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REPLICATION ACTIVITY: INITIATING THE ESTABLISHMENT OF A NEW MPA IN TUNISIA

Socio-economic study for the creation of a Marine Protected Area in the north-eastern part of the Kerkennah Islands in Tunisia

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I. GENERAL INTRODUCTION

1.1. History and geographical situation

1.1.1. History

The many remains scattered through the area of study bear witness to a Phoenician presence since the 12th century BC. The Phoenicians, a sea people, developed an economy based on trade and agriculture and saw the Kerkennah archipelago as a trading post and stopover for ships coming from the east. Later, with the founding of Carthage in 814 BC, they settled in Kerkennah and built the town and port of Cercina (in El H'sar) on the western coast of Kerkennah. The Greek historian Herodotus in the 5th century spoke of Kyrannis (Kerkennah) as a prosperous island famous for its vineyards and olive groves and its major trading port. There are many Phoenician ruins in Kerkennah, such as the Punic underground tombs in Karraba, near Borj El H'sar, and in Mellita (Fehri A., 2000 and 2003).

After the Phoenicians came the Romans, who occupied the archipelago and settled in the same places as did their predecessors, expanding into other areas. They extended the port of Cercina to found a trading and military complex and a big town called the free town (Titus Livy). They also built the bridge (El Kantra) between the two islands (Gharbi Mellita and Cherguia) to facilitate the carrying of agricultural goods from Gharbi Island to the port of Cercina (Fehri A. 2003).

After this time of prosperity the strategic importance of Kerkennah gradually dwindled over the Islamic period. In the Aghlabite and Hafsid age (9th and 10th century AD) it had not completely lost its strategic place, but in the 11th century, with the Hilalian invasion, Kerkennah suffered economically, for the Hilalian tribes gave it over for their cattle.

From the 12th century on, the Kerkennah archipelago was attacked first by the Italian, then by the Spanish and finally by the Ottoman Turks (16th century). These many attacks made the people flee the west coast to settle on the east coast, where shallows prevented big ships from sailing and landing, or in the interior; this is how the present village network was set up (Kebaïli Tarchouna M., 2014).

1.1.2. Geographical location

The Kerkennah archipelago is located on the eastern coast of Tunisia, in the north of the Gulf of Gabès, about 18 km. east of the town of Sfax. It spreads for 35 km. from north-east to south-west and has a variable width of at most 14 km., giving a surface area of about 150 sq. km. The coastline is 174 km., 171.5 of which is stable (DGEQV, 2012).

The archipelago is made up of two main islands: Charguia Island is the big one, and Gharbi Island or Mellita lies to the south-west. There are 12 uninhabited islets concentrated in the northern part, among them Gremdi (207 hectares), Roumadiya (160 hectares), Rakadia (5 hectares), Sefnou (50 hectares) and Charmandia (3.3 hectares). These have been classed by APAL as sensitive littoral areas (APAL, 2001).

The archipelago is characterized by the size of its village network, including 18 villages organised as 10 *imadas* (Remla, El Ataya, Sidi Frej, Mellita, El Kallabine, Ennajet, Echargui,

El Kraten, Ouled Kacem and El Kantra). The most populated villages are El Kraten, Ennajet, El Ataya, Remla and Mellita.
The archipelago is made up of a single delegation and governed under a single municipality; these are sited in Remla, which constitutes the archipelago's administrative centre. As well as these two administrations, Remla has a tax office, two banks, a hospital, three chemist's, a secondary school, a lycée, a community arts centre, a library, a youth club, a stadium, a weekly market and several commercial outlets, more than in the other villages.

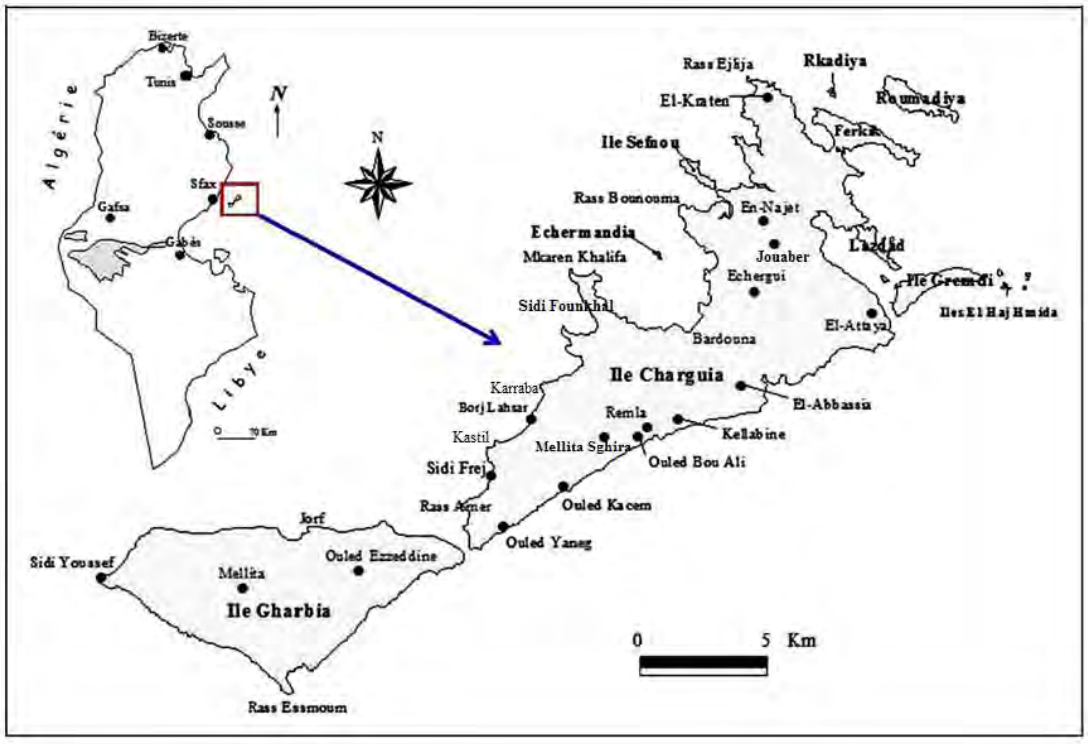


Fig. 1. Geographical location

1.2. Physical environment

1.2.1. Bioclimatic conditions

The area of study possesses an arid Mediterranean climate. The average annual temperature is about 18.8° C. The maximum and minimum average temperatures occur respectively in August (26.3° C) and January (11° C) (INM, 2011 and 2012).

Rainfall is characterized by a big annual and seasonal irregularity. In 1995-6, 591 mm. was recorded as against only 87 mm. in 1987-8. During the year, there is also great variability: October, the wettest month, has an average 44 mm., almost 1/5 of average annual rainfall; July is the driest month, with an average of less than 1 mm. Autumn sees 44.5% of total annual rainfall as against 32.2% for winter (Fehri, 2011).

The dominant winds come from the northern (north, north-east) and eastern sectors in summer and spring and from the western sectors (west) in autumn and winter.

Thus, the bioclimatic conditions of the archipelago are one of the main reasons for the vulnerability of the natural environment in the Kerkennah Islands. The low rainfall, the

relatively high temperatures, and the winds (although not violent) cause active evaporation that deprives the soil of much of its humidity and results in a big water deficit of over 1,036 mm./year (Fehri, 2011).

1.2.2. Geomorphology

The area of study is characterized by a very flat relief. Its topography is made up of a succession of flatlands, occupied by *sebkhas*, *shorrs* and irregular hillocks. The highest point is no more than 13 m., in Ouled Ezzedine. Kerkennah's very extensive coastal *sebkhas* lie at the edge of the sea, which allows rainwater to run off into the sea. They are always very low, very often less than 2 m. high; their outside margins are frequently affected by seawater. During storms they can be completely flooded (DGEQV, 2012).

The accelerated rise in sea level and the advance of the sea onto low-lying land causes the forming of *shorrs*. A *shorr* is originally a coastal *sebkha* criss-crossed by run-off channels with clumps of halophilous vegetation; then a silty soil forms; finally the *shorr* is crossed by tidal channels.

The archipelago's shore shows a varied morphology in which cliffs, low rocky coasts and beaches alternate. The biggest cliffs are in the sectors of Borj El H'sar and Jorf on the western façade. The low rocky coasts are made up particularly of sandstone formations of marine origin inherited from the last interglacial (Tyrrhenian). They are frequent, especially on the western coast and in the capes.

The beaches only have a very secondary place. Those of a certain size back on to little capes or occupy the bottom of coves and exist mainly in Sidi Frej and Founkhal (APAL, 2008).

1.2.3. Water resources

The archipelago is characterized by sparse water resources. The features of these resources basically depend on climatic, geological and hydrogeological conditions. Because of the flat topography and many *sebkhas* that communicate with the sea, ground waters (*oueds*) are practically inexistent.

The low potential in underground water is constituted by Kerkennah's superficial phreatic sheets and Sfax's deep sheet that extends from north to south over about a hundred km.

The superficial sheets are exploited by surface wells of little depth, usually sunk in the centre of little basins where surface water accumulates. The Kerkennah Islands currently have over 400 wells that pump out a water of average-to-mediocre quality, where the dry residue is often over 2 g/l. As regards the Sfax deep sheet, it presents water of average quality with a dry residue that varies between 3.5 g/l and 4.5 g/l. This sheet is currently exploited by two artesian wells managed by the SONEDE, whose water is destined to supply drinking water after desalination (www.listephoenix.com). The brackish water desalination plant in Kerkennah is the first to be installed in Tunisia since 1983; its capacity is 3,300 cubic metres a day; it uses the inverse osmosis technique (DGAT, 2011).

1.2.4. Soil resources

Pedogenesis has been strongly conditioned by the geological substratum, climate and topography and the insular nature of Kerkennah, which has encouraged the forming of salty to alkaline land with degraded structure, and saline soil with crumbly surface structure, which occupy 7,315 hectares, i.e. about 47% of the total surface area of the archipelago. These soils are characteristic of the *sebkhas* and their edges (Fehri, 2011).

It is in the lower parts of the breaks in the slopes that loose formations with running water offer the thickest soil and thus explain the presence of the beautiful orchards of Sidi Ezzorai, Sidi Frej and Ouled Yaneg. Other loose outcrops are the dunes that appear at the edges of some *sebkhas* in Remla and between Mellita and Sidi Yousef (Oueslati, 1995).

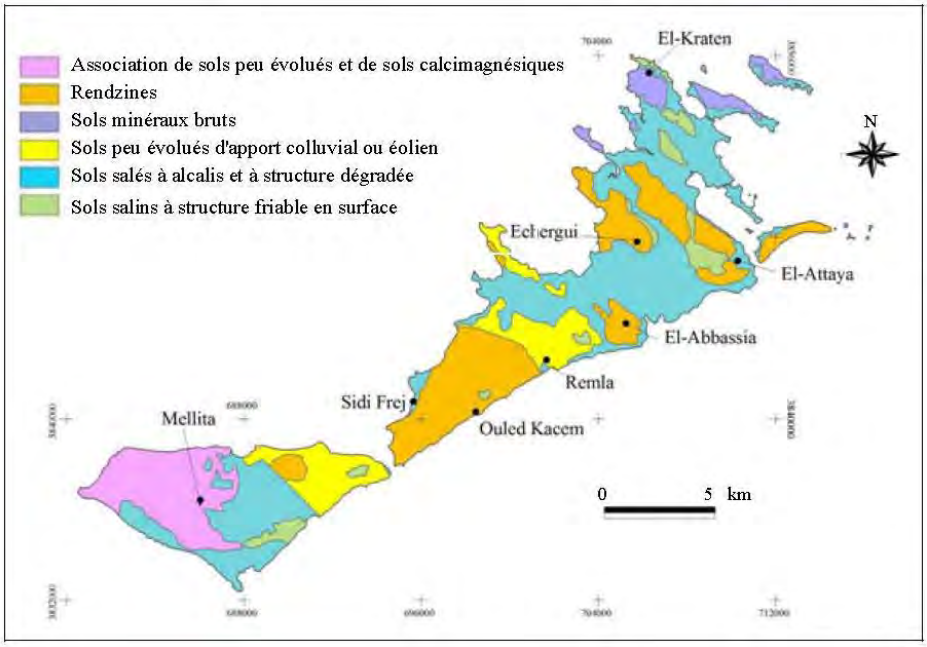


Fig. 2. Pedological map of the Kerkennah archipelago (Fehri, 2011)

1.3. Oceanology

1.3.1. Underwater morphology and depths

The waters of Kerkennah are not deep, like the low continental topography. The archipelago hardly emerges from a vast, shallow platform in the north of the Gulf of Gabès extending from Ras Kaboudia to Mahares. The maximum depth is observed in the Sfax canal with an average depth of 15 m. and a maximum of 27 m. Around Kerkennah, the platform is characterized by shallow water because the -10 isobath is reached in some places within 65 km. of the coast.

Yet despite the lack of deep water, the underwater topography is very jagged. It is characterized by tidal channels or *oueds*, depressions or *bhiras*, shallows or *d'har et tsir*. These, some a few dm. high at 1-2 m. down, stretch out and surround the *bhiras* of El Gremdi (max. depth 2.7 m.), El Abbassia (max. depth 2.3 m.), El Hassar (max. depth 3.8 m.) etc. As well as these depressions, there are other vast platforms called '*Gh'dira'* whose depth is between 2 and 9 metres. They are in the north-east of Kerkennah near Rommadia islet, such as *Gh'diret* Errameh, El Mazghenni, El Khraib etc. (Kebaïli Tarchouna M., 2014).

The banks between the -5 m. isobath and the southern and eastern shores are perpendicular to the coast and link it to another bank lying parallel to the coast that is about 77 km. long and that surrounds the island to the south and north (DGEQV, 2012).

The banks lying perpendicular to the coast are cut into by 13 underwater *oueds* that are between 3 and 10 m. deep and are usually perpendicular to the coast. The biggest is Oued Mimoun (near El Ataya); it is the deepest (max. 13 m.), the longest (6 km.), and the widest (300-800 m.) (Oueslati, 1986). Other *oueds* are fairly sizeable: Bouzrara, Saadoune, Issa, El Ouest etc.

According to the nature of the plant cover, the banks are called *D'har* or *T'ser*: the *T'ser* vegetation is denser and taller than that of the *D'har*. The shallows called *T'ser* are found north and north-east of the archipelago at a distance of 10-25 m. from the shore and have a depth of 1-1.5 m (Kebaïli Tarchouna M., 2014).

1.3.2. Hydrodynamics

1.3.2.1. Tides

The Gulf of Gabès is known for the size of its tides compared to all the other Mediterranean coasts. As part of the Gulf of Gabès, the Kerkennah archipelago thus has a sizeable tide. This is a twice-daily tide (2 high tides and 2 low tides a day). The average size is about 0.8 m. But although the tidal range is small compared to other areas in the Gulf of Gabès, in Kerkennah the tide is more obvious because of the shallowness of the water around its coasts. The currents at high tide simultaneously penetrates the north-eastern and south-western tips of the Kerkennah canal, and the currents at ebb tide drain out of these two tips. The maximum speed at high tide is 1 m./s (Amari, 1984).

1.3.2.2. Swell and littoral drift

The system of swell currents is closely related to that of the winds that cause them in terms of both speed and direction. According to their direction, five kinds of swell can be distinguished: western, north-western, north-to-north-east, south-south-east and southern and lastly western. The most frequent and the most violent are those from the west and the north-west that make up 22.6% of annual occurrences with speeds of up to 16 m./s (APAL, 2008). They give rise to a big drift current going from north-west to south-east, causing coastal erosion that can be seen on the west and north costs of Chergui Island.

1.3.2.3. Hydrology

1.3.2.3.1. Temperatures and salinity

The values for temperature and salinity are representative of the archipelago's hydrological, climate, and geomorphological conditions.

As to surface temperature, the thermal difference between the hot and cold seasons is very marked: some 13.3° C. In the area of study, the winter temperature of the surface water is 13.2° C; it can be over 26.5° C in summer (Oueslati, 1986). The values for salinity also show a relatively great variation, between 37.5 and 39‰.

The high values for temperature and salinity of the superficial water is due to exposure to the sun, sparse rainfall, lack of run-off water and, especially, the small influence of the big marine currents with relatively low temperature and salinity, like the Atlantic current.

1.3.2.3.2. Sediment

The beds of the Gulf of Gabès are made of loose, fine chalky sediment. The shore of the archipelago is characterized by often fine sediment with a silty-sandy facies, especially over the shallows where the fixed fisheries are dropped. The sediment is usually carried by swell currents, giving rise to its accumulation through deposit and decantation, especially off the archipelago's northern and southern coasts (APAL, 2008).

1.4. Biological heritage

1.4.1. Marine environment

The benthos of the area of study, particularly in the archipelago, seems relatively original compared to that of all the other parts of the Mediterranean. This specificity is true for both quality (presence of rare and endemic species and species threatened with extinction) and quantity.

As to algae, the most recent campaigns (APAL, 2011) have enabled 30 species to be identified, 8 chlorobionta (green algae), 12 rhodobionta (red algae) and 10 xenobionta (brown algae). The distribution of the main species going from the coast to the open sea is as follows:

- The foreshore area where the tides come in and out is characterized by the presence of small sparse prairies of the dwarf phanerogam *Zostera noltii*, characteristic of the superficial silty sands
- The shallower coastal areas shelter prairies with wide areas of *Cymodocea nodosa*. It develops everywhere around the islands at depths of between 0.5 m. and 2-3 metres and is particularly sizeable in the north-west
- In turbid areas with dominance of a silty substratum is found, both mixed with *Cymodocea nodosa* and then in a pure population, a fairly scattered lawn formed by the sub-tropical Chlorophycea alga *Caulerpa prolifera*
- On sandy-silty and sandy substrata, from 3-4 metres down, alignments of the big Mediterranean endemic phanerogam *Posidonia oceanica* can be found. The Posidonias present an enormous development north, west and north-east of the archipelago (APAL, 2011) where the meadow is almost continuous between 3 and 30 metres. The Kerkennah meadow **has great heritage value** because it is the widest on the Tunisian littoral. This is particularly important for the archipelago's ecosystem as a whole since these meadows play a major ecological part.

Concerning the benthic macrofauna, the most exhaustive prospection, one that looked at both coastal areas and high sea areas, was done in 1998 (in DGEQV, 2012); in it, 122 species were identified. *Pinctada radiata* was the most abundant species, a place previously held by the noble pen shell *Pinna nobilis*, which has since become very rare. Then came the little starfish *Asterina panceri* and the little sea cucumber *Ocnus petiti* that was formerly absent. The bearded mussel *Modiolus barbatus*, which in 1998 was present in 76% of the stations, had dropped considerably.

Despite these changes in the faunistic biodiversity of the archipelago, the species that have high heritage value are:

- the noble pen shell *Pinna nobilis*, a species that is rare in the Mediterranean, and whose quantity in the Kerkennah beds with meadows is relatively great
- the species *Gibbula umbilicaris latior* with its albino form, which, despite environmental constraints, remains abundant.

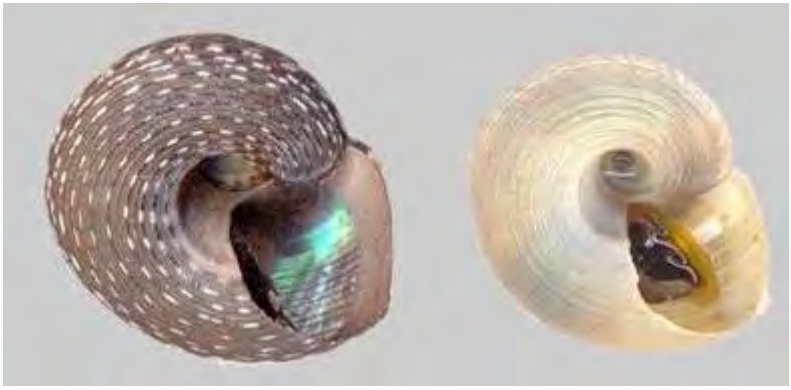


Fig. 3. Kerkennah – *Gibbula umbilicaris latior* and its albino form (IHE photo, 2012)

Concerning the ichthyofauna, in all 177 species of bony fish and 32 species of cartilaginous fishes were recorded in the Gulf of Gabès area (DGEQV, 2012). A more detailed description of these resources in the archipelago will be given in the part on fishing activity in the present report.

