie in the protection of some natural sites through their development and their opening to visitors. In Djerba about 360 mosques were made (since 1700 are subject to visits of tourists and this is a very good process to preserve these sites (entertainment).

Negative impacts lie mainly in the pressure exerted on space and natural resources, particularly soil, water, and energy. The development of tourism has been accompanied by the development of urban areas around tourist centers. Development models have led to concentrating tourist infrastructures and superstructures in areas established outside the cities. In addition to the fact that this development isolates tourists and places them in relatively isolated places. These tourist areas represent the negative impacts of tourism.

In Djerba, we regularly observe a constant decline in dune areas and beaches, especially downstream from ports. Hoteliers regularly seek to mitigate the phenomenon of erosion by man-made silting up and even through riprap. Every year, artificial recharging is necessary (Fig.9).



Figure 9. Erosion of touristic zone in Djerba Midoun (2003)

III.3. Interaction with fishing activities

Fixed fisheries are particularly located in the north zone of Houmet souk in shallow depth. This area is the biggest area with vegetal cover and is a nursery of fish and cephalopods. The coastline is stirring other coastal maritime activities such as tourism and urbanization. The sea is also frequented by swimmers and other tourist activities (kitesurf, Jet Ski...).

On the other side there are interactions among fishery resources and between the resources and their environment, for instance, the effects of fishing on non-target species and habitats, food-chain effects, and biodiversity.

III.4. Interaction with energy

The annual per tourist night average for 2016-2017 was estimated at 29 kWh. This is significantly higher than previous estimates for the average per tourist night electricity demand in Tunisia, which ranged from 13.7 kWh to 20 kWh per tourist night for 1997-2006 (ANPE, 2010).

Total annual electricity demand by the tourism sector was approximately 88.3 GWh in 2017, which is nearly one third of total annual electricity demand of all consumers on the island. One way to put this into perspective for decision makers is by using the 'population equivalent' of tourism; that is, the ratio of tourist-nights to resident nights over a year.

In 2017, tourist nights in Djerba were 4.017 million, hence the tourism population equivalent was roughly 7% or equivalent to 11,000 residents. This means that the equivalent of 7% of the population (tourists) consumes one-third of total electricity and the remaining two-thirds is consumed by the 160,000 residents and other economic sectors.

IV. Conflicts and synergies between the different Coastal and Maritime activities

IV.1. Synergies

IV.1.1. Tourism and artisanal industries

The most important synergy exists between tourism and artisanal industries. In fact, handicrafts, in particular wool and pottery, have played a major role in the island's economic life and have been an important source of income thanks to the trade in these products. Thanks to tourism, three sectors have been able to resist and even regain a boom: the manufacture of carpets, pottery in the town of Guellela and that of jewelry (gold and silver) especially in Houmet Souk where artisanal jewelry making is still surviving and represent an important lucrative activity especially for the Jewish community in Djerba (Jomni, 1981).

IV.1.2. Tourism and patrimonial sites

The touristic activities have played an important role in the patrimonial sites' valorization in Djerba. With a strategic position in the Mediterranean, Djerba was for a long time a land of covetousness: both the richness and the diversity of the sites, such as the five fortifications still visible, bear witness to this (Tlatli, 1967). Phoenician trading post in the orbit of Carthage, renowned for the quality and variety of its products. In fact, the island of Djerba has always been a land of asylum to a Jewish community from the 4th century BC. The Roman occupation left the remains of Meninx and the causeway connecting the island to the mainland. Its economic and strategic importance is confirmed under the Arabs. Moreover, the island is part of a religious movement whose rigor still marks the character and way of life of the inhabitants. Djerba suffered throughout its history from successive attacks from the Normans and the Spaniards who made it their base before coming under Ottoman rule in 1610 (Ben Yagoub, 1986).

Djerba is an island of tolerance where the three religions of the Book, Islam, Christianity, and Judaism coexist.

There are archaeological sites scattered all over the island. These identified sites should be opened for all sites discovery.

- Historical centers and monuments such as military buildings, mosques.
- Ethnographic buildings, places of various cults, economic facilities such as weaving and pottery workshops, oil mills, residences and Menzels.
- Ethnographic furniture resulting from the traditional way of life and illustrating its various aspects.
- Libraries which contain valuable manuscripts, but which do not contribute to heritage research.