For marine vertebrates, Bradai in 2000 inventories 6 species of marine mammals, with 3 odontocetes (the bottlenose dolphin, the striped dolphin and the Risso's dolphin), and 3 mysticetes (the fin whale, the megaptera and the little rorqual) and 3 species of marine turtle (the loggerhead turtle, the green turtle and the leatherback turtle). All these species are of high heritage value and are all threatened and protected by various conventions ratified by Tunisia.

As regards birds, the archipelago, especially the inter-tidal areas (foreshore), are very important for limicolous and other species that winter or migrate there. Nearly 40 species were counted, giving a maximum of about 8,000 individuals (Wetlands international, 2003 in DGEQV, 2012).

The Kerkennah Islands are recognised as a Zone Important for the Conservation of Birds (ZICO) because they are an important wintering area for the cormorant Phalacrocorax carbo, a protected species that feeds almost exclusively on fishes. It is one of those with great heritage value; others whose status seems to be very worrying at archipelago level are the Caspian tern *Sterna caspia* (nests disturbed), the sandpiper *Calidris alpina* (disturbance on the foreshore), the stone curlew *Burhinus oedicnemus* (in the steppe areas) (DGEQV, 2012).

1.4.2. Land environment

According to the IHE, 2012, the floristic inventory of the Kerkennah Islands shows 4 main plant associations:

- The Artemisia herba-alba and Asparagus albus association

- The Lygeum spartum and Thymaelea hirsuta association
- The Frankenia thymifolia and Suaeda mollis association
- The Arthrocnemum indicum and Halocnemum strobilaceum association.

The 3 formations have a halophilous tendency.

In some places where the plant cover is well-preserved, the archipelago has a varied floristic gathering where certain rare high heritage value species are present, such as *Cenchrus ciliaris*. This species is basically present in the islet of Gremdi.

The Kerkennah date palm is widespread throughout the archipelago naturally as clumps. It is seen as spontaneously growing, not cultivated.

The land fauna is less important than the marine fauna because of the aridity of the climate. There are insects and some mammals like the hare. The herpetofauna is made up of 10 species of reptile, between lizards and snakes (not venomous).

1.5. Landscape and cultural values

1.5.1. Natural landscapes

The area of study has major landscape advantages. Even though the underwater landscapes are not as varied as in the northern part of Tunisia, we remark the importance of the *Cymodocea nodosa* prairies on the coast going down to 2-3 metres, and especially the Posidonia meadow, the most extensive in Tunisia, going down to 40 metres in some places (DGEQV, 2012).

The littoral landscapes are mainly made up of sea cliffs that form most of the coast; they are usually small, rarely more than 3-4 metres. The low rocky coasts are also numerous and always cut out of carbonated rock. The uninhabited islets in the north of Kerkennah, the *sebkhas*, the *shorrs* and the maritime marshes are much more important than the cliffs and rocky coasts in that they constitute wintering places for several migratory species of bird.

Thus the aesthetic quality of the landscape, and the possession of a sizeable number of threatened species that have become rare in the Mediterranean, confirm the interest of protecting the archipelago.

1.5.2. Cultural and historical heritage

The area possesses the elements of an archaeological and cultural heritage:

- Borj El H'sar, the biggest archaeological site in Kerkennah, with its Turkish fort
- The Roman villa in Cercina which runs into the sea; digs have shown the presence of many masterpieces like frescos, mosaics, sculptures and ceramics (Chelbi, 1995)
- The classical port of Cercina and its lighthouse (Hajret El Baou), also under water. Digs in this port have found things that are unique in the world: salting and soaking vats, ovens, fishponds (Chelbi, 1995)
- Remains of a Punic and Roman city on the eastern front of the Sidi Founkhal peninsular (Oueslati, 1995)
- The many *marabout* sites that form a belt around the island, especially the eastern coast: Sidi Youssef, Sidi Salem, Sidi Gaaben, Sidi Khalfoun, etc.

- Old cisterns (*festkia*) that bear witness to a way of life and a rational management of water
- Festivals – to celebrate the octopus, the mermaid and the dates
- Traditional, nearly four-hundred-year old, *Charfia* fishing and fishing craft that are typical of the archipelago, like *felouques* and *louds*.

This very rich heritage should be strengthened and made best use of, among other things to satisfy the objectives of ecological tourism.

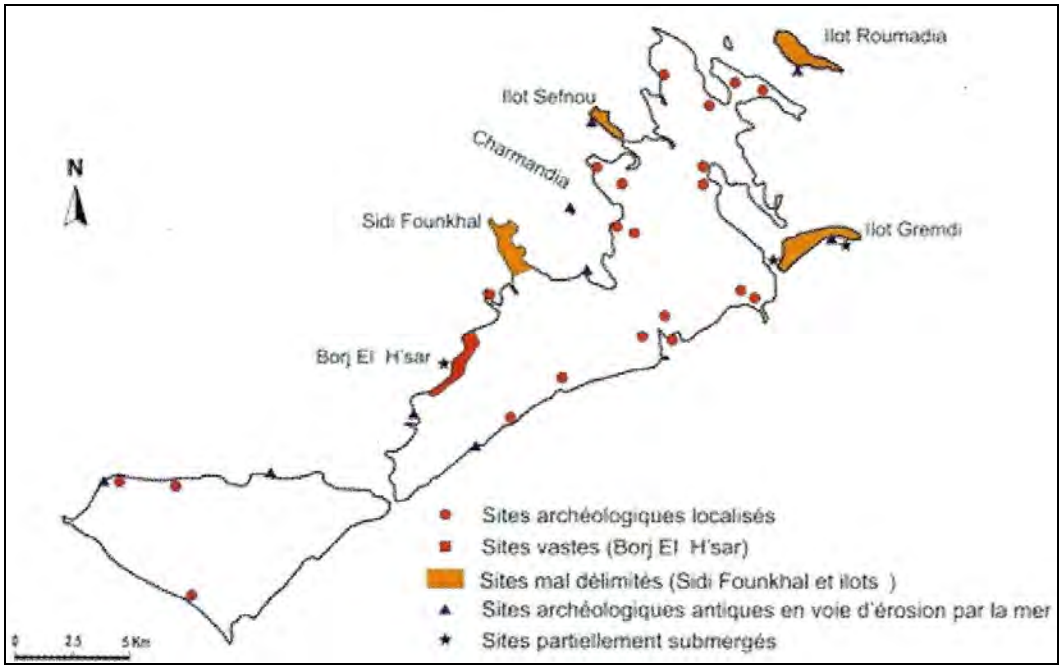


Fig. 4. Archaeological map of the Kerkennah archipelago (Kebaïli Tarchouna, 2014)

II. THE SOCIO-ECONOMIC CONTEXT

2.1. Demographic data

2.1.1. Breakdown of the population

The Kerkennah delegation has 15,501 residents, i.e. about 1.6% of the total population of the *Gouvernorat* of Sfax (INS, 2014).

With a demographic density of 99 residents/sq. km., the Kerkennah delegation could be seen as having a fairly strong population since its density is higher than the national average (64 res./km^2.).

All the people of Kerkennah live in a communal environment, the seat of the commune being in Ramla.

Table 1. Population, density and rate of urbanization in the Kerkennah delegation

	Kerkennah delegation	**Sfax governorat**	**Tunisia**
Surface area (km^2.)	157	7545	163610
Number of residents	15501	928951	10531278
Demographic density (res./km^2.)	99	123	64
Rate of urbanization (%)	100	62,3	67,7

INS, 2014

The breakdown of the Kerkennah population by sector shows a concentration in the sectors of Mellita, El Atiya and El Ramla (65%). The sectors of El Kantra, Sidi Frej and El Chargui are less populated.

The gender breakdown of the population shows a balance between men and women. Males represent 49.9%, comparable to the national level but slightly less than that of the *Gouvernorat* of Sfax (50.3%).

Regarding the migratory balance recorded between the last two censuses, we notice an 8% increase in the Kerkennah population, i.e. a rate greater than that recorded for the *Gouvernorat* of Sfax (3%) or for Tunisia generally (4%). 4 sectors out of 10 have seen a reduction in their numbers of between -18% (in El Chargui) and -30% (in Sidi Frej). The other 6 sectors have seen a fairly significant rise in their populations, varying between 11% in Mellita and 26% in El Ramla.

Table 2. Breakdown of the population of Kerkennah by sector and by gender

Sector (*Imada*)	**Male**	**Female**	**Population**	**% of total**	**Variation 2004-14**	**Masculinity rate**
El Ataya	1725	1743	3468	**22,4**	391	49,7
El Ramla	1293	1330	2623	**16,9**	537	49,3
Sidi Frej	209	191	400	2,6	-169	52,3
Melita	1976	1966	3942	**25,4**	386	50,1

Sector (*Imada*)	Male	Female	Population	% of total	Variation 2004-14	Masculinity rate
El Kalabine	471	464	935	6,0	172	50,4
En-Najet	481	506	987	6,4	-255	48,7
El Chargui	145	144	289	1,9	-64	50,2
El Kantra	248	264	512	3,3	-148	48,4
El Kraten	633	655	1288	8,3	135	49,1
Ouled Kacem	552	505	1057	6,8	116	52,2
Kerkenah delegation	**7733**	**7768**	**15501**	100,0	1101	**49,9**
Sfax Governorat	**480700**	**474721**	**955421**		**26470**	**50,3**
Tunisie	**5472391**	**5510363**	**10982754**		**451476**	**49,8**

INS, 2014

2.1.2. Demographic structure

The table below presents a comparison between the demographic structures (by age bracket) of the population of Kerkennah, the *Gouvernorat* of Sfax, and Tunisia generally.

Table 3. Breakdown of the Kerkennah population by age bracket

Age bracket	0-14 ans	15-29 ans	30-39 ans	40-49 ans	50-59 ans	60 and over
Kerkennah	21,7%	23,5%	15,5%	13,3%	7,8%	18,4%
Sfax	23,4%	24,3%	16,7%	12,8%	11,2%	11,6%
Tunisia	23,8%	24,5%	16,4%	12,8%	10,8%	11,7%

INS, 2004 and 2014

Kerkennah's demographic structure is different from that of the *Gouvernorat* of Sfax and Tunisia as a whole. Its population is elderly, for the over-60s age bracket represents 18.4% of total population. This rate is higher than those of the Sfax *Gouvernorat* (11.6%) and Tunisia as a whole (11.7%).

As to the 0-14, 15-29 and 30-39 age brackets, these present higher rates than those of the Sfax *Gouvernorat* and Tunisia as a whole.

This could partly indicate that young people are leaving the archipelago to continue their higher education or to find other job opportunities in the interior of the country. This would also explain the gradual drop in the labour supply, particularly in the fishing sector in Kerkennah.

2.1.3. Migration

Given that the data from the 2014 census has not yet been processed, we are only looking at the data from the 1994 and 2004 censuses.

Since the first year of independence, the migratory balance has always been negative; the 1956-66 decade witnessed a deficit of 1,117 residents.

This deficit was 410 residents in 1994 and 147 in 2004. The breakdown of this last deficit by type of migration and by gender is as follows:

- The internal migratory balance was -85 residents (+97 males and -182 females); the negative balance for women could be attributed to migration due to marriage
- For outside migration (abroad), the balance is -62 residents, all male.

2.2. Main indicators of socio-economic development in Kerkennah

2.2.1. Rate of school attendance and illiteracy

A breakdown of the population older than 10 years old by educational level shows that the Kerkennah delegation is well ahead of the Sfax *Gouvernorat* and national averages in terms of rate of attendance at basic school, but falls behind in secondary and higher education. The *Gouvernorat* of Medenine holds the first position in terms of level of primary and secondary school attendance, while Sfax *Gouvernorat* is ahead in terms of level of higher education. This reflects the very high drop-out rate at secondary and higher educational level.

Moreover, the interest the people living in the area of study have in education is very well represented by an illiteracy rate that is under the national average.

Table 4. Breakdown of the population of Kerkennah by level of school attendance

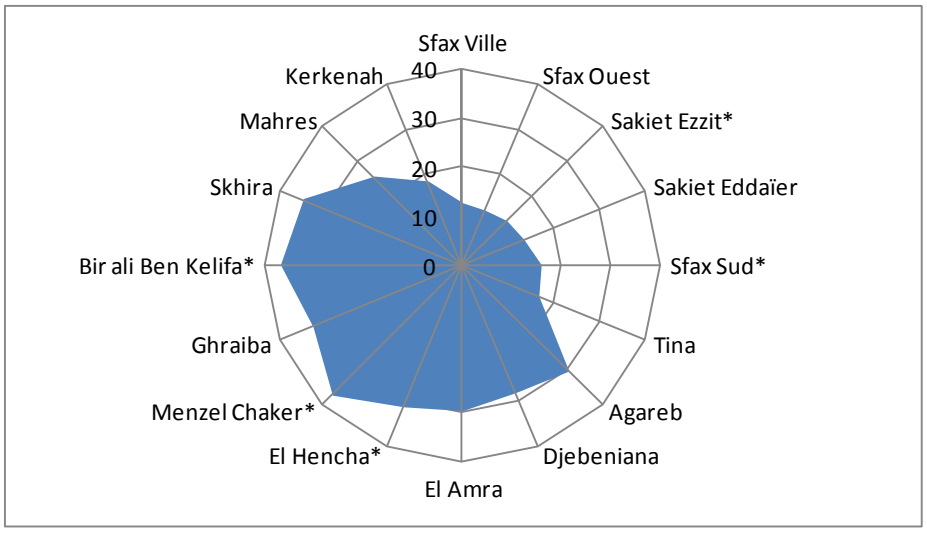
	Illiterate	Basic education	Secondary	Higher	Not stated
Kerkennah	18,3%	43%	25,8%	9%	3,9%
Sfax	16,6%	34,8%	34,7%	12,5%	1,4%
Tunisia	18,8%	32,5%	35,0%	12,8%	0,9%

INS, 2004 and 2014

In comparison with the other delegations of the Sfax *Gouvernorat*, we note that the further you go from the centre of the *Gouvernorat*, the greater is the rate of illiteracy.

Moreover, there is no correlation between this rate and the geographical position of the delegation (littoral or not).

The minimum rate is recorded in the West Sfax delegation (11.7%) and the maximum rate in the delegation of Menzel Chaker, with 37.3%.



RGPH, 2004

Fig. 5. Variations in the illiteracy rate in the Sfax *Gouvernorat* by delegation

2.2.2. Rate of activity of the population

The rate of over-15s in the population who are actively employed is 34% for the Kerkennah delegation, i.e. a rate lower than that recorded in the Sfax *Gouvernorat* and at national level, which were in 2014 39.6% and 39.4% respectively.

This rate is confirmed by the results of the 2009 Gulf of Gabès socio-economic survey, which gave 35.4% of the surveyed population of Kerkennah as active. Also, the same survey showed that 74.1% of the heads of families, 8.8% of the wives and 40% of the children surveyed worked.

2.2.3. Rate of activity of the population by economic sector

The activity rate by economic sector varies, from the Kerkennah delegation to the Sfax *Gouvernorat* and at national level. The activity rate in the farming and fishing sector is much higher in Kerkennah, with 43% of workers as against 16.5% nationally and only 11.6% in the Sfax *Gouvernorat* (see Table below).

People working in the Sfax *Gouvernorat* and nationally prefer the manufacturing industry sector, which is much less well represented in the Kerkennah delegation.

The results of the 2009 Gulf of Gabès socio-economic survey (CITET, 2009) confirm the importance of fishing in absorbing the archipelago's working population, for it shows that over 60% of the surveyed population lives by maritime activities. The same survey showed that 74% of the heads of families, 18.8% of the wives and 52.5% of the children surveyed worked in the fishing sector.

Table 5. Breakdown (as a %) of Kerkennah's working population by economic sector

	Agriculture and fishing	Manuf. Industries	Mining and energy	Construction and public works	Trade	Transport and communications	Administration and education	Other services
Kerkennah	43,0	7,0	2,0	12,0	8,0	5,0	15,0	8,0
Sfax governorat	11,6	29,8	0,9	12,6	10,5	5,2	15,0	13,0
Tunisia	16,5	19,3	1,2	13,3	10,7	5,5	18,3	13,9

INS, 2004 and 2014

2.2.4. Assessing the rate of unemployment

According to the results of the national survey on population and employment 2010 (INS, 2010a) and the Gulf of Gabes socioeconomic survey (CITET, 2009), the Kerkennah region is marked by an exceedingly low rate of unemployment. This rate, estimated at 5.2%, is far below the national average (13%) and lower than the rate of unemployment in the Sfax *Gouvernorat*, estimated at 7.4%.

The most important fact is the increasing rate of unemployment in the Sfax *Gouvernorat* and the nation between 2010 and 2014. Given that we do not at present have the final unemployment rate for the Kerkennah delegation, we can argue that it could increase but will probably remain less than the Sfax *Gouvernorat* and Tunisia as a whole.

Table 6. Rate of unemployment (as a %) of the population of Kerkennah, the Sfax *Gouvernorat* and the nation

	Kerkennah	Sfax	National
Rate of unemployment (+15 years) 2009/2010	**5,2**	**7,4**	**13**
Rate of unemployment (+15 years) 2014		**12,2**	**14,8**

INS, 2010 and 2014

An analysis of the rate of unemployment per delegation, based on the RGPH 2004 statistics, confirms the existing disparities between the delegations of the Sfax *Gouvernorat*. The most populous delegations and the urban areas generally present low rates, with 8% in Sfax M'dina, 6.5% in south Sfax, and 6.2%. in Kerkennah, while unemployment rates are above 23% in rural delegations like El Amra and Skhira. The low rate in Kerkennah (the lowest of all the Sfax *Gouvernorat*'s delegations) could be attributed to the great demand for employment by the fishing sector, and the migration of young people to the continent or abroad, looking for new and better paid job opportunities.

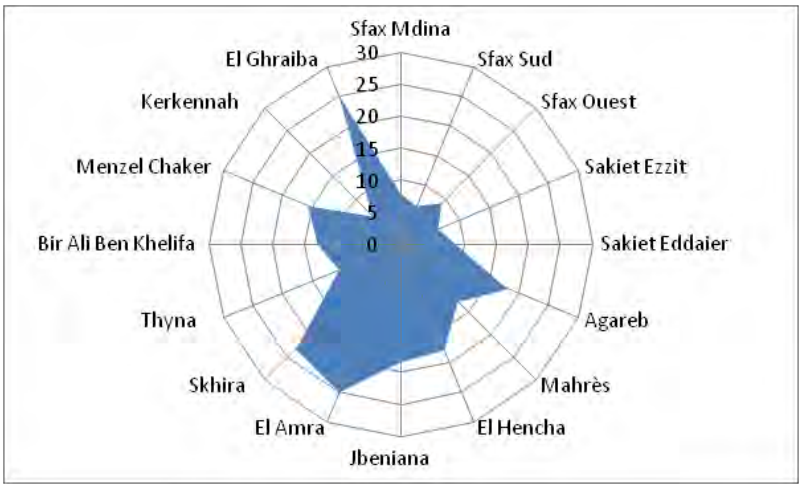


Fig. 6. Variations in the rate of unemployment in the Sfax *Gouvernorat* by delegation

2.2.5. Breakdown of the unemployed according to educational level

According to the results of the 2014 RGPH, a breakdown of the unemployed according to their educational level shows that the rate of unemployment is higher for people with a higher educational level in the Sfax *Gouvernorat.* The rate is over 35% while at national level it is 32% (see Table below). This situation is explained by the economic fabric of these regions, where small and medium-sized businesses and individual properties predominate, where there are few jobs on offer and those that are do not require a high level of qualifications.

The jobless of secondary school level come in second position, with a rate of 34.2% in the Sfax *Gouvernorat.* This rate is, unlike the rate for jobless with higher educational qualifications, under the national average. These facts must urge the state and the private sector to do more to recruit people with higher educational diplomas in the southern part of Tunisia.

Table 7. Changing breakdown as a % of the unemployed by school level between 2004 and 2014

	Year	Illiterate	Primary education	Secondary education	Higher education	Not stated
Sfax	**2004**	2,9	23,3	31,1	41,8	0,9
	2014	7,0	22,4	34,2	35,3	1,1
Tunisie	**2004**	4,5	24,1	39,4	32	0,1
	2014	6,5	20,5	40,5	31,9	0,6

INS, 2004 and 2014

2.3. Households and living conditions

2.3.1. Size of household

According to the 2014 RGPH, the average size of household was 4.01, 3.94 and 4.05 for the delegation of Kerkennah, the Sfax *Gouvernorat* and Tunisia as a whole, respectively.
Gabès and Médenine.

Over time, the size of households has very slightly fallen, since the 2010 statistics show an average size of 4.1 in the Sfax *Gouvernorat* and Tunisia as a whole. And yet the reverse has happened in Kerkennah: the average size of household recorded in 2010 was 3.66 persons (INS, 2010a).

In the Kerkennah delegation the size of household varied between 2.61 persons in the El Kantra sector, to 4.8 and 4.94 persons in El Ramla and Ouled Kacem respectively.

Table 8. Breakdown of number and size of households by sector in the Kerkennah delegation

	Number of people	Number of households	Size of household
El Ataya	3468	947	3,66
El Ramla	2623	546	4,80
Sidi Frej	400	133	3,01
Melita	3942	886	4,45
El Kalabine	935	199	4,70
En-Najet	987	314	3,14
El Chargui	289	94	3,07
El Kantra	512	196	2,61
El Kraten	1288	340	3,79
Ouled Kacem	1057	214	4,94
Kerkennah delegation	15501	3869	**4,01**
Sfax *Gouvernorat*	955421	242740	**3,94**
Tunisia	10982754	2712976	**4,05**

INS, 2014

2.3.2. Drinking water supply and energy source in the households

The households' connection to the SONEDE's drinking water supply is highly satisfactory in the Kerkennah delegation (93.1%). It is higher than the national average (84.4%) and that of the Sfax *Gouvernorat* (85.8%).

It is the same for households' access to bottled gas, with a 99.1% rate for the Kerkennah delegation.

And yet the rate of connecting up of households to the STEG electricity supply is below the averages for the Sfax *Gouvernorat* and Tunisia as a whole (see Table below).

Table 9. Rate of supply to households in the Kerkennah delegation of running water, electricity and gas

Gouvernorat	Running water	Electricity	Bottled gas	Natural gas
Kerkennah	93,1	96,3	99,1	2,1
Sfax *Gouvernorat*	85,8	97,9	97,9	1,8
Total Tunisia	**84,4**	**96,7**	**83,8**	**16**

INS, 2004 and 2014

2.3.3. Indicators of households' living conditions

Compared to the national averages, we note that households in the Kerkennah delegation are relatively lacking in means of comfort compared to those in the Sfax *Gouvernorat* (average) and Tunisia as a whole. This is very clear in terms of possession of a car, air conditioning, and computers and to a lesser extent in terms of possession of a television, a satellite dish, and a mobile phone.

Table 10. Indicators of living conditions of households in the Kerkennah delegation

	Car	Television	Dish Satellite	Air-conditioner	Refrigerator	Oven, gas-fired	Washing machine	Land-line phone	Mobile phone	Computer	Internet
Kerkennah	8,1	89,9	37,4	1,5	91,3	57,4	42	62,2	30,4	2,6	
Sfax	26,7	92,6	46	4,2	88,3	62,2	46,2	48,2	47,6	7,8	19,9
Tunisie	**21**	**90,1**	**46,6**	**5,7**	**81,8**	**52,9**	**34,5**	**35,3**	**46,3**	**7**	**17,5**

INS, 2004 and 2014

2.3.4. Structure of household expenditure according to consumer function

2.3.4.1. Household expenditure in the centre-east of Tunisia

The results of the survey on household consumption done by the INS in 2010 (INS, 2010b) have not been published for *Gouvernorats* or delegations but rather for major regions of Tunisia. We shall be looking at the results for the centre-east region (*Gouvernorats* of Sousse, Monastir, Mahdia and Sfax) and at national level.

According to the Table below, we notice that average annual expenditure per person (DAMP) and per household (DAMM) in the centre-east region are higher than the national average. This region comes in second position after the Tunis district (DAMP = 3,120 TD).

The results at the level of the centre-east region reveal that the largest part of the expenditure is still on food, with 30.5% of total expenditure despite a 3 point drop compared to 2005 (33.3%). This drop was remarked despite the annual evolution in the value of food expenditure per resident of 4.2% in current prices during the same period.

However, transport costs have risen significantly at an annual rate estimated at 9.8% in current prices over the period 2005-2010, causing an increase in the share of this item of expenditure compared with total expenditure from 11.2% in 2005 to 12.6% in 2010, to take third place.

The development in the use of mobile phones has significantly raised related services. Thus, the share of the communications item jumped from 3.6% to 5.9%, recording the biggest average annual growth of 22.8% between 2005 and 2010.

The most striking fact is the fall of the share of expenditure related to the culture and leisure item, which dropped from 5.7% in 2005 to 1.8% in 2010, thus an annual negative variation estimated at -11.2% over the period 2005-2010. People in the centre-east spend more on housing, transport and clothing while neglecting their need for culture and leisure.

Table 11. Structure and variation of average annual expenditure per person and per household in the centre-east region

Year	2005 (Centre-east: Sfax)	2010 (Centre-east: Sfax)	Variation 2005-2010 (Centre-east)	2010 National
Food	33,3	30,5	4,2%	34,8
Housing	24	26,7	9,5%	22,8
Clothing	9	9,6	7,8%	8,8
Hygiene and health care	10	9,9	6,1%	10,3
Transport	11,2	12,6	9,8%	10,7
Telecommunications	3,6	5,9	22,8%	3,7
Education	2,8	2,4	2,1%	2,8
Culture and leisure	5,7	1,8	-11,2%	5,6
Other	0,4	0,6	19,1%	0,5
TOTAL	100	100	6,4%	100
DAMM (in TD)	**8978**	**11102**		**9393**
DAMP (in TD)	**2083**	**2755**		**2325**

INS, 2005 and 2010b

DAMM: Average annual expenditure per household
DAMP: Average annual expenditure per person

2.3.4.2. Household income and expenditure in the Kerkennah area

Faced with the absence of sufficiently broken down official data on household income and expenditure, we had recourse to other sources of information, particularly socio-economic studies and management plans for the sensitive zones of the Gulf of Gabès, collected as part of the project to protect marine and coastal resources in the Gulf of Gabès (Ministry of the Environment/World Bank, 2003-2012).

The data available at the INS do not enable an analysis to be made of the structure of income and expenditure per delegation.

Below we attempt to present some results that we thought pertinent for our study. The information concerns the year 2009 (CITET, 2009).

The average monthly wage of a family living in the Kerkennah Islands was estimated as 300 TD. The main source of income for the Kerkennah population is fishing, for 72% of the workforce works in this sector.

Total annual income of a Kerkennah household was estimated as 6,861 TD, 52.5% of which is made up of wages and 17.2% of which comes from agriculture (see Table below).

Table 12. Structure of average income per household in Kerkennah

Source of income	Amount in TD	Share 0
Wage	3600	52,5
Member of the family in Tunisia	408	5,9
Member of the family abroad	497	7,2
Rent	1178	17,2
Agriculture or breeding	1178	17,2
Total	**6861**	**100,0**

CITET, 2009

The average annual expenditure of a Kerkennah household is 6,550 TD. Food expenditure represents the biggest share of expenditure, with 48.4%, followed by health care and transport (26%) and housing (20.5%) (see Table below).

Table 13. Structure of average expenditure per household in Kerkennah

Nature of expenditure	Annual amount in TD	Share 0
Housing	1344	20,5
Electricity consumption	240	3,7
Water consumption	94	1,4
Food	3168	48,4
Other (health care, transport etc.)	1704	26,0
Total	**6550**	**100,0**

CITET, 2009

By comparing average annual income to annual expenditure, we notice a balance between them; there is thus no possibility of saving for future investment in households or in fishing activity, which explains the precariousness of the social situation of Kerkennah families despite the diversity of their sources of income.

III. ECONOMIC ACTIVITIES AND THE USE OF SPACE

The general features of the area of study, set out above, mean that economic activity is essentially based on the primary sector, marked by a very old form of agriculture and, especially, a fishing activity that constitutes the base of the economy around which life in the archipelago is structured.

3.1. Farming

This activity comprises vegetal production, animal production and fishing.

3.1.1. Potential

The scarcity of water resources, the salinity of the soil, and the frequency of violent winds mean that dry farming, extensive arboriculture and cereal-growing, particularly of barley, and breeding, are the activities most practised. Vines, figs and olive trees are widespread throughout the archipelago. We note the existence of 7 varieties of vine, the most important being 'El Assli', 8 varieties of fig, the most typical being 'El Bithri', and 2 varieties of olives, 'Chemlali' and 'Chetwi' (Kebaïli Tarchouna M., 2014).

The Kerkennah date palms constitute the archipelago's most numerous natural plant. This is why the area occupied by date palms is commonly called 'Ghaba' (forest). The Kerkennah date palm's genetic diversity is very rich. Each individual represents a clone head (DGEQV, 2012).

3.1.2. Breakdown of land and production

The surface area of the archipelago is about 15,000 hectares, 8,300 hectares of which are farmland. But, given the above-mentioned natural constraints, 5,500 hectares are not cultivated and occupied by palm trees and natural herbaceous vegetation, i.e. 66% of the usable farmable surface area. Thus only 2,800 hectares remain, set aside for agriculture; of this, 1,200 hectares are partly devoted to cereal growing, 600 hectares to olives, 500 hectares to vines, 300 hectares to figs and 200 hectares to various fruit trees. Vines are grown on Hamada between the north-western part of Cherguia Island (zone of Borj El H'sar) and the village of Ouled Kacem, and fig trees are found in the zones of Kraten and El Ataya in Cherguia Island. Olive trees are found in the sectors of Ennajet and Chergui of Cherguia Island (Kebaïli Tarchouna M., 2014).

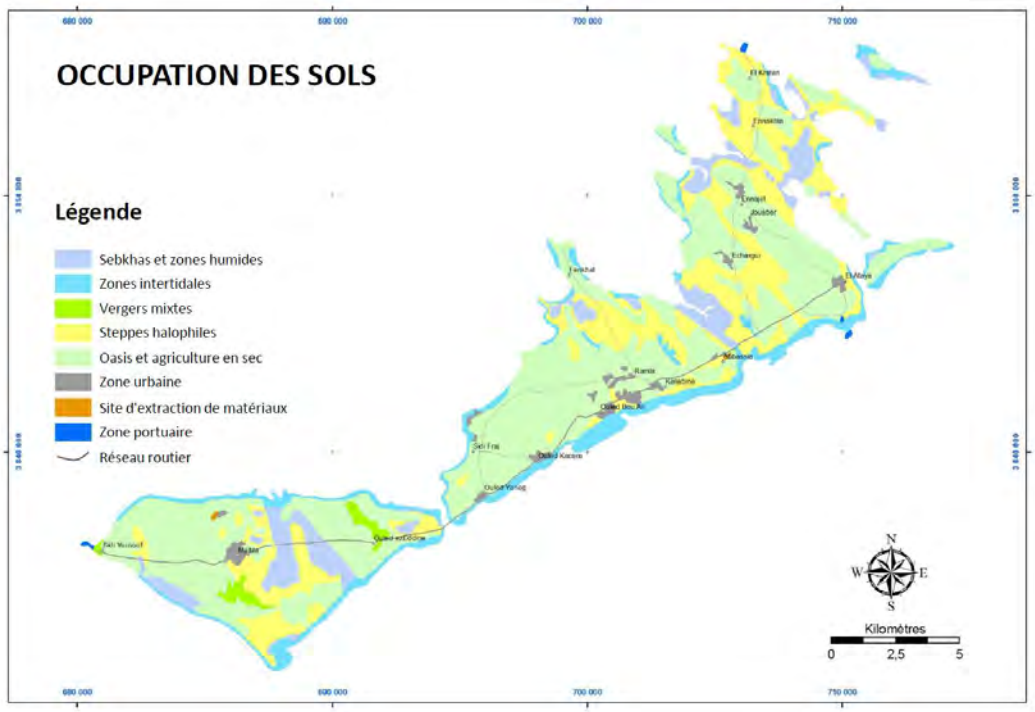


Fig. 7. Map of soil occupation (Fehri, 2011)

The socio-economic survey done in 2009 in the Gulf of Gabès indicated that 47.7% of the families surveyed possess agricultural land of an average surface area of 3,650 sq. m., and 60% of them cultivate their plots permanently. The land is cultivated as follows: 34.4% for glasshouse crops, 22.4% for olives, 14.9% for irrigated arboriculture and 7.4% for dry-farm arboriculture (CITET, 2009).

Note that the Kerkennah archipelago contains 3 irrigated areas: those of Remla and Melliti, that were started from 1996/7 and a new one in Ouled Ezzedine, started in 2009.

The features of these three irrigated areas appear in the Table below:

Table 14. Features of irrigated areas in Kerkennah

Irrigated area	Number of farms	Average surface area of a farm	Water sources (flow and salinity)	Main crop
Mellita	264	0,3 ha	Artesian well (40l/s; 3,4g/l)	Olives
Remla	1945	0,09 ha	Artesian well (40l/s; 3,6g/l)	Olives, fodder
Ouled Ezzeddine	365	0,25 ha	Artesian well (40l/s; 3,5g/l)	Olives, figs, vines

(CRDA, Sfax, 2013)

We note the division of the agricultural land into smaller units, which is one of the reasons why agriculture has not developed. In Kerkennah, agriculture has remained subsistence agriculture.

Finally, as regards agricultural production, low compared to other areas in the Sfax *Gouvernorat*, it has grown from 1,000 tons in 1999 to 2,550 tons in 2014, with 2,200 olive trees (CRDA Sfax, 2014). This rise is the fruit of the irrigated areas that were installed in the archipelago.

3.1.3. . Breeding

Like farming, stock breeding is an activity that has remained traditional and supplementary. It involves a few small herds integrated in the farm. The livestock is dominated by small ruminants, particularly sheep, with about 10,000 head. Moreover, developing the irrigated areas has enabled the growing of fodder to feed cattle, the breeding of which did not form part of the archipelago's traditions. Currently, milk production is about 350,000 litres/year (CRDA Sfax, 2014). The socio-economic survey done in 2009 in the Gulf of Gabès revealed that 19.4% of the families surveyed do some breeding, which gives them a supplementary income, and 17.9% of them possess a stable.

The number of sheep raised per family is on average 16 head, with a maximum of 300, while the cattle livestock is about 8 head per family, with a maximum of 20. Cattle-rearing is more directed to milk products, whose average yield is 2,000 litres/cow. The bovine livestock was about 3,900 head in 1996 (CITET, 2009).

The developing of breeding in the Kerkennah archipelago corresponds to a need to supplement income and savings rather than to constitute a stable source of income. Indeed, civil servants, shopkeepers and wage labourers often invest in this activity.

3.1.4. . Farm work

In the area of study, farming employs about 2,000 people. This workforce is mostly made up of women of all ages (CRDA Sfax, 2014). The productive potential and current production systems only permit a partial occupation of part of the workforce, thus creating a potential of young unemployed adults. As for the fishing sector, it employed about 4,400 people in 2014, practically all of them fishing as the sole source of income (DGPA, 2014).

3.1.5. . Resource-taking activities

Mainly this means fishing and to a lesser extent hunting.

The fishing activity is very old and is part of the residents' social and economic history. The study area possesses two fishing ports, the coastal ports of El Ataya and El Kraten, and about 17 unloading sites throughout the archipelago. The traditional calling of the study area is coastal, and the production is made up of species of high commercial value (sea bass, octopus, king prawn, cuttlefish, breams, etc.). Fishing is done with passive and relatively selective gear such as bottom or surface straight nets, octopus traps, keepnets, *Charfias*, and palangres. A more detailed analysis of the fishing system will be given in the 4th part of the present work.

Hunting is practised but usually outside the permitted seasons and zones. Hunting hare with sparrow hawks is a very old activity in the archipelago. This practice symbolises the local community's attachment to its history.

3.2. Industry

Industrial activity in the study area is marginal. We mention the existence of 14 businesses, only 4 of them set up after 1985, with a capacity of 10 employees per unit, specialising especially in the electricity and electronics industries.

We also note the existence of a saltworks in Sebkhet El-Abbassia. It is relatively old, starting in the late 19th century, but its activity has been intermittent. It was only in the 1990s, as a private initiative, that the saltworks recovered fully, with a remarkable effort of mechanisation. Big saltpans were constructed, first in the central part of Sebkhet El-Abbassia, and then on its edges. Covering a surface area of about 84 hectares in 1976, the salterns now extend over an area that is greater than 402 hectares (Fehri, 2011).

Saltworks in Sebkhat El Abbassya

3.3. Oil and gas (ETAP annual report, 2014)

Although the energy sector in Sfax seems to be a weak provider of jobs in the *Gouvernorat*, it is a big producer of hydrocarbons, particularly in regard to the natural gas deposit in Miskar, about 100 km. south-east of the archipelago, and exploited by British Gas Tunisia. The production recorded in 2014 was 695 thousand tonnes.

The other, Hasdrubal, concession, deriving from the Offshore Amilcar permit, lies 64 km. south-west of the archipelago at a depth of about 62 metres. The holders of the concession are ETAP and BG Tunisia, each with a 50% interest. The Hasdrubal field is a gas condensate deposit with an oil ring. It is developed as a project that is independent of the Miskar concession; its production reached 764 thousand tonnes in 2014.

As well as these off-shore deposits, we note the recent discovery (1992/3) of oil and gas on the western coast of the archipelago. The oil is exploited by the Thyna Petroleum Service (TPS) in the Cercina/South Cercina fields. The production of oil was 44 thousand tonnes in 2014, i.e. 2.2% of national production.

Gas is exploited by the Petrofac company in the Chergui fields. In 2014, the production from these deposits was 248 thousand tonnes of gas, representing 14.33% of national production

and 1.5% of consumption in Tunisia. These deposits also produce oil, and produced 13 thousand tonnes in 2014.

The oil and gas produced in the archipelago are carried to the continent via underwater pipes laid down in the Kerkennah channel.

3.4. Transport services

3.4.1. Transport in Kerkennah and Sfax

Maritime transport is vital for Kerkennah. The link between the archipelago and Sfax is handled by the Kerkennah New Transport Company (SONOTRAK). It started up in 1976. This company's boats are commonly called El Loud, like the traditional boats of the same name that are built in Kerkennah and used for transport.

Today, 5 car ferries are by used by SONOTAK, offering an overall capacity of 3,800 passengers and 465 vehicles (cars and lorries). The journey lasts 1 hour 15 minutes. There are 8 trips a day in the low season and 12 in the summer, with the possibility of extra trips on holidays and at weekends. Over the past ten years, the traffic has grown continuously; the annual increase in the number of passengers was 5.3%, and that of vehicles around 6%. Almost 40% of the total annual number of passengers was concentrated in the months of July and August. In 2009, the kinds of summer passengers for the Kerkennah boat were as follows: Kerkennah residents (32%), Kerkennans living on the continent (50%), residents of Sfax (15%), Tunisian tourists (2%) and European tourists (1%) (Kebaïli Tarchouna M., 2014).