IV.2. Conflicts

IV.2.1. Conflicts between coastal protection instruments and the tourism plan

Coastal areas are an important tourist attraction for sustainable tourism. Infact, Tunisia's strategy for 2030 to strengthen tourism, promotes the rehabilitation of developed coastal areas, contributing to the intensification of tourism in key areas. Thereby, increasing pressure on environmental and natural resources. Furthermore, the Coastal Protection aims to regulate and restrict development in the area to conserve and protect the natural capital and prevent any fragmentation of the coastal zone from the interior.

IV.2.2. Conflicts between tourism and artisanal fisheries of 'Charfia'

This fishery was used in the coastal sea between MellitaBorj Jilij and Houmet souk. The conflict is caused by the diminution of the area of Charfia fishing concentrated in the Mellita zone.

IV.2.3. Conflicts between tourism and fishers

The over space in Houmet Souk port (Marina) for landing. The same space (13,000 m²) is used for both activities. At some times of year (summer) up to 200 to 300 vessels are wanting to land there (Fig.10).



Figure 10. Touristic and fishing boats in Houmet souk port

On the other hand, conflicts of interest between the different fleet segments (trawlers, seiners, coastal boats, and fixed fisheries) are increasingly observed with a real problem of zonation and the use of illegal methods.

IV.2.4. Conflict between tourism and ecosystem

With a daily average of around 1000 customers during the high season (July/August), and around 60000 people visiting the RassRmel site during the two months through the sea excursion and having an impact via anthropogenic pressures, tourism represents a conflict over the marine and coastal ecosystem sustainability. Tourist activities such as quads (more than 2000 per day), Jet skis, especially on the Ras Rmal spire, have contributed to the ecosystem deterioration as well as to the beach's development in parasols establishment.

Waste treatment issues have clearly arisen since there is no wastewater and solid waste treatment effective strategy. All hotel sector waste is stored next to the beach, near the Roman road and the archaeological site (Fig.11). Mass tourism comes at the expense of responsible tourism and thus represents a threat to the cultural, human, and ecological heritage of Djerba.



Figure 11. Tourism solid waste in Djerba

V. Cumulative effect of coastal and maritime activities on Coastal/Maritime tourism

There is a cumulative effect of tourism, urbanization, climatic changes, and pollution and fishing activities on the north coastline of Djerba.

Tourism and urbanization have affected the artificialization of the coast in Midoun and Houmet Souk region. More specifically, tourism and related urbanization exert pressure on the coastline. These pressures mainly take the form of coastal erosion and pollution of bathing water following the discharge of treated wastewater and waste.

Pollution has degraded the quality of marine ecosystems and coastlines and illegal fishing activities accentuate the impact on marine ecosystems.

For example, the *Posidonia oceanica* meadow around Djerba is in continuous decline. This phanerogam is a nursery area for marine species. It also represents a barrier, reducing the effect of waves on the coastline and thus protecting the beaches from the phenomenon of erosion.

The impact of climate changes on this semi-arid region is clearly mirrored in temperature elevation and reduction in rainwater inputs and in groundwater overexploitation (Fig.12). It is an arid area, where the pressure on the outer waters is very strong and very old. The coastal water tables are already in a much-degraded state like the Zarzis tablecloth. The Ben Gardane water table has a very high salinity due to the nature of the gypsum and saliferous soils of this endorheic zone and to the presence of a big number of Coastal Sabkhas.

Most dry tailings from the wells are between 9 and 15 g (APAL, 2019).