Table 15. Features of SONOTRAK's maritime transport units of travellers

Name	Date when put into service	Capacity	
		Passengers	Vehicles
Kiranis	1988	600	52
Hached	1996	900	67
Kerkennah	2002	900	68
Loud Tunisie	2007	600	128
Cercina	2010	800	150
Total		3800	465

3.4.2. Transport inside Kerkennah

Public transport inside the archipelago is supplied by 9 SORETRAS buses, with currently 13 routes and a cumulative length of about 686 km. (return journey) serving all the important sites (APAL, 2008). Their timetables mainly dovetail with the arrivals and departures of the car ferries at Sidi Youssef port. Of the 13 routes, 3 are regular:

- the El Ataya-Jouaber-Kraten-Sidi Frej and Sidi Youssef route
- the El Ataya-Ramla-Sidi Youssef route
- the Ramla-Sidi Frej-Sidi Youssef route.

Moreover, we note a rapid development of private transport (taxis), and an ever-increasing number of permits: in 1999, the number of taxis was 53, 40 of them seating 8 and 13 seating 4 (Kebaïli Tarchouna, 2014).

3.5. Commerce

In the area of study, commercial activity could be described as stagnant. It consists mainly of:

- 114 service areas
- 2 food wholesalers
- 1 construction material wholesalers
- 195 food retailers
- 17 fabric and clothing retailers
- 10 construction material retailers
- 19 fruit and vegetable retailers
- 85 general retailers.

The only day when there is much activity is Tuesday, when there is a weekly market at Ramla. This *souk* attracts a lot of people from other villages in Kerkennah and a number of passing tourists.

3.6. Tourism

Usually, the fact of being an island is a tourist product that is prized throughout the world. But in comparison with most Mediterranean islands, the Kerkennah archipelago receives a very modest tourist flow. In fact, the narrowness of the beaches, the degradation of the natural environment, the unsuitability of the transport (absence of air transport), the qualitative and quantitative lack of hotel infrastructure and basic infrastructure and the absence of a tourist information office are factors that explain the modest tourist activity, now in crisis and declining.

3.6.1. History

Set up in 1963, the Society to Make Best Use of the Kerkennah Islands was the pioneer actor in the archipelago's tourist development. It built 3 hotels (Grand Hôtel, Résidence Club holiday village, Hôtel Farhat) in the Sidi Frej zone, with a 1981 order that this tourist area be fitted out as such. So 3 other hotels were built (Kastil, Aziz and Cercina) with a total capacity of 1,099 beds. This tourist area, covering 112 hectares, lies in the south-west of Cherguia Island and extends into the northern part of Sidi Frej bay. Recently, in 2010, two new hotels opened, the Résidence Ennakhla, with a 58-bed capacity, and Dar Kerkennah, near Borj El H'sar, with a 32-bed capacity.

As well as this hotel infrastructure, there are several secondary residences that invade the entire tourist area of Sidi Frej, particularly between Rass Ameur and El Kantra and between the Grand Hôtel and Borj El H'sar (see map below). The secondary residences, covering much more land than the hotels, belong to people from Kerkennah who live on the continent and come back to spend their holidays in their own part of the country, and a few foreigners, especially English and Italians, who have luxury residences in Sidi Frej, Cercina and Kastil, and Sidi Youssef.

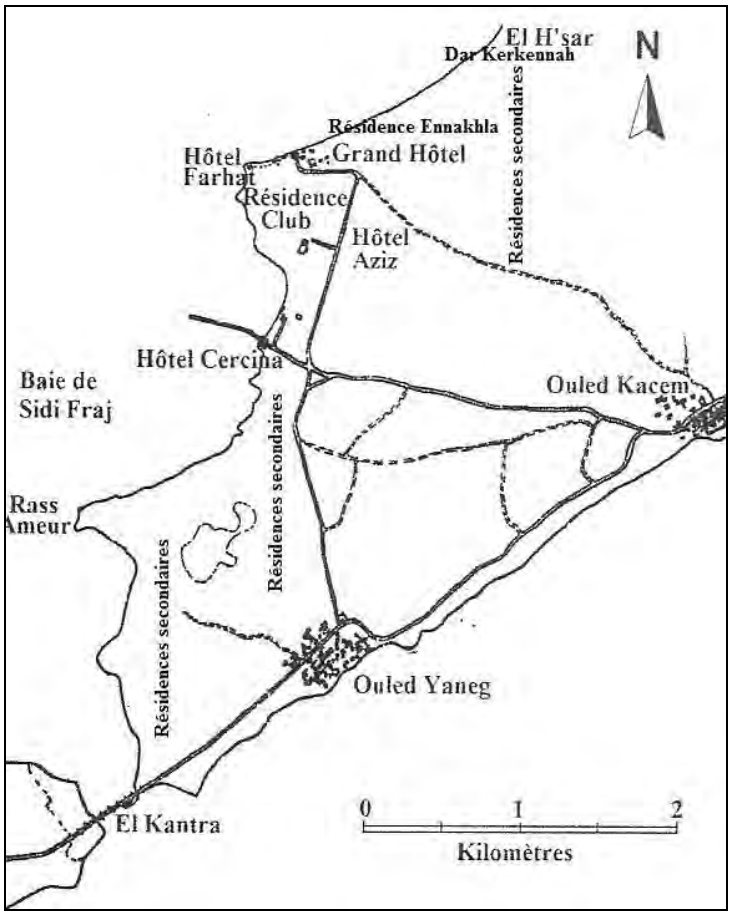


Fig. 8. Map of the Sidi Frej tourist zone

3.6.2. The hotel business

The Kerkennah Islands have 15 hotel units; one of these, the Farhat, with a 308-bed capacity, has been closed since 1995.

The 14 remaining units are modest: 2 3-star hotels, 2 2-star hotels, one 2-star holiday village, 1 hotel with flats, and 8 unlisted units. The total capacity of these units is 957 beds, a capacity seen as very weak since it only represents 7% of the capacity of the Mahdia-Sfax region.

Table 16. Features of hotels in the Kerkennah archipelago

Name	Classification	Category (stars)	Number of beds
Dar Kerkennah	Hotel	3*	32
Résidence Ennakhla	Hotel	3*	58
Grand Hôtel	Hotel	2*	225
Hôtel Cercina	Hotel	2*	70
Résidence Club	Holiday Village	2*	200
Appart-hôtel Aziz	Aparthotel		88
Kerkennah Centre	Hotel		100
Résidence Abbassya	Hotel		30
Raed	Not Rated (N.R.)		58
Kastil	N.R.		32

Name	Classification	Category (stars)	Number of beds
El Jazira	N.R.		32
Mouna	N.R.		16
Stacy	N.R.		8
Archipel	N.R.		8

3.6.3. Changes in tourism in Kerkennah (ONTT, 2011)

Since the late 1980s, we note a decline in the archipelago's tourist activity in terms of both number of tourists and of nights spent. Thus, after a maximum in 1990, the number of tourists – and especially the number of nights spent – not including the secondary residences, dropped markedly to represent only 29% of what was recorded in 1990.

Table 17. Changing numbers of tourists, bed-nights and average length of stay from 1988 to 2010 in the Kerkennah archipelago

Year	Number of tourists	Number of bed-nights	Average length of stay (days/tourist)
1988	14050	88000	6,3
1990	16900	100050	5,9
1995	11850	58000	4,9
2000	11013	57052	5,2
2005	9904	33644	3,4
2010	10330	29348	2,8

ONTT, 2011

Moreover, the occupancy rate for hotels in the Sidi Frej tourist area is very low; it was 16% in 2010 as against a 50% national rate. The average length of stay also dropped from 6.3 days in 1988 to 2.8 days in 2010.

As to the clientele, most were Tunisians (67%), followed by the French (11.6%), Belgians (6%), Libyans (4.7%) and English (3%).

All these indicators show that the tourist sector in Kerkennah is in trouble. Worse, it shows that the experiment of seaside tourism was not successful in Kerkennah, which led decision-makers to look for a tourist product that was more suited to the island environment of Kerkennah. That was ecotourism. The site selected for developing ecotourism was Sidi Founkhal.

3.6.4. Sidi Founkhal ecotourist project

The Sidi Founkhal tourist zone projected in Kerkennah was designed to offer an ecotourist product, not a zonal one. It is sited in a peninsular in the northern part of the archipelago. Bearing in mind the fragility of the site's ecosystem, several improvement scenarios were suggested for it, and one, 'Ecological balance', selected; it opts for an ecological tourist resort. The chosen project extends over 90 hectares, with four residential units sleeping 3,000 and four leisure units. The fitting-out programme provides for: 4 residential hotel islets spreading over 50 hectares, with 2,550 beds, a housing islet of 7.5 hectares with 450 beds, 4 activities islets over 7.2 hectares and green areas and tracks covering a total 25 hectares.

This project, decided on in 1999, has not yet been put into effect. An attempt to revitalize it was made in 2004, revising the project's contract specifications and launching a tender. The final date for bids was 3 September 2014, but so far no news about the project has emerged.

3.7. Craft work

Handcraft work is one of the archipelago's oldest traditions. It is famous for its many traditional products, part of its special charm.

Various parts of the palm tree are used in making the basic elements of the fixed '*Charfia'* fisheries. They are used for the edges of the *Charfias,* and twigs from the bunches of dates are used for making keepnets. Women do this job. Palms are also used for making baskets.

Women's traditional dress like the '*jebba'*, '*tarf*', '*couffia'* and '*zonnar'* and men's clothes like the '*jebba'*, '*kadroun'*, and '*burnous'* made out of woollen cloth have so far been basically made by women, but the know-how is disappearing.

Knowledge also goes into making best use of agricultural and fishing products like dried octopus, dried figs ('*Chriha'*), raisins ('*Zbib'*) and dried dates ('*teflit'*) (Kebaïli Tarchouna M., 2014).

The 2009 Gulf of Gabès socio-economic survey revealed that craft work represents an important source of income for families in Kerkennah. The percentage of income from craft work compared to the total income of the families surveyed varies between a 10.4% minimum in El Ataya and a 50% maximum in Echarki village. Also, craft activities are especially the work of women and are handed down from mother to daughter as a source of income. 68.7% of the wives surveyed and 35% of the children did craft work.

3.8. Infrastructure

3.8.1. Road infrastructure

The archipelago's road network extends over about 182 km., 69 km. of which is tarmac and the remainder made up of tracks of varying quality.

The road infrastructure in the area of study is constructed around the RR204 linking the port of Sidi Youssef and the village of El Ataya, passing through Mellita and Ouled Ezzedine (Gharbi Island) and all the villages on the eastern coast of Cherguia Island: Ouled Yaneg, Ouled Kacem, Ouled Bouali, Ramla, Kellabine and El Abbassya. Leading off this main road is a series of local roads:

- The RL 884 linking Ouled Yaneg to the Sidi Frej tourist zone
- The RL 957 linking Ouled Kacem to the Sidi Frej tourist zone
- The RL 885 linking the Charki, Ennajet and Kraten villages (redeveloped in 2007)
- The RL 886 linking El Ataya to the RL 885 at Charki, passing through Jouaber (redeveloped in 2009)
- Two additional local roads developed by PETROFAC in 2010 and 2011: the Karraba-Mellita Essghira road and the road linking the Chergui 6 deposit to the Karraba-Mellita Essghira road

- Two additional local roads developed by the Ministry of Facilities in 2010: the Kastil-Mellita Essghira road (built over a former track) and the second linking Sidi Founkhal to Mellita Essghira.

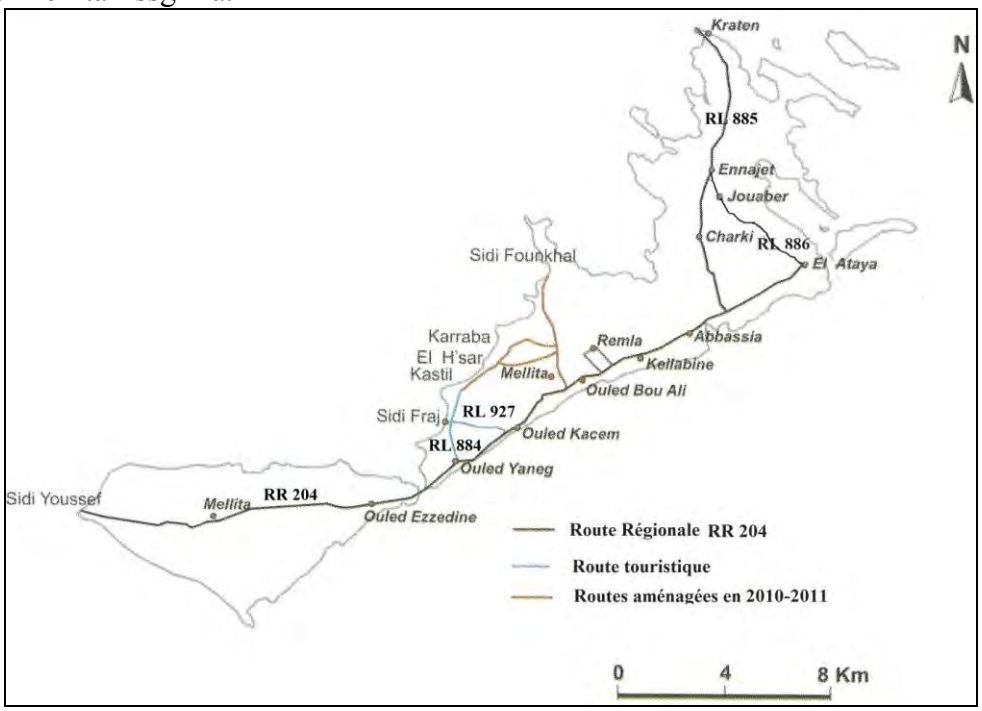


Fig. 9. Map of the road infrastructure in the Kerkennah Islands

3.8.2. Electric infrastructure

The electricity network serves the archipelago in a homogeneous way via two underwater cables. The situation in the archipelago is not problematic, for most of the people live in villages and 96.3% of the dwellings are connected up to the STEG network.

PETROFAC has set up the first photovoltaic lighting network in the archipelago, allowing fishermen a more sustained rate of work and safer navigation.

3.8.3. Drinking water supply

The villages of the archipelago are supplied by the SONEDE network. The water comes from two artesian wells, whose water is earmarked for supplying drinking water once it has been desalinated in the Kerkennah desalination plant for brackish water. The plant's annual production is about 1,400 thousand cubic metres; the untreated water (average 3.7 g./l. salinity) is filtered by osmosis to obtain water of 300 mg./l. salinity. 93.1% of dwellings are connected up to the SONEDE network. The others are essentially supplied from surface wells, of which there are 400.

3.8.4. Waste-water

In the Sidi Frej zone, a system of evacuating waste-water and cleaning up has just been installed. But most of the villages are not connected up to the network and dwellings usually have septic tanks. Waste-water pumped from the tanks by the municipality is released into the

sebkhas untreated, thus degrading the environment and polluting the different levels of water and littoral water.

3.8.5. Telecommunications and post offices

Most of the Kerkennah villages are covered by post office facilities. There are post offices in Ramla, Kraten, Mellita, El Ataya, Ennajet and Ouled Kacem, giving about 1 post office for every 2,500 residents.

As regards telecommunications, the area of study includes a network that provides 17 lines per 100 residents. Also, the archipelago is covered by three mobile phone servers (Tunisie Télécom, Ooredoo and Orange).

3.8.6. Port infrastructure

The area of study has 3 ports, Sidi Youssef (a commercial port) and 2 coastal fishing ports, the first in Sidi Daoud and the second a recent creation in Haouaria. A detailed description of both ports will be given in the fourth part of this work.

3.8.7. Cultural and sports infrastructure

Cultural facilities and infrastructure are almost completely lacking in the area of study. These facilities are localised in the village of Ramla. There is a youth hostel and a youth club, a cultural centre, a public library, a young people's science club, a municipal stadium, a roundabout and a few sports associations. The only museum that exists in the area of study is in Abbassya, the Museum of the Kerkennah Island Heritage (Dar El Fehri). It is thus important to invest in this sector in order to offer local people as well as national and foreign visitors a satisfactory cultural product.

3.8.8. Health infrastructure

The Kerkennah archipelago has one regional hospital, 7 basic health centres in Mellita, El Ataya, Chergui, Ouled Kacem, Ennajet, Ramla and Ouled Yaneg and a health centre in El Abbassya.

We note that the British oil prospecting and energy exploiting company, PETROFAC, endowed the island's hospital with a surgical device to facilitate surgical exploration and emergency operations or those in an operating theatre. It also fitted the hospital out with a scanner and laboratory equipment, an echograph and a bone X-ray unit.

These 'citizenly' actions are part of the company's contribution to social, economic and cultural development in the Kerkennah Islands, and it earmarks an annual budget of 2 million dinars for them.

3.8.9. Educational infrastructure

The archipelago's educational infrastructure is made up of 9 primary schools (1,230 pupils in 2014), a preparatory school and a lycée, both of them in Ramla (1,396 pupils in 2014), and a multipurpose training and apprenticeship centre in El Ataya (420 pupils in 2014).

PETROFAC has made a gift of 165,000 TD to the Ministry of Education to fit out the archipelago's 9 primary schools. This initiative is part of the company's social activities, to demonstrate its citizenly qualities and its participation in developing the archipelago.

IV. FISHING ACTIVITY IN THE AREA OF STUDY

In the area of study, the fishing activity is a very old tradition around which the economy and social life in the archipelago are structured. Conditions of insularity, underwater topographical specificities, the wealth of marine flora and fauna, and physical features, particularly the striking phenomenon of the tides, encouraged the fishermen of the archipelago to adapt their fishing techniques to the special environmental conditions. The only kind of fishing that exists is coastal fishing, done with different passive gear some of which have classical, particularly Roman, origins, like the fixed '*Charfia'* fisheries and traps like keepnets for fishes and hollow stones for octopus.

4.1. General introduction

4.1.1. Infrastructure

4.1.1.1. The ports

The archipelago's port infrastructure is composed of 3 ports (Sidi Youssef, El Kraten and El Ataya) and 10 sea wall shelters. The 3 ports contain infrastructure that is relatively sufficient to provide the services necessary for the fishing fleet they shelter. And yet there is a lack of balance in the geographical distribution of the ports and shelters between the archipelago's two islands. Gharbi Island possesses the port of Sidi Youssef in the south-western tip and 3 shelters (Macheni, Skala Gueblia and Marsa Ouled Ezzedine), while Cherguia Island has two ports (Ataya and Kraten) in the far north-east of the archipelago and 7 shelters on the western and eastern coasts of the island (Sidi Frej, Marsa Bounouma, Marsa Ouled Bouali, Sidi Gaaben, Marsa El Abbassya, Marsa El Ataya and Marsa Ejlija). The existence of a host of villages and fishermen, especially on the western coast of Cherguia Island, has encouraged fishermen to develop 8 docking sites where they land their produce. These are Marsa El Achrine, Marsa El Branka, Marsa El Ksar, Marsa Ouled Yaneg, Marsa Ouled Kacem, Marsa El Kellebine, Marsa Fom El Oued and Marsa Essaadi (see map below). These docking sites are not present in Gharbi Island (Mellita).

<u>El Ataya port</u>

The fishing port of El Ataya was built in 1976 and developed in 1982, with an extension built in 1992 and 1996; the port is 1.5 km. from the site of El Ataya.

The infrastructure and facilities of El Ataya port include:

- 1 400 ml.-long access jetty
- 1 270 ml.-long eastern sea wall
- 1 740 ml.-long western sea wall
- 1 access channel dredged with -3.5 m. hydro
- 1 9-hectare pond, dredged with -3.5 m.
- 1 95-ml. quay with -2.5 m. hydro
- 1 82-ml. quay with -3.5 m. hydro
- 1 80-ml. quay with -1.5 m. hydro
- 1 102 ml. landing stage
- 1 *darse* for lift with 100 T capacity

- 1 360 sq. m. wholesale market
- 120 sq. m. return hall
- 1 130-ton mobile frame
- 1 10-ton fixed frame
- 1 diesel station with 100-cubic-metre capacity
- 1 administrative premises over 168 sq. m.
- 1 workshop for repairs and naval construction over 3,200 sq. m.
- 14 fishermen's premises over 211 sq. m.
- 5 fish wholesaler's offices over 60 sq. m.
- 4 premises for social and public use covering 361 sq. m.

Cold-storage and storage equipment is made up of:

Description	**APIP**	**Private**
Refrigeration complexes	1	
Storage capacity (0°C)	40 Tonnes	
Freezing capacity (-25°C)		
Freezing tunnel capacity		
Ice storage capacity	15 Tonnes	
Ice production capacity	10 Tonnes/day	

BEN SALEM, 2013

El Kraten port

The fishing port of El Kraten was built in 1986; the site was traditionally used by fishermen for anchorage because of the favourable conditions it offers.

The infrastructure and facilities of El Kraten port include:

- 1 540 ml.-long eastern protection sea wall
- 1 440 ml.-long western protection sea wall
- 1 1.2-hectare platform perpendicular to the coast
- 1 6.5-hectare dredged man-made lake -2 hydro.
- 2 service quays, 60 ml. each, and a 27 ml. supply dock
- 2 60 ml. landing stages on the northern side for boats of 9 metres
- 3 60 ml. landing stages on the southern side for boats of 6/6.5 metres
- 1 inclined plane and a shipyard on the southern side of the port
- 1 fixed landing stage
- 1 140 sq. m. wholesale market
- 1 diesel station with 40 cubic metres capacity
- 1 administrative premises over 160 sq. m.
- 1 workshop for repairs and naval

construction over 170 sq. m.

- 1 naval mechanics workshop over 56 sq. m.
- 40 fishermen's premises over 240 sq. m.
- 2 fish wholesaler's offices over 24 sq. m.
- 7 premises for social and public use covering 547 sq. m.

Cold-storage and storage equipment is made up of:

Description	**APIP**	**Private**
Refrigeration complexes	1	
Storage capacity (0°C)	90 Tonnes	
Freezing capacity (-25°C)		
Freezing tunnel capacity		
Ice storage capacity	15 Tonnes	
Ice production capacity	5 Tonnes/day	

BEN SALEM, 2013

Sidi Youssef port

The study for the master plan for fishing ports in Tunisia done by the DGPA (Ministry of Agriculture) in 2006-9 recommended creating a site reserved for fishing next to the present port of Sidi Youssef. Implementation of the plan involved including the project to create a fishing port at Sidi Youssef in the DGPA's action plan for 2010. So the study on creating a port near the present port was launched by the Merchant Navy and Ports Office, and carried out in 2014 by the Betapi design office. The selected development scenario consists of handing over the present port's main pool to Sonatrak's maritime transport units and building a new pool right alongside for fishing activity. The two pools will be separated by the present northern sea wall. The study also estimated the cost of the project at about 25 million TD, 5 million of which will be earmarked for building the infrastructure and superstructure of the future fishing port. In October 2015 there was a call for tenders for the developments anticipated by the study.

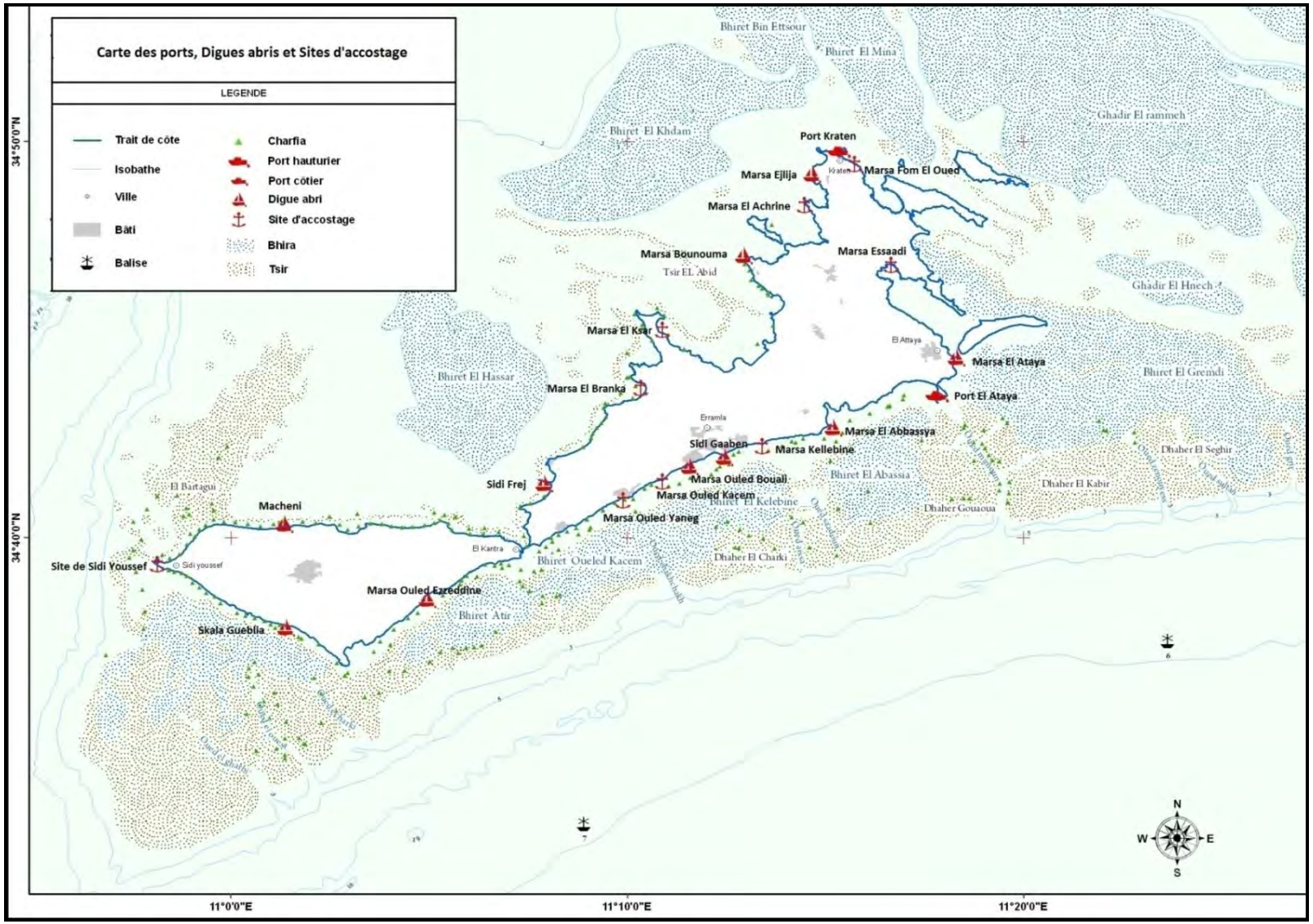


Fig. 10. Map of ports, shelters, docking sites and *b'hiras* in the Kerkennah Islands (Source, DGPA, 2014a)

4.1.2. Resources and potential of the area of study

As we have already said in the first part of this work, the area of study in the Gulf of Gabès possesses great, diversified halieutic wealth. 209 species are found in the Gulf of Gabès, of which 177 are bony fishes and 32 cartilaginous fishes (Bradai, 2000).

And yet these species are not all subject to the same pressure of fishing, most of them not being targeted by the fishermen. Exploiters of the halieutic resources in the Kerkennah archipelago mainly target:

- the white fishes *Mullus* sp*., Pagellus erythrinus*, the Mugilidae, *Pagrus* sp., *Lithognatus mormyrus, Merluccius merluccius*, the *Diplodus* sp., *Solea* sp., *Sarpa salpa, Pomatomus saltatrix, Serranus* sp., *Sparus aurata*, *Epinephelus aeneus* and *Boops boops*
- the crustaceans *Melicertus kerathurus* and *Metapenaeus monoceros*
- the cephalopods *Octopus vulgaris* and *Sepia officinalis*
- the little pelagics *Trachurus trachurus, Trachurus mediterraneus* and *Scomber scombrus*
- the big pelagics *Seriola dumerlii* and *Xiphias gladeus*
- the sponges *Hippospongia communis* and *Spongia officinalis*.

The benthic and demersal species were the subject of assessment studies on halieutic resources on the Tunisian coast done by the National Institute of Sea Technologies and Sciences (INSTM) from 1997 on. The results concerning the southern part of Tunisia, including our area of study, appear in the Table below:

Table 18. State of exploitation of the main benthic resources in the Gulf of Gabès

Period	Under-exploited	Optimal exploitation	Over-exploited
1996-2002	*Saupe* *Marbré* Octopus *musqué* Garfish King prawn	Annular sea bream *Solea aegyptiaca* Red mullet Cuttlefish *Serre* Golden mullet	*Pageot* Little *pagre* Dentex Grey mullet Gilt-head bream Hake Moroccan dentex
2002-2005	*Marbré* Annular sea bream King prawn Grey shrimp	*Saupe* *Solea aegyptiaca* Red mullet Cuttlefish Octopus	*Pageot* Little *pagre* Grey mullet Gilt-head bream Hake *Serre*
2007-2010	King prawn Octopus	Cuttlefish *Solea aegyptiaca* Grey shrimp Annular sea bream	*Pageot* Little *pagre* Dentex Grey mullet Red mullet Hake Squid

Source: INSTM, 1999, 2002, 2006 and 2011

We note that most benthic species studied are over-exploited. The two species that were declared under-exploited are the king prawn and the common octopus; they have short lives and a great power of regeneration. The work also showed that in 2010 the fishing effort was about 40% above its optimal level. Illegal fishing with the benthic trawl and '*Kiss'* in the shallows has long caused this over-exploitation. For most species, trawlers and the fishing units that use the '*Kiss'* cause great mortality among juveniles compared with coastal fishing.

Faced by this situation, INSTM recommended increasing the mesh size of trawls and making them more selective, reducing the fishing effort (by 40%) and directing trawlers to zones where the depth is over 50 metres. It is important to bear in mind that the same recommendations were made in 1980 at the seminar on halieutic resources in the Gulf of Gabès and their exploitation (anonymous, 1980).

For little pelagic species, the exploitable biomass (EB) by species or groups of species obtained after prospection campaigns done by INSTM on board N/O *Hannibal* are shown in the Figure below. The graph shows that between 1998-2007 there was a continuous increase of EB in little pelagics. But in 2009, this EB dropped to 28,300 tonnes. This fall was particularly linked to dwindling of exploitable potential of the sardine and to a less extent the anchovy and the *bogue.* For 2010, the exploitable potential had increased and was assessed in the winter season as about 40,000 tonnes. This increase can be attributed to the increase in the sardine biomass (Ben Abdallah, pers. com.).

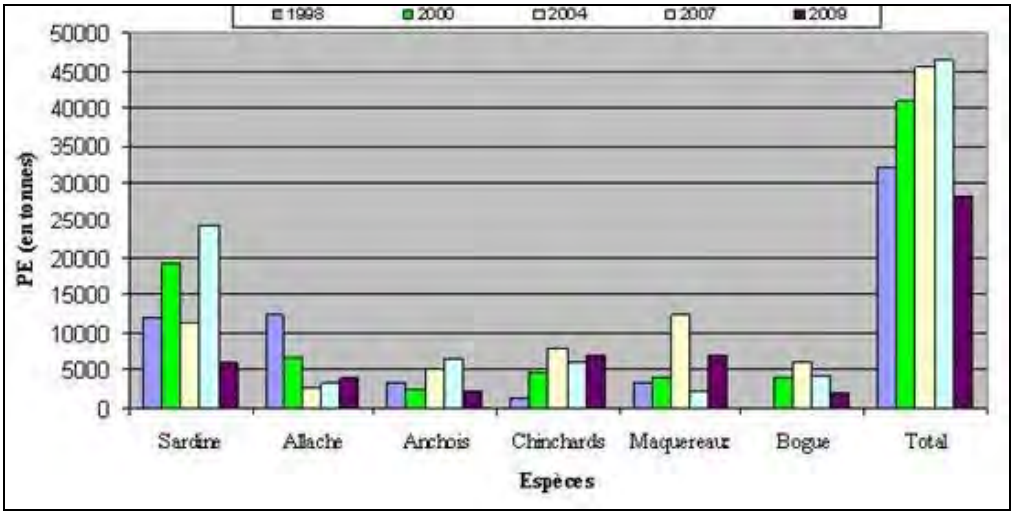


Fig. 11. Annual change of exploitable potential of the little pelagics by species in the Gulf of Gabès (INSTM, 2011)

Lastly, for the big pelagics, no national stock assessment study has been done up to now given the technical difficulties of estimation inherent in their nature of great migrant and also to difficulties encountered by the researchers in acquiring biological material. However, observation of the demographical structures of landings of swordfish, amberjack and dolphin shows that juveniles constitute a large part of these landings; this can have serious consequences for the stocks of these species (INSTM, 2006 and 2011).

4.1.3. Fleet and fishermen

The fishing units that exist in the archipelago are coastal craft, usually of wood, falling into two categories:

- Non-motorized Coastal Craft (BCNM): length usually between 3 and 7 metres, powered by sail or oars. The absence of a mechanical driver limits these boats' activities to a small coastal fringe
- Motorized Coastal Boats (BCM): have engines whose horsepower is usually between 30 and 50 HP but is in some cases less than 20 HP. Overall length (LHT) of the boats too is most often between 9 and 12 metres.

Currently the Kerkennah Islands possess a fleet that is made up of 1,663 working coastal fishing units including 1,140 BCNM and 309 non-working BCNM including 281 BCNM. Compared with the Sfax *gouvernorat*, the archipelago's fleet is relatively big, for it represents 52% of that of the entire *gouvernorat*. The Table below shows the changes in this fleet between 2004, 2009 and 2014, and reveals a drop in the number of working units as against a rise in the number of non-working, probably due to falling profitability as stocks are exhausted. 43% of this fleet is situated in the Mellita zone, and the ports of El Attaya and Kraten present percentages of 32% and 25% respectively.

The fisher population, currently 4,325 seamen, 60% of whom are working on board BCMs, has also dropped by more than 37% between 2009 and 2014.

Table 19. Changing numbers of fishing units and fisher population in the Kerkennah Islands from 2004 to 2014

		2004			2009			2014		
Port	**Type**	**Actives**	**Inactives**	**Pop.**	**Actives**	**Inactives**	**Pop.**	**Actives**	**Inactives**	**Pop.**
El Ataya	**BCM**	181	1	713	126	1	630	132	8	660
	BCNM	509	8	1570	525	2	1575	420	73	630
Kraten	**BCM**	127	2	493	132	3	660	148	10	740
	BCNM	340	7	1030	265	9	795	260	75	390
Mellita	**BCM**	202		812	246	2	1230	243	10	1215
	BCNM	351	28	1286	675	58	2025	460	133	690
Total Kerkennah	**BCM**	510	3	2018	504	6	2520	523	28	2615
	BCNM	1200	43	3886	1465	69	4395	1140	281	1710
% compared to the *Gouvernorate* of Sfax	**BCM**	44%	4%	40%	42%	8%	42%	37%	21%	37%
	BCNM	58%	30%	58%	68%	51%	68%	62%	79%	62%

(DGPA, 2004, 2009 et 2014)

4.1.4. Changing fishing catch

To describe halieutic exploitation in the Kerkennah Islands, our data source was basically the statistics directories of the General Board of Fishing and Sea Farming (DGPA) for the years between 1995 and 2011. We did not take into consideration data from 2012 to 2014, because there are several errors, according to people working in the DGPA, which are now being corrected.

In 2011, production from the coastal fishery in the Kerkennah Islands was about 1,830 tonnes as against 1,303 tonnes in 2010, i.e. an increase of over 40%. Production in 2011 corresponds to about 33.4% and 7.4% of the production of coastal fishing in the Sfax *gouvernorat* and nationally. The value of the production was assessed at 9,150 thousand Tunisian dinars, corresponding to 11% and 2.1% respectively for the same production in the Sfax *gouvernorat* and nationally.

The Mellita zone has the biggest share (42.7%) of the archipelago's halieutic production in both weight and value. It is followed by the Kraten zone (34.3%) and lastly the El Ataya zone (23%).

Looking at the changes in production over the period 1995-2011 one concludes that the Kerkennah archipelago's fishing production is clearly affected by catches of octopus and, rather less, cuttlefish. These two species, with their short lives and rapid growth, are extremely vulnerable to environmental conditions, especially the fishing effort. Thus, both the attack on the stock and then its reconstitution happen relatively faster than for other species.

The cyclic evolution of octopus production shows this well. The appearance of a major potential of this species in the area of study attracts a large number of coastal boats from other parts of Tunisia, particularly the Sahel, which remain during the whole period of octopus fishing (November to April). Then, when the breeders migrate (May-June) to reproduce in the egg-laying areas, which are usually places of refuge like rocks and crevices in the open sea areas, this species becomes the target of intense trawler fishing. The effect of such fishing is seen in following years in a drop in octopus biomass and then a drop in production. The stock is reconstructed after a relaxation of the fishing effort over a period of 3-4 years, and then a new cycle starts up all over again.

Yield by EBM [1](Motorized Boat Equivalent) follows the same evolution as production, with a maximum in 2000 assessed at 2.9 T/EBM. Yield fluctuated after that to drop from 2004 until 2010. In 2011, yield increased again to reach 2 T/EBM as against 1.3 T/EBM in 2010. This indicator should not mislead us as to the state of halieutic stocks in this area, for the species that contributed to the increased yield in 2011 are cuttlefish and octopus, species that are known for their ability of rapid reconstitution, unlike the grey mullet and annular sea bream, which do present signs of over-exploitation.

Per species, an analysis of the structure of production over the period 1995-2010 reveals the presence of white fishes, crustaceans and especially cephalopods, which reveals a specialization of the archipelago in exploiting this group. Over this period, octopus represented on average 32% of the archipelago's total production, followed by cuttlefish

1. EBM is equal to 1 BCM + 1/3 BCNM, assessed on the base of the yield of one BCM being equal to three times the yield of one BCNM.

(22%), grey mullet (9%), sparoids (9%) and king prawn (5%). The general look of the curves per species follows that of total production (see graphs below).