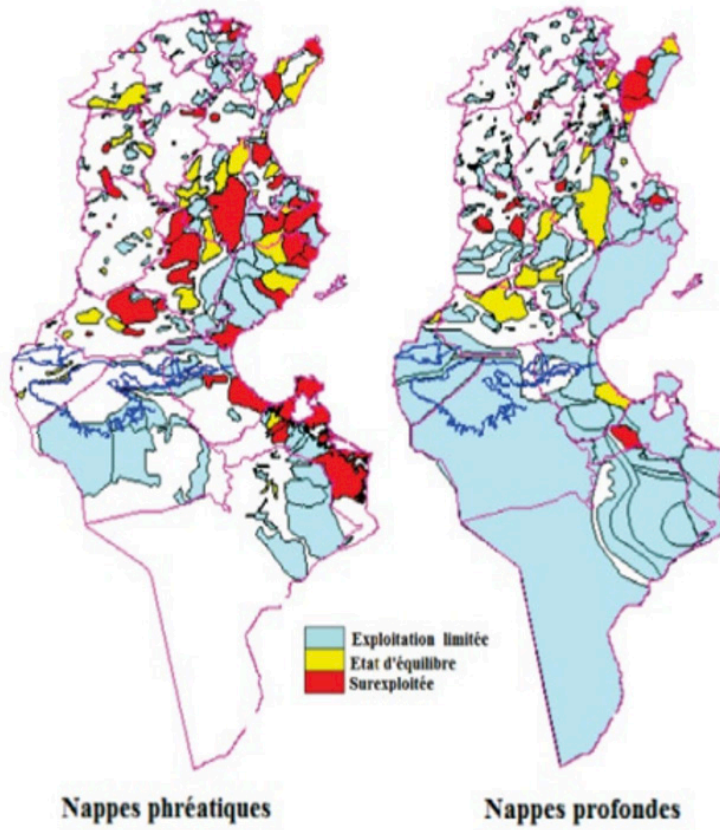


Figure 12. State of exploitation of the water tables of Tunisia

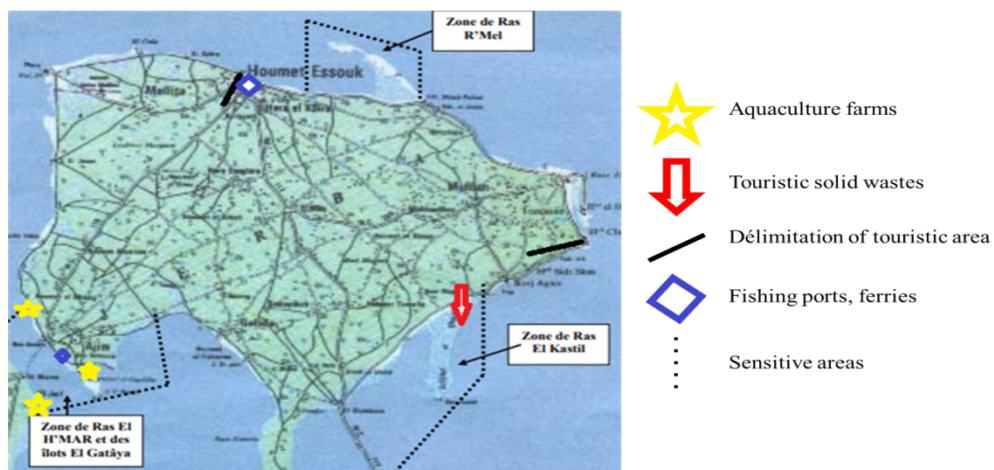


Figure 13. Coastal and maritime activities in Djerba Island

VI. Policies, plans and programs to reduce land-sea use conflicts

In Tunisia, the public maritime protection and the marine ecosystems preservation are currently experiencing a certain revival of interest thanks to the industrial establishment's disastrous consequences, abusive exploitation and growing public concern for the coast, as well as to the sea and its related leisure activities. However, such protection is subject to difficulties which arise mainly from contradictory concerns and issues, between the general interest and particular interests, between industrialists, fishermen and yachtsmen, and between coastal protection and the development of activities related to the sea. It is a delicate issue which depends on the effectiveness of the coastline protection and the public maritime domain.

Moreover, the range of coastal ecosystems, including the public maritime domain, is a territorial space requiring special development to limit its anarchic use that would facilitate violations and infringements. The coastal development control includes the control of the specific risk linked to the coastal retreat phenomenon under the marine erosion influence. Land use planning therefore goes through two stages which are: master development plans and urban development plans. These plans aim at protecting the territorial space concerned by the development of the space use through ensuring the state program implementation, local public authorities, public establishments, and services, and by working towards their coherence within the framework of economic and social development prospects, considering the impact of development on the environment (Law n° 94-122, art. 5).

This component will focus on the different threats of the Tunisian marine ecosystems as well as the possible interactions between the different sources of these threats, particularly fishing, aquaculture, and tourism. Therefore, a general definition of the Maritime Public Domain (DPM) and an introduction to the Agency for Coastal Protection and Development (APAL) and its objectives are given. In a second stage, the trade-offs between the protection of ecosystems, fisheries and aquaculture and the sustainability of tourism in Tunisia are analyzed.