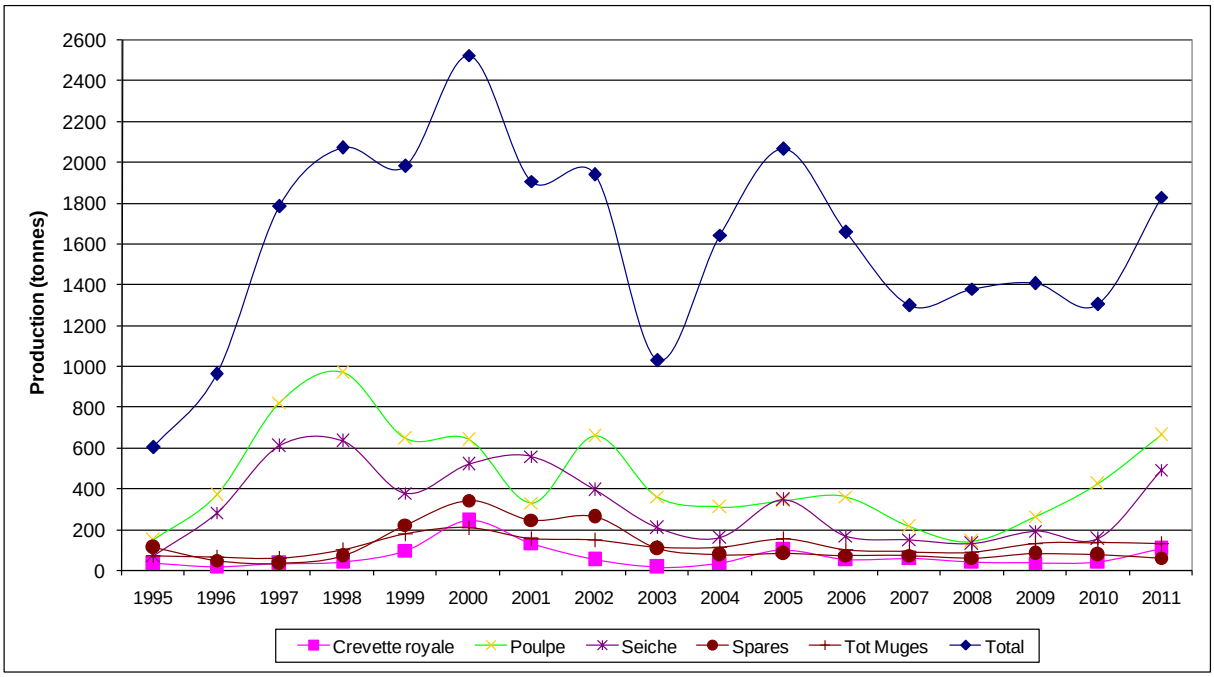


Fig. 12. Changes in total production of coastal fishing and by species in Kerkennah

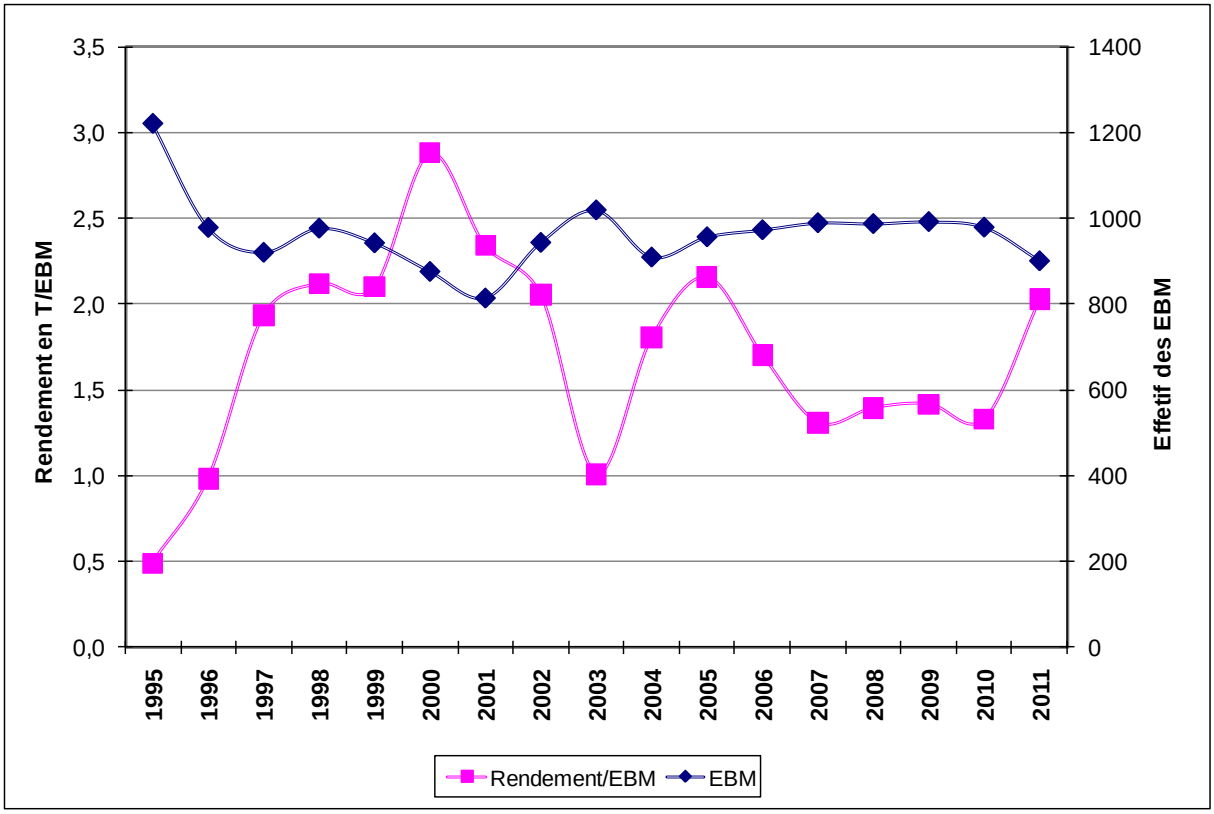


Fig. 13. Changes in the fishing effort and yield from coastal fishing in Kerkennah

4.1.5. Recreational Fishing

In the Governorate of Sfax, the recreational fishing is carried on board a pleasure boat or through spearfishing with underwater guns.
It is a difficult to characterize and have information on this activity due to the large number of practitioners, mostly illegal, their practices often nomadic, scattered and heterogeneous, and the absence, in the contrary to commercial fishing, of fishing license monitoring and the lack of a rigorous control of practices at sea and especially statistical monitoring of production.
The only data we could collect concern fishing permits issued by the fishing district of Sfax between 2012 and 2015:

Table 21: recreational fishing permit granted to the ports of Sfax and Kerkennah between 2012 and 2015

Site type	Fishing type	2012	2013	2014	2015*	Authorized fishing technique
Sfax Port	**Diving**	5	6	7	2	Underwater guns.
	By boat	13	10	14	7	Only the lines with a maximum of 50 medium-sized hooks (minimum # 9)
Kerkennah	**By boat**	26	30	30	15	
Total		**44**	**46**	**51**	**24**	

CRDA, Arrondissement de pêche de Sfax, 2015

2015* : Data from January until May 2015

From Table 21, we note that the recreational fishing licenses granted in the archipelago of Kerkennah are only for fishing on boats. According to official statistics, there are no permits of fishing by diving in the archipelago.
However, based on our interviews with the heads of fisheries departments in Kerkennah, all recreational fishing methods are practiced in the archipelago with various fishing techniques and gears (fishing on foot, lines, longlines, nets, lockers, underwater guns, etc.). Furthermore, they think that the number of active recreational boats in the archipelago is around 300 units of which the majority were built after January 14, 2011.
Moreover, given the lack of fishing guards in the Governorate of Sfax, there has never been a control of the recreational fishing. According to officials of fisheries services, target species are in order of importance cuttlefish, octopus, seabass, seabream, annular seabream, striped seabream and bream.

4.1.5. Fishing gear used

The fairly varied halieutic exploitation on the coast of the Kerkennah archipelago requires the use of a vast range of fishing gear. The technical characteristics of the gear vary according to fishing zone, season of fishing and species targeted.

Apart from the overall survey of fishing done by the Ministry of Agriculture in 2009, no other study has made an exhaustive analysis of fishing techniques. Below we shall present the fishing gear recorded in 2004 in Kerkennah as well as the frequency of their use by fishermen. A detailed examination of the use of the fishing gear of Kerkennah will be undertaken in the part that analyses the surveys done in the context of the present work.

As well as fixed fisheries of the '*Charfia'* type, 22 kinds of fishing gear used by coastal boats were found in the archipelago in 2004: 6 kinds of mesh net, 4 kinds of trammel, 5 kinds of line and palangres, 3 kinds of trap, 1 combined net, 1 '*Kiss'* towed gear, 1 sponge-collecting gear and 1 non-sliding spinning seine.

The gear most used in the archipelago are, in descending order: trammel for cuttlefish, bottom mesh for various benthic fishes, trammel for fishes, trammel for shrimps, surface mesh for fishing various pelagic fishes, hollow stones for octopus, and keepnets.

We note the striking fact that the '*Kiss'* is used, and used with a use proportion of 5.6%, which is higher than the regulation selective gear like lines and palangres.

Table 20. Percentage of use of fishing gear by fishermen in Kerkennah in 2004

Gear	% of use
Trammel for cuttlefish	**52,4%**
Bottom mesh (various)	**41,7%**
Trammel for fishes	**27,8%**
Trammel for shrimps	**21,9%**
Surface mesh (various)	**19,6%**
Hollow stones	**11,2%**
Keepnets	**10,1%**
Mesh for sparoids	**7,9%**
Octopus pot	**6,7%**
Towed gear (*Kiss*)	**5,6%**
Sponge	**3,3%**
Trammel for sole	**3,0%**
Lines for sea bass	**2,2%**
Lines for sparoids	**1,6%**
Mesh for spotted dogfish	**1,6%**
Mesh for grey mullet	**1,5%**
Palangres for grouper	**1,3%**
Bottom palangres (various)	**1,3%**
Mesh for garfish	**0,9%**
Non-sliding seine	**0,5%**
Surface palangres	**0,4%**
Combined net	**0,2%**

(DGEDA, 2004)

4.1.6. Statutory aspects

4.1.6.1. Fishing

To protect the halieutic stocks from all unregulated exploitation and to thus ensure the biological balance of the marine environment and the sustainability of the fishing activity, Tunisian fishing law provides a whole range of texts (laws, decrees and orders). In this section

we shall refer to the Decree of the Minister of Agriculture of 28 September 1995 on fishing and to that of 20 September 1994 on fishing by diving and underwater sport fishing. We shall try to take into consideration the articles that are best suited to the fishing techniques used and the geographical and physical features of the area of study.

Decree of 28 September 1995

- **Section 2. Organisation of the fishing effort**: As is provided for in Article 4, our area of study is part of the southern zone: lying between the parallel that passes through Ras Kapoudia and the Tunisian-Libyan border.

- **Section 3. Organisation of fishing operations**:

Art. 6 – The distance to be observed between fishing units carrying out fishing and using drift nets or spinning seines or floating palangres is at least 500 metres

Art. 7 – Fixed nets must be lowered in the evening or at night and raised at latest at daybreak the following day, except in case of *force majeure* and after informing the nearest centre of services responsible for coastal surveillance

Art. 8 New

-Ban on anchoring: It is forbidden for fishing units with towed nets (trawls) in the Gulf of Gabès to anchor outside 4 geographically marked out zones

-**Ban on passage**: It is forbidden for fishing units with trawls when they find themselves in the Gulf of Gabès outside the period of the shrimp fishing drive to go west of the line linking Ras Bourmeda with the Echaffar zone and Ras Bourmel with the Djerba zone.

-It is also forbidden for the above-mentioned units, during the periods of shrimp fishing, to enter zones with beds less than 30 m. situated west of the above-mentioned line linking Ras Bourmeda and Ras Bourmel

- **Section 4. Size of aquatic species**:

Art. 9 sets out the minimum size of fish and the species that are totally forbidden to fish:

-Protected species: These are aquatic species the fishing of which is forbidden whatever their size or weight. For example, seals, cetaceans, marine turtles, and turtle eggs

-**Species with regulated size, weight or quantity**: Usually, the fish species can be fished when they reach 11 cm. in length measured from the tip of the snout to the start of the tail. An exception is made of certain aquatic species that must satisfy a precise size or weight, as follows:

Espèce	**Taille ou poids**
▪ *Rouget*, sea bream, mackerel,	12 cm length
▪ Marbled black scorpionfish	15 cm
▪ Loup, sole, mullet, bream, hake, saupe, Torpedo, snapper, mackerel	20 cm
▪ toothed, green	22 cm
▪ Greater amberjack, dolphin fish, eel,	30 cm
▪ Meru,	35 cm
▪ Lich,	40 cm
▪ Swordfish	100 cm
▪ Dryer	10 cm

▪ Clovisse	3,5 cm
▪ Mould	5cm
▪ Shrimp	11 cm
▪ Sponge	15 cm diametre
▪ Octopus	1 Kg
▪ Bluefin Tuna	30 Kg

- **Section 5. Features of fishing gear**:

Art. 12 – The mesh of mesh nets must measure at least 30 mm. a side. In triple-net nets the size of the mesh of the lateral nets must be at least three times that of the mesh of the main net

Art. 15 – It is forbidden to make use of, or possess, the following fishing gear:

- *gangave*
- benthic or semi-pelagic *Kiss*
- remote-controlled mechanical devices for shell fishing
- devices that generate shocks
- drift-nets whatever their size.

Moreover, the fishing methods below are totally banned (Art. 10 of Law 94-13):

- Fishing with firearms
- Fishing with explosives
- Fishing using substances that are likely to intoxicate, poison or harm fishes that are passing through
- Fishing using lights except for catching fishes that are passing through
- Fishing by disturbing the water by any means whatever or frightening the aquatic species to take them in the nets, except using oars.

Art. 16 – Spinning nets used for fishing small pelagics must have mesh of at least 12 mm a side

Art. 20 – Racks, keepnets, pots and other gear of the same kind must be at least 20 mm. a side for square mesh and at least 30 mm. a side for triangular mesh.

- **Section 6. Forbidden fishing zones**:

Art. 25 – Fishing is forbidden:

- within ports and their access channels, except for sport fishing with lines equipped with two or more hooks
- on parts of the littoral, lakes or lagoons or reservoirs that require fixed fishery permits or within 500 metres of these fisheries
- within fairly extensive protection zones that could be marked out by fixed fishery exploitation permits
- within 500 metres of oil wells

Art. 27 – Fishing with towed nets is forbidden:

1) within the zone lying between the low-water mark and the 3-mile open sea line
3) less than 3 miles from the spinning nets used
5) south of the Ras Kapoudia parallel in bottoms less than 50 m. deep

Moreover, we note the ban on trawling during the two periods devoted to the king prawn fishing drive, i.e. from 15 May to 30 June and from 16 October to 30 November each year, with the possibility of extending the second period by fifteen days, given the biological data

on aquatic species in the fishing zone (Art. 34 of Decree 95). These are zones defined as follows:

- on this side of the zone covering depths of over 30 metres lying to the west of the meridian that passes through Buoy no. 6 and north of the 33°55 North line of latitude
- on this side of the zone covering the trench known as the Fora Mustapha Trench, extending over areas greater than 40 metres down, in the zone marked out in the north by the 34°10 North line of latitude and in the south by the 33°55 North line of latitude. The ban on this species is stipulated for boats whose engine power is more than 500 HP.

Art. 28 – The use of spinning nets is forbidden in depths of less than 20 metres

Art. 29 – Fishing using fire is forbidden: in depths of less than 35 m., less than 500 m. from other fishing units and less than 3,000 m. from *madragues*

- **Section 7. Special arrangements for certain fisheries**:

Part 2. Sports fishing

Art. 41 – Pleasure boaters can only fish from palangres with a set of at most 50 hooks (the biggest being no. 9)

- **Section 8. Special arrangements for fixed installations**:

Part 2. Fixed fisheries generally

Art. 42 – Applications for permits for fixed fisheries must be made on stamped paper and addressed to the competent authority, particularly stating the following:

1. Name, first name, profession, nationality and domicile of the applicant in Tunisia
2. Nature of the projected fishery

Joined to the application will be:

a) papers proving that the applicant satisfies the conditions provided for by the law on fixed fisheries
b) an extract from the 1/50,000 map of Tunisia making clear the situation of the fishery and its geographical coordinates
c) a 1/10,000 map of the projected installations

Fixed fishery permits are only given to natural persons of Tunisian nationality and to artificial persons whose capital is totally held by natural persons of Tunisian nationality.

Moreover, we can distinguish two kinds of '*Charfia'* fixed fishery:

- '*Charfias'* exploited by one or several fishermen pursuant to a temporary occupation order delivered by the maritime public domain as a result of a tender
- *'Charfias'* exploited by the heirs of the fishermen who owned these fisheries on the date when the Decree of 5 February 1931 on the Chebba and Kerkennah Islands fisheries, as modified by Decree no. 89-392 of 18 March 1989 organising the exploiting of '*Charfias'* in the Kerkennah Islands was published

4.1.6.2. Biological repose

The system of biological repose was introduced pursuant to **Law no. 2009-17 of 16 March 2009** on the system of biological repose in the fishing sector and how it is to be funded, and

that modifies Article 7 of Law 94-13. So far, the law on biological repose has been applied to one zone only, i.e. the Gulf of Gabès, and one repose activity i.e. trawling. The period of repose is three months in the summer season, from 1 July on, i.e. immediately after the shrimp fishing season is over.

4.1.6.3. Sport fishing

Decree of 20 September 1994 on fishing by diving and underwater sport fishing

- **Section 2. Underwater sport fishing**

Art. 14 – By underwater sport fishing should be understood activity of a sporting nature where aquatic species are caught when swimming or diving

Art. 18 – Underwater sport fishing is forbidden within 500 metres of fixed fisheries, beaches and bathing places, and within 200 metres of jetties, port access channels and floating nets

Art. 20 – Use of underwater diving equipment of whatever nature whatsoever enabling a person to breathe without returning to the surface is forbidden during underwater sport fishing. However, the use of equipment of this kind can be authorized for scientific purposes

Art. 22 – Apart from underwater sport fishing competitions and championships organised by specialist Tunisian associations, persons of foreign nationality must practise underwater sport fishing from the coast and not use boats or other floating means

Art. 23 – It is forbidden:

a) to keep loaded, out of the water, an underwater sport fishing device
b) to use luminous devices or bait for underwater sport fishing
c) to go underwater sport fishing between sunset and sunrise

Art. 24 – Marketing fish caught when underwater sport fishing is forbidden

Art. 25 – The total weight of catch per day must not exceed 5 kg. unless this is one single individual fish. However, during underwater sport fishing competitions and championships, the competent authority may grant special permits for catching a quantity bigger than what is stated above

Art. 26 – Fishing for grouper using underwater sport fishing gear is forbidden, except by authorization of the competent authority.

4.1.6.4. Marine and coastal protected areas

Law no. 2009-49 of 20 July 2009 on marine and coastal protected areas

Law 2009-49 is a specific legal framework established to protect nature and biodiversity in the marine and coastal environment and the use of their natural resources within the context of sustainable development, by setting up marine and coastal protected areas (MCPAs).

MCPAs are set up through a decree at the suggestion of the ministers responsible for the environment and fishing. The creation is preceded by public surveys that enable the concerns and rights of the parties concerned by the impact of the creation to be taken into consideration (Art. 10 of Law 2009-49).

Fishing activities within the MCPAs are either forbidden, or subject to prior authorizations and restrictions. Limited or permitted fishing activities must be carried out in accordance with the conditions determined through a decree by the minister of the environment after eliciting the opinion of the minister in charge of fishing (Art. 27 of Law 2009-49).

4.1.7. Managing and protecting resources

In the Gulf of Gabès, including the Kerkennah plateau, many different fisheries, fishing zones and kinds of fleet interact. To make exploitation of these fisheries more rational, to avoid as far as possible clashes between users of the marine space, and to ensure the sustainable and continuous development of the fishing sector, fishing activity in certain fisheries is regulated according to specific annual fishing drives. Furthermore, in order to fight against illegal trawling by trawlers in shallow waters or using the banned '*Kiss'* gear, artificial reefs have been laid down in sensitive areas in the Kerkennah plateau.

4.1.7.1. Fishing drives

These are ways of managing the effort, and concern temporal and/or spatial fishing bans which usually coincide with the periods of reproduction of certain species that are 'beacons' for the Tunisian economy.

The drives our area of study deals with concern very specific species, i.e. the king prawn (*Penaeus kerathurus*), the common octopus (*Octopus vulgaris*), the *serre* (*Pomatomus saltatrix*) and the sponges (*Spongia officinalis* and *Hippospongia communis*).

Moreover, we note that in the context of the common management of tunas and similar species in the Mediterranean, the International Commission for the Conservation of Atlantic Tunas (CICTA) made two binding recommendations about the organising of the bluefin tuna and swordfish fishing drives:

- Rec. 2011-03 (CICTA): Swordfish fishing is forbidden from 1 October to 30 November and from 15 February to 15 March of each year
- Rec. 2014 (CICTA): Bluefin tuna fishing is forbidden from 25 June to 25 May of each year

The open and close seasons of all these drives appear in the Table below:

Table 21. Statutory periods of fishing drives in the area of study

Drive	Permitted fishing period
King prawn (benthic trawl in the Gulf of Gabès	15 May – late June et du 16 October – 30 November (Possibility of extension up to 15 December)
Octopus	15 October – 15 May (With possibility of shifting the opening date up to 15 November and the closing date to end March)
Serre (seine fishing)	1er May – 31 August
Sponges (diving)	1er June – 31 March
Bluefin tuna	26 May – 24 June
Swordfish	1er December – 15 February and from 16 March – 30 September

Source: Decree of 28.9.1995 updated

4.1.7.2. Artificial reefs

Wishing to protect halieutic resources and fight against the proliferation of illegal fishing activities, both regional and central authorities kept the Kerkennah Islands on the list of priority regions in the national programme to provide the Gulf of Gabès with artificial reefs. This programme was started in 2005 in the form of pilot experiences via cooperation projects, here with the JICA (Sustainable Management of Resources of Coastal Fishing), later extended to the entire Gulf of Gabès in depths of between 10 and 20 metres and with a budget of the order of 5 million TD over a 10-year period.

Moreover, a study was launched in 2012 by the General Board of Fishing and Aquaculture (DGPA), entitled 'Project to protect the Gulf of Gabès by laying down artificial reefs'; the aim was to assess prior experiments of this kind, identify priority sites and zones where artificial reefs could be laid, and present scenarios for equipping these zones.

The study's region of intervention was divided into two parts, to which two zones were respectively attributed. Part 1 covered sites lying around the Kerkennah Islands (Zone 1). This choice was made on the basis of a survey and agreement between the various actors in the sector (administration, profession, research). A total of six zones were identified, i.e. Kerkennah Ghdir, East Kerkennah, Kraten Bhaier, Cercina, Atay and Sidi Youssef, covering an overall surface area of 57,748 hectares (i.e. 80% of the total surface area for Part 1: Zone 1 and 2 (Table 1 – Map 1).

In 2014, the General Board of Fishing and Aquaculture laid down 400 artificial reefs, weighing 2-3 tons, off the El Ataya area, while the Sfax Regional Commission for Agricultural Development pursued this activity in 2015 with 2,000 artificial reefs in the Kraten and El Ataya region, weighing about one ton (now being installed).

In 2011 APAL ordered a feasibility study for laying down artificial reefs and anti-trawl blocks in an experimental site and its signposting south of the Kerkennah Islands with the Serah-Abarloa2 design office groups and Alicante University. The scenario adopted proposed laying down artificial reefs of 2.4 and 8.3 tons in a sector going from Buoy no. 6 to Buoy no. 7 to the south of the Kerkennah Islands (off the two villages Mellita and Ouled Ezzedine) in depths of 18-22 metres. But up to now this project has not been carried into effect, despite the finalizing of the study and the fact that the contract specifications for the work were crafted in 2012.

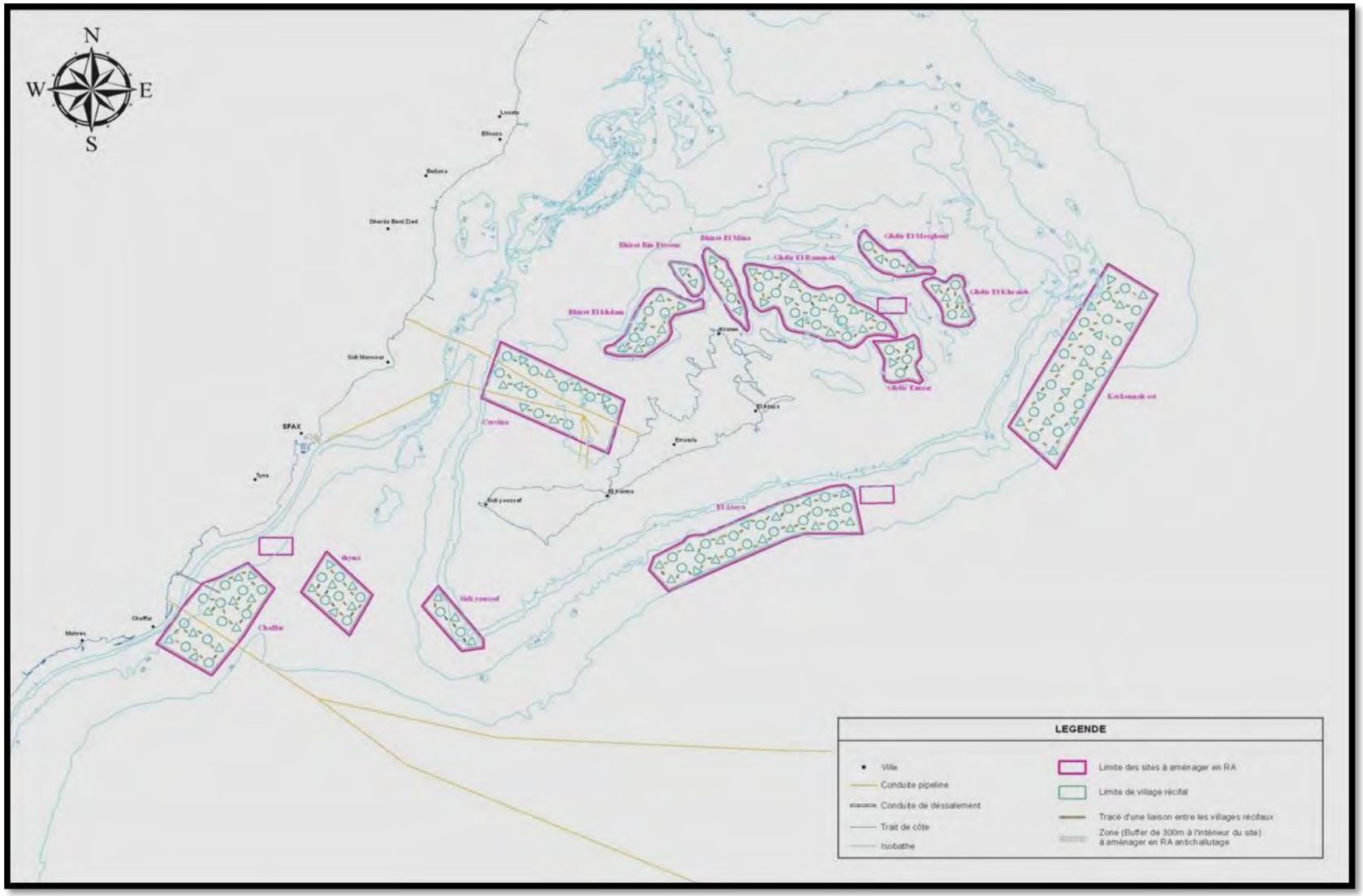
For its part, the Ministry of Agriculture, Hydraulic Resources and Fishing, aware of the inefficiency of the system of checking and monitoring and of the proliferation of illegal fishing, especially the '*Kiss'* (mini-trawl), and also of trawlers' incursions into (shallow) forbidden waters, decided that in its future strategy (2020) it would bank on enhancing the laying down of artificial reefs in these sensitive zones, thus making sure that banned fishing activities would be countered and also that sensitive or degraded zones would be restored, by arranging the various reefs into 'hamlets' or 'villages'.

The decentralization of this action, and the Sfax CRDA's initiative to put into effect part of the programme of laying down artificial reefs in its zone of intervention, should be supported. The Kerkennah region has taken the lion's share in terms of surface area selected for artificial reefs; efforts should be made at regional and central level to put this project into effect, making sure that all the actors (profession, civil society, administration) are involved. It is also important that NGOs take part in this project, mobilising funds, and that popularization work be done with fishermen to make them aware of the interest of protecting halieutic resources and conserving the environment. Also, a robust research programme must be set up to monitor and assess the impact of the reefs laid down in the Gulf of Gabès as a whole.

Table 22. Sites selected for laying down artificial reefs in the Gulf of Gabès

Delegation	**Zone**	**Identification**	**Surface**
North Sfax	Kerkennah Ghdir	Ghadir El Khraieb	2022.602
		Ghdir Emzar	2029.75
		Ghdir El Mezghenni	1844.969
		Ghdir El Rammeh	7954.680
	Kerkennah Est	Kerkennah Est	14630.542
	Kraten Bhiret	Bhiret El mina	1972.442
		Bhiret Bin Ettsour	936.412
		Bhiret Lakhdam	3761.702
	Cercina	Bhiret Lahsar	9832.730
	Ataya	Ataya	10613.039
	Sidi youssef	Sidi Youssef	2149.297
	Témoins 2	Kerkennah S-E	697.077
	Témoins 3	Kerkennah N-E	529.929
	Thyna	Thyna	3716.548
North Sfax	Chaffar	chaffar	8310.312
	Kneiss	Kneiss	3105.665
	Témoins 1	Témoins 1	696.986

DGPA, 2014a



Map. 1. Sites selected for laying down artificial reefs (DGPA, 2014a)

V. RESULTS OF THE SURVEY ON FISHING

In the field survey done as part of this study 45 coastal fishermen were interviewed over the months of August and September 2015. The survey sheet used appears in Annex 1.

A verdict on the reliability of the data could be gathered from the question, 'Is the person surveyed the owner of the boat or not?' All the fishermen surveyed stated that they were the owners of their means of production.

5.1. Socio-economic parameters of the fishermen

5.1.1. Generalities

The survey concerned 45 fishermen broken down into ship-owner/master (40 people), i.e. an owner who is simultaneously the master on board his own boat, ship-owner (1 person) and fishing master (4 people). Most of these fishermen had not had a professional training to become masters. 29% of fishermen were trained.

The 45 fishermen surveyed are all from, and live in, the Kerkennah archipelago. The distance between where they live and the landing site is no more than 7 km.

As to their civil status, 63.5% are married, 34.9% single and 1.6% divorced. The average size of household is 4.9 people, with a minimum 1 and a maximum 12. The survey showed that about 50% of household members practiced fishing, which shows once again how important fishing is for the residents of the archipelago.

As to cover by the CNSS, the survey showed that 80% of fishermen contributed to and enjoyed social services. As a result of the increase in health spending and the ageing of the fishing population and family requirements (education, leisure), social cover and pensions have become an absolute priority for the fishermen of the archipelago.

5.1.2. Age and job experience

During the survey we collected information on age and job experience for 74 people, including the 45 fishermen surveyed. We noted the absence of mechanics in the sample of boats surveyed.

The average age of the coastal fishermen sampled in Kerkennah was 41. By work station, we noted that the masters were older (44) than the sailors (36). This result is completely normal for a master has to be more experienced than a sailor. Moreover, the maximum age of the masters and sailors of Kerkennah is over 70 (Table below). Similarly, the proportion of fishermen of over 60 (legal age of retirement in Tunisia) is about 6%, higher than the other Tunisian regions (IHE, 2012). These findings show the Kerkennah population's fondness for fishing activity.

As to experience in the job, the total average in the archipelago is 24 years. By work station, this indicator is strongly correlated to the average age, since experience in the job was on average 26 and 19 years respectively for the masters, mechanics and sailors.

Table 23. Age and experience of the maritime population of Kerkennah

	Master			Sailor		
Parameter	Ave.	Min.	Max.	Ave.	Min.	Max.
Age	44	21	73	36	14	75
Experience	26	4	58	19	4	46

5.1.3. Household income and outgoings

The average annual income of the households surveyed was about 6,865 TD, 79% of which came from fishing, other sources of income (rent, building work, etc.) (14%), small trade (6%), and farming (agriculture, livestock farming) (1%). In the archipelago, the last activity is seen as a subsistence activity.

Considering the income from fishing, the earnings are divided between the ship-owner and the members of the crew after the common costs (necessary for the fishing trip) have been deducted from total sales.

The share of the ship-owner is about 58.7%. That of the crew (41.3%) is divided between the fishermen with 1.3 shares for the fishing master to 1 share for the sailor. It should be noticed that there is no great difference between the number of shares of the master and the sailor. This is because in almost all cases the ship-owner is himself the fishing master. Also, the members of the crew often come from the same family.

The average annual expenditure of the households of the people interviewed is 5,838 TD, of which 47.7% is set aside for food, 33.7% for the fishing activity, 9.7% for education, 5.2% for health and 3.7% for the rent.

It should be noted that the income-expenditure balance sheet is positive for the fishermen surveyed, with a surplus of 1,027 TD. And we note the size of the expenditure to fund the fishing activity, even higher than the expenditure on education and health.

5.1.4. Incentives and funding

Only 3 fishermen out of 39 answered the question about help and encouragements from the local, regional or national institutions; they said they had received encouragements from the Sfax Regional Agricultural Development Authority to the tune of about 8%. The average value of help received by these three fishermen was 310 TD to fund the fishing activity.

Almost half (49%) of the fishermen surveyed had had recourse to a loan from the bank. But this indicator does not reflect the reality of fishermen's indebtedness, since loans are usually handled by the fish wholesalers. The fishermen take loans either to fund family consumption needs only (5% of answers) or to respond to the needs of the fishing activity only (18%) or for both of these at the same time (77%). Most fishermen use consumer credit which is easier to obtain to fund their fishing activities.

Concerning the type of lender of credit, the Table below shows that the fish wholesalers constitute the main source of funding for the fishing activity, since nearly 47% of the fishermen surveyed stated that they obtained loans from fish wholesalers to an average value of 4,170 TD. This amount is also the highest compared to the average sums of the other loans taken by the fishermen. In second position is the BNA, with 13.3% of the fishermen for an average sum of 3,816 TD. But the most striking fact is the recourse to credit from fish wholesalers to finance the needs of family consumption. This category comes in third position, with 8.9% of the fishermen surveyed, but the average amount of this kind of loan is the smallest compared to the other kinds (675 TD).

Table 24. Origin, proportion of fishermen and average amounts of loans taken out by Kerkennah fishermen

	Family consumption loans		**Fishing activity loans**	
Banks	**Proportion %**	**Average sum in TD**	**Proportion %**	**Average sum in TD**
BTS			4,4%	1600
BNA			**13,3%**	**3816**
Other banks	2,2%	2000	2,2%	3000
Fish wholesalers	**8,9%**	**675**	**46,7%**	**4170**
Friend	2,2%	1000	6,7%	2330

5.1.5. Associative activity

Concerning the fishermen's membership of associations, the survey revealed that most of the fishermen interviewed (84%) did not belong to any structure. For members, these are either members of one of the Fishing Development Groups (GDP) locally (13% of the total population) or members of the Tunisian Agriculture and Fishing Union (UTAP) (2%). The very low rate of membership of the UTAP is due to the fact that the fishermen saw this structure as a political body before the revolution and felt that it only protected the interests of members of its executive board and of the heads of the regional unions.

The fishermen who belonged to an association said that this was voluntary and that the main reason for their membership was the need for supervision and the protection of their fishing-related interests.

5.1.6. Infrastructure and indicators of the fishermen's standard of living

The survey showed that the archipelago's fishermen are well provided with infrastructure and means of well-being in higher proportions than the regional and national average (see first part of the present work).

As well as the good infrastructure indicators (housing, electricity and drinking water), the most striking indicators are linked to communications facilities, since 100% of the fishermen surveyed have mobile phones and 51% of them have land lines. Nationally, these percentages are respectively 46.3% and 35.3%. Moreover, connection to the internet and linkage to the social networks, especially Facebook, are also high (20% and 18% respectively compared to 17.5% nationally). This fact constitutes an important factor in the fishermen's openness to modern communications tools and tools for the sharing of information.

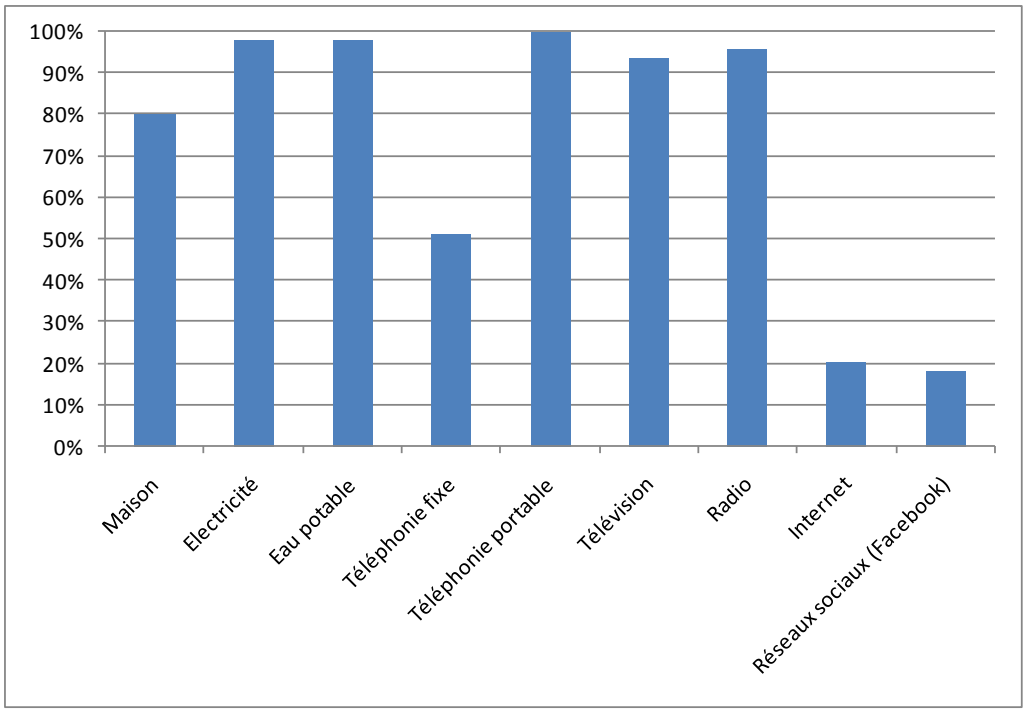


Fig. 14. Infrastructure and standard of living indicators for the Kerkennah fishermen

5.1.7. Marketing

In the Kerkennah archipelago, catch is mainly sold to the fish wholesalers (79.8% of the 45 answers on marketing), then to consumers (9.7%) and for self-consumption (7.3%). The least favoured destinations are the port market (2.9%) and the markets in the nearby towns (0.3%). No fisherman stated that he sold his catch directly to the fishmongers (retailers), processing factories and restaurants. The fish wholesalers take on the supplying of these after collecting the fish in the landing areas along the coasts of the archipelago.

The low rate of catch that is taken to the markets of the ports of Kraten and El Ataya is due to their having been closed for abut ten years. This is the main reason for the fact that much of the production escapes the agents who collect fishing statistics, and as a result explains the fact that the official data published by the DGPA is not very reliable.

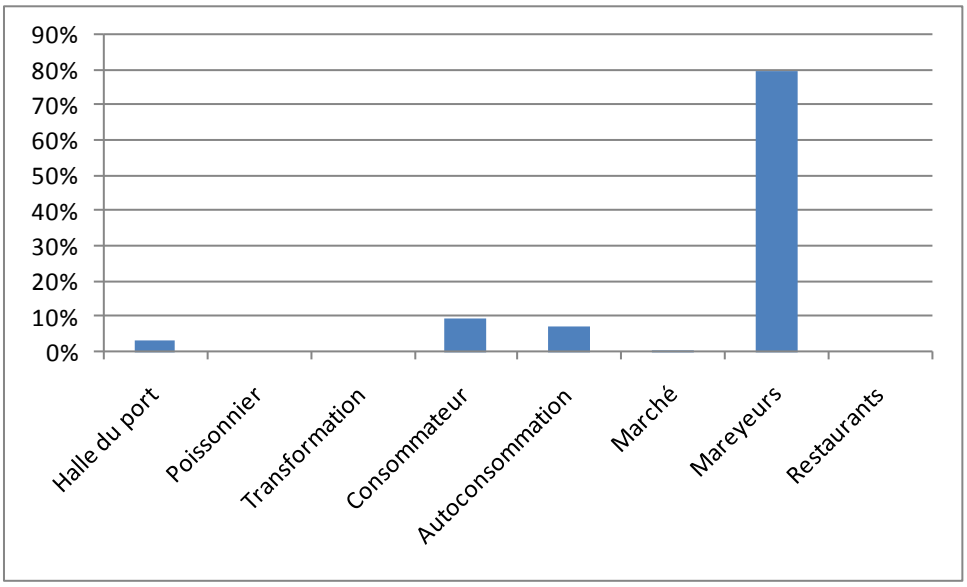


Fig. 15. Occurrence as a % of the answers about marketing by destination in Kerkennah

During the sale of catch to the fish wholesalers, the usual kind of negotiation in the archipelago is that involving a single wholesaler (91% of the 45 answers received). Negotiations with several wholesalers, 'auctions', only occur in 11% of cases, and the kind of negotiation whereby 'the wholesaler decides the price according to the fishermen's debts to him' is in last position (2%). In the archipelago there is no negotiation between the fish wholesalers and the fishermen's associations/cooperatives. This result highlights the fishermen's lack of associative culture in the area studied.

5.2. Fishing regulations

5.2.1. Areas where fishing is forbidden

<u>Knowledge of the regulations</u>

Concerning the question put to the fishermen about knowledge of no-fishing zones, we noted that most of the archipelago's fishermen (72.2%) were not aware of the regulation.

This ignorance is very high for the deep sea areas where seine fishing is forbidden (88.9% of answers) because this type of fishing is not practiced by the archipelago's fishermen. For zones where trawling is banned, we saw that 55.6% of the fishermen were unaware of the regulations.

<u>Respecting the regulations</u>

Concerning the issue of respect for the law on zones where fishing is banned, we saw that most of the fishermen (88.9%) do not care about the regulations. Analysis by no-fishing zone shows that the depths where trawling is banned record a 91.1% rate of non-respect as against only 2.2% for respect for the regulations.

Table 25. Occurrence as a % of the answers about knowledge of and respect for trawl fishing and seine fishing areas in Kerkennah

	Knowledge		Respect		
Banned zones	**Yes**	**No**	**Yes**	**No**	**RAS**
Trawling (<50 m.)	44,4%	55,6%	2,2%	91,1%	6,7%
Seine (torchlight: <35 m.) and day <20 m.)	11,1%	88,9%	0,0%	86,7%	13,3%
Total	27,8%	**72,2%**	1,1%	**88,9%**	10,0%

Concerning the issue of reasons for the non-respect for the regulations over no-fishing zones, we notice that habit is the main reason, with 91% of the 45 answers received. The reason 'because of ignorance' and the economic reasons for non-respect for the regulations are infrequent, with respective rates of 11% and 4.5%.

5.2.2. Mesh of the nets

Knowledge of the regulations

Concerning the question put to the fishermen about knowledge of the mesh size of the fishing gear, we noted a very high percentage of ignorance, even greater than ignorance about no-fishing zones. 82.5% of the answers of the people interviewed were unaware of the regulation size of mesh of fishing gear (see Table below).

Analysis by fishing gear reveals that except for the mesh of 20 mm.-square mesh keepnets, the regulation size of mesh for all other gear was unknown.

Respecting the regulations

Concerning the question on respect for the law on the mesh size of fishing gear, we note that the fishermen do not pay attention to the regulations (85.1% of answers obtained) in all the regions except Zarzis-Ketef and Boughrara. We see too that 100% of the fishermen do not respect the mesh sizes of mesh nets and trammel nets. For square-mesh keepnets, the percentage of respect for the regulations was higher (42.2% of fishermen) than for other gear.

Table 26. Occurrence as a % of the answers about knowledge of and respect for regulations on the mesh size of fishing gear in Kerkennah

	Knowledge		Respect		
Fishing gear	**Yes**	**No**	**Yes**	**No**	**RAS**
Gillnet and trammel net 30 mm	4,4%	95,6%		**100,0%**	
Trawl 20 mm	11,1%	88,9%		88,9%	11,1%
Purse seine 12 mm		100,0%		88,6%	11,4%
Seine for fishing tuna 50mm	4,4%	95,6%		88,9%	11,1%
Nasse Square mesh 20 mm	66,7%	33,3%	42,2%	55,6%	2,2%
Nasse triangle mesh 30 mm	17,8%	82,2%	4,5%	88,6%	6,8%
Total	17,5%	**82,5%**	7,8%	**85,1%**	7,1%

Concerning the question on reasons for the non-respect for the regulations on the mesh size of fishing gear, we saw that in the archipelago habit (do as the other fishermen do) was relatively the reason most given, with 89% of the fishermen surveyed, followed by ignorance of the law (62%) and the economic reason (51%).

5.2.3. Minimum size of catch

Knowledge of the regulations

Concerning the question put to the fishermen about knowledge of the minimum size of catch, we also noted a very high percentage of ignorance. 85.2% of the answers of the people interviewed were unaware of the regulation size of catch. This percentage reached 100% for size of sardines and oysters. These species, especially oysters, are not usually fished in the archipelago.

Analysis by species reveals that the regulation weight of the octopus (a traditional species in the archipelago) is the only one that presents percentages of knowledge (57.8%) that are higher than that of ignorance (42.2%). The length of the mantle of the cuttlefish is relatively well known (22.2%) compared to the other species.

Respecting the regulations

Concerning the question on respect for the law on the minimum size of catch, we note that the fishermen do not pay attention since the percentage of non-respect is 83.3% as against 0.2% for respect. This holds for all species.

Habit is the main reason for non-respect for the regulations in Kerkennah, with 89% of the answers of the 45 people surveyed, followed by the reason 'ignorance' (9%) and lastly the economic reason (7%).

Table 27. Occurrence as a % of the answers about knowledge of and respect for regulations on the minimum size of catch in Kerkennah

	Knowledge		Respect		
Species	**Yes**	**No**	**Yes**	**No**	**RAS**
Octopus (1 Kg)	57,8%	42,2%		100,0%	
Cuttlefish (10 cm LMD)	22,2%	77,8%	2,2%	93,3%	4,4%
Sardine (12 cm LSt)		100,0%		88,9%	11,1%
Loup, mackerel, sea bream, etc. (20 cm LSt)	6,7%	93,3%		91,1%	8,9%
Clam (35 mm shell size)	2,2%	97,8%		26,7%	73,3%
Oyster (50 mm shell size)	0,0%	100,0%			
Grand total	14,8%	**85,2%**	0,4%	**83,3%**	16,3%

5.2.4. Forbidden fishing methods

Knowledge of the regulations

Concerning the question put to the fishermen about knowledge of forbidden fishing methods, we noted that the percentage of ignorance was relatively low compared with that for other kinds of regulation. 57% of the answers of the people interviewed in Kerkennah know the regulations on forbidden fishing methods as against the 43% who do not know (see Table below).

Analysis by forbidden fishing method reveals that the ban on use of the '*Kiss'* is known by almost every fisherman surveyed.

As to drift nets, their ban is also known by 75% of fishermen. For other prohibited methods, the percentages of knowledge of the ban are lower than the percentage of ignorance.

Respecting the regulations

Concerning the question on respect for the law on forbidden fishing methods, we note that over one-third of the fishermen surveyed judge that there is no respect for the regulations.

By type of forbidden fishing, we stress that the regulations on the practice of the '*Kiss'* are widely non-respected in the Kerkennah area (100% of answers). This holds good for use of drift nets, with a rate of non-respect of nearly 98%. But the fishermen showed respect for the regulations banning the use of dynamite for fishing and fishing with cast nets.

Concerning the question on reasons for the non-respect for the regulations on forbidden fishing methods, we note, as for all the above-mentioned regulations, that habit (do as the other fishermen do) is the reason most represented (60%), with ignorance of the law (56%) and the economic reason (10).

Table 28. Occurrence as a % of the answers about knowledge of and respect for regulations on forbidden fishing methods in Kerkennah

	Kwowledge		Respect		
Prohibited Method	**Yes**	**No**	**Yes**	**No**	**RAS**
Fishing "Kiss"	100,0%			100,0%	
Sponge fishing using 'gangave'	15,6%	84,4%		55,6%	44,4%
Beach seines (HLIG and Tilla)	33,3%	66,7%	4,4%	68,9%	26,7%
Driftnets	75,6%	24,4%	2,2%	97,8%	
'Dynamite' Fishing	22,2%	77,8%	73,3%	26,7%	
Sparrowhawk	11,1%	88,9%	60,0%	40,0%	
Overall Total	43,0%	**57,0%**	23,4%	**64,7%**	11,9%

5.3. Characterization of fishing units

5.3.1. Driving power

The units of coastal fishing in the Kerkennah archipelago can be broken down into four types according to their propellants: motor driven (M), rowing boat (R), sailing boat with outboard motor (V (HB)); rowing boat with outboard motor (R (HB)).

Of the 45 boats sampled, 31 were motor driven (M, 69%), 10 were V (HB), 2 were R (HB) and 2 were rowing boats. Over the past decade, several rowing and/or sailing boats have acquired outboard motors; these boats make up 27% of Kerkennah's active coastal fishing fleet. In the next part of the study, boats equipped with outboard motors will be considered as M, motor driven. Given that the number of non-motor driven boats (only 2 rowing boats) has become tiny, which prevents reliable statistics being taken (min., max., average, type difference, etc.), we shall deal with the different variables of the survey to consider the entire sample, not drawing any distinction between types of boat.

5.3.2. Age, length and motor power of the fishing boats

The archipelago's fishing boats are relatively old, their average age being 19.3 years with a minimum of 3 years and a maximum of 32. As to length, this varies between 5 and 15 m., with an average of 7.6 m. Similarly, the motor power varies between 6 and 350 HP with an average of 45.6 HP. The very powerful motors are used by fishing boats that go in for the banned '*Kiss'* technique.

A breakdown of the coastal boats by age shows that 71% are more than 16 years old and 11% less than 10 (see Figure below).

Concerning the renovation of fishing boats, the percentage of renovation is 26% with an average duration of 8 years.

We can conclude that despite the relatively high average age and average duration of renovation of the fishing boats of Kerkennah, they continue to work in good conditions. According to the fishermen surveyed, they always carry out routine and regular upkeep (careening) of the boats so they remain in good condition.

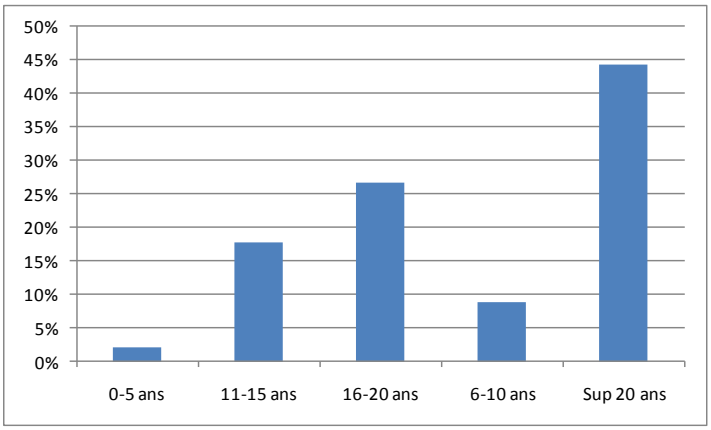


Fig. 16. Breakdown of fishing boats in Kerkennah by age

5.4. Exploiting fishing gear and fishing sites in Kerkennah

This section is devoted to an analysis of the data collected relative to the sections '7. Fishing gear used' and 8. 'Fishing sites for each season' that appear in the questionnaire used.

In what follows, the analysis concerns 12 kinds of fishing gear that can be distinguished from the data collected:

- MSpa: Mesh net for annular sea bream
- TrSeiche: Trammel net for cuttlefish
- TrCre: Trammel net for shrimps
- M: Mesh nets (various fishes)
- Tr: Trammel nets (various fishes)
- Potp: Octopus pots
- Pal: Palangre
- Nasses: Keepnets
- Saut: Sautade
- *Kiss*: Mini-trawl
- *Charfia*: Fixed fisheries (*Charfia*)
- Sponges: Sponge fishing

Concerning the time of year, we have selected two periods:

- C: Hot period (from March to August)
- F: Cold period (from September to February)

For fishing zones, given the coastal topography of the archipelago with its alternating depressions (*Bhiras* and *Ghdirs*), *oueds* and shallows, all of which have local names and of which we were informed during the field study, we were forced to group them into 4 big zones for greater readability and understanding of the results of the surveys.

The fishing sites selected are:

- **Rameh zone** (north and north-east of the archipelago), containing Ghdir Rameh, Ghdir El Hnach, Ghdir El Mezghani, Ghdir El Khraib, Bhiret El Mina and the area around buoys no. 1, 2, 3 and 4
- **Gremdi zone**, containing Bhiret El Gremdi up to the area around buoys no. 5 and 6
- **Zone east/south-east of Kerkennah**, containing Bhiret El Abbassya, Bhiret El Kellebine, Bhiret Ouled Kacem, Bhiret Atir, Bhiret Sidi Youssef and the area around buoys no. 7 and 8
- **Zone west of Kerkennah**, containing Bhiret El H'sar, Bhiret El Khdam, Bhiret Bin Ettsour, and Tsir El Abid up to the Sfax coast.

Finally, for the deeper strata, we have selected four: 1-5 m., 6-10 m., 11-20 m., and greater than 20 m. (>20 m.).

We shall try below to characterize the fishing gear, their use during the year and a spatial-temporal analysis of the fishing effort, fishing zones and species taken.

Moreover, in accordance with the terms of reference, the results from our survey on traditional fishing using the *Charfia* and that using the banned '*Kiss'*, which will be set out in the various sections of this part, will be supplemented by a bibliographical summary at the end of the report.

5.4.1. Fishing gear

Based on the 184 answers about types of fishing gear used in the archipelago, we see that the gear most favoured by the Kerkennah fishermen are mesh nets for fishing various fishes (20.7% of answers) followed by the trammel net for cuttlefish (19.6%), keepnets (13.6%), the mesh net for annular sea bream (11%), pots for octopus (10%), the trammel for shrimps (8%), the trammel for various fishes (7.6%) and *Charfias* (5%). It is also important to note that some fishermen stated that they used the '*Kiss'* mini-trawl although it is banned and causes environmental and social problems for the fishing activity in the archipelago. About 2% used this gear. The 3 remaining modes of fishing (palangres, sponge fishing and *sautade*) only represent, taken together, 2.5% of answers on gear used (see Figure below).

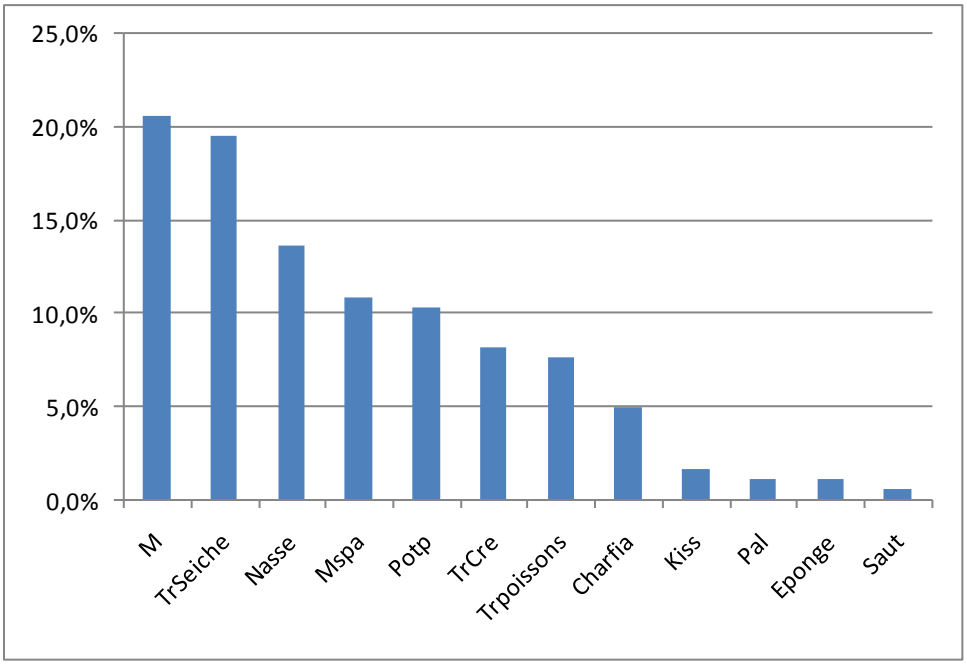


Fig. 17. Fishing gear possessed by the fishermen of Kerkennah

There are on average 4 gear per boat, with a minimum of 1 gear and a maximum of 7. The Figure below shows that the most usual number of gear used per year is 6 (33% of answers), followed by 5 (24%) and 3 (17%). Many fishermen have *Charfias* and a private area for octopus fishing using hollow stones ('*Massâa'*) that they check every day and use at the same time as the other gear. We also note that the boats that use one gear only throughout the year are basically boats that use either the '*Kiss'* mini-trawl or go sponge fishing.

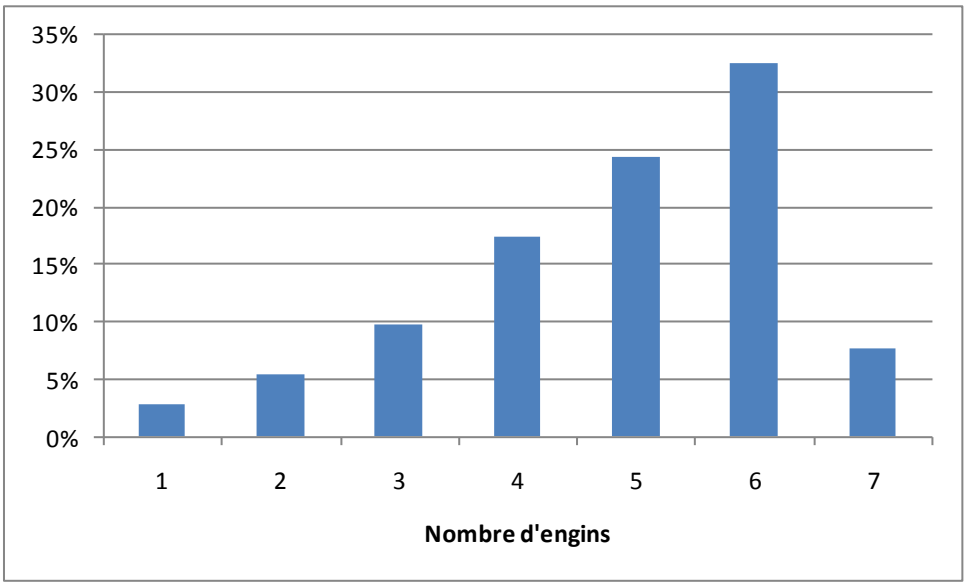


Fig. 18. Breakdown of the number of fishing gear used by boat

5.4.1.1. Features of fishing gear

The features sought in the questionnaires are size of mesh (mesh side) and number of nets as well as type of hooks for palangres.

The Table below describes the features of the fishing gear. In our paper, we are more interested in the 5 main gear in the Island of Kerkennah, i.e. those with percentages of use that are higher than 10%.

First of all, we must state that apart from the trammel for cuttlefish, all the other kinds of net present an average mesh size of under 30 mm., which is the regulation size.

The mesh nets used have an average mesh of 27 mm., with a minimum 20 mm. and a maximum 65 mm. The last are basically used for catching dogfish. The average number of nets is 36, i.e. an average length of 1,800 m. (a net measures 50 m. on average).

Concerning the mesh net for cuttlefish, the average mesh is 30 mm. and the average number of nets is 55, i.e. an average net length of 2,750 m.

The keepnets used have a square mesh with an average size of 19 mm. The average number of keepnets used per boat is 512 pieces with a maximum 2,000.

The mesh net for annular sea bream has an average mesh of 24 mm. and an average number of pieces of 21, the lowest of all types of net.

For octopus pots and stones, we see that the average number of pieces per outfit is relatively great (almost 2,000 pieces) with a maximum 5,200 units.

The banned '*Kiss'* gear presents an average size of mesh at the bottom of the mini-trawl of 19 mm., with a minimum of 15 mm.

Table 29. Average, minimum and maximum values of mesh size, number of hooks and number of nets of fishing gear used, by boat

Gears	Mesh size (mm) or n° hook			Number pieces / gear		
	Min	Average	Max	Min	Average	Max
M	20	27	65	10	36	130
TrSeiche	26	30	35	15	55	180
Nasse	15	19	22	50	512	2000
MSpa	22	24	30	10	21	50
PotP				300	1922	5200
TrPoissons	24	29	35	10	46	140
TrCre	20	23	28	15	80	160
Charfia				1	3	7
Pal	6	6	6	1800	1800	1800
Eponge						
Kiss