The DPM is made up of all public goods belonging to public persons, which are assigned for public use, and which are either located near the sea or implanted in the interest of maritime navigation, whether natural or artificial. Moreover, it has been accepted that the coastline is a wider space than the maritime public domain, defined by Law n° 95-72 of 24 July 1995 creating APAL, in its article 1 as being “the contact zone that concretizes the ecological, natural and biological relationship between land and sea and their direct and indirect interaction”. As for the shoreline, it is conceived as the meeting point between the coast and the maritime public domain, it is the part alternately covered by the tides, the leis and the relays of the sea and the dunes. It represents at the same time a part of the natural maritime public domain and a part of the coastline. The coast is a less broad notion than the one of maritime public domain. In fact, it is a point of contact between land and sea, which borders the continent. It is also the

border between the coast and the maritime public domain. It is a longitudinal line that follows the configuration of the maritime-land zone. In addition, the natural maritime public domain includes, on the seaside, the internal waters, territorial waters, soil, and subsoil of the continental shelf, as these spaces are delimited by the texts and bilateral agreements concerning the limits of the Tunisian maritime territory, the exclusive fishing zone and the exclusive economic zone (Law No. 95-73, art. 2).

Finally, it is important to note that the coastline comprises, on the one hand, the natural components of the maritime public domain and, on the other hand, “inland areas within variable limits according to the degree of climatic, natural and human interaction between them and the sea, such as coastal forests, estuaries, marine capes and coastal wetlands” (Law n°95-72, art. 1).

VII. MSP and ICZM as tools to address coastal and maritime activities interactions

Perceived by European Union (EU) and numerous international organizations as the most appropriate approach for the development and the management of coastal zones, the approach of Integrated Coastal Zone Management (ICZM) is defined as “a dynamic process for the sustainable management and use of coastal zones, taking into account at the fragility of coastal ecosystems and landscapes, the diversity of activities and uses, their interactions, the maritime orientation of certain activities and uses and their impact on both the marine and land parts.

It aims to provide a comprehensive understanding of the relationships between coastal resources, their uses, and the mutual impacts of development on the economy and the environment.

The main legal instrument for implementing ICZM in the Mediterranean is the Protocol on Integrated Coastal Zone Management in the Mediterranean (ICZM Protocol). It is the seventh Protocol in the framework of the Barcelona Convention and completes the set of Protocols for the Protection of the Marine Environment and the Coastal Mediterranean Region. It allows the Mediterranean countries to better manage and further protect their coastal zones, as well as to deal with the emerging coastal environmental challenges, such as climate change. It is a unique legal instrument on ICZM in the entire international community.

The legal basis provided by the ICZM Protocol constitutes a framework to regulate economic activities along the coast and is therefore a valuable governance tool for improving the Tourism sustainability.

Although Tunisia signed the Protocol on Integrated Coastal Zone Management in 2008, the ratification of this protocol has not yet taken place. This law project was expected to be presented in the national assembly for a vote in 2011 but the revolution and the succession of governments have created other “priorities” which have hindered the ratification of the ICZM Protocol.

APAL has been designated as the national focal point for the Protocol and is responsible for ensuring its implementation. Many actions have been undertaken by the Tunisian authorities, with the support of international cooperation (GIZ, UNDP, WB, *etc.*), to give climate change an important place in the country’s development policy.

VIII. Actions to reduce the effects of land-sea uses by fostering Blue Growth

The concepts of “blue economy” and “blue growth” emerged before Rio + 20; The 2012 United Nations Conference on Sustainable Development (UNCSD). During formal negotiations and less formal UNCSD discussions, the concept of the blue economy has been used by different institutions with different meanings, often inconsistently. Since then, there is no officially established definition of the blue economy. In fact, the eco-union definition has been adopted for this report: The blue economy is a non-polluting economy, circular and efficient in the use of resources, based on consumption practices and sustainable production, which promotes human well-being and social equality and creates economic value and employment, while significantly reducing environmental risks and resource shortages. The blue economy helps to preserve the health of the Mediterranean marine and coastal ecosystems, while ensuring a continuous supply of goods and services for present and future generations.

The gradual establishment of a blue economy is based on the sustainable development of several essential socio-economic activities.

In Djerba and concerning fishing activities, the implementation of EAF: Eco-systemic Approach in Fisheries in 2018 is an important action to reduce the conflict with fishing activities with a participative approach.

X. Conclusions

Tunisia is a country largely open to the sea. More than 70% of the population and socio-economic activities are now located on the coastal fringe. This excessive concentration has been achieved gradually over time because the Tunisian coast offers a multitude of geographical, natural, and climatic opportunities.

Djerba Island is one of the most coveted coastal areas of the country. In fact, tourists concerned with breathtaking picturesque sites, the fishery resources exploitation through fishing, maritime routes use, the seabed use for the telecommunications connection setting are concrete proofs of the interrelation that exists between coastal and marine ecosystems and human activities.

In this document, and through participative and sectoral analyses, the interrelationship between touristic activity and maritime activities as well as the cumulative effect of these interactions have been clearly identified and highlighted.

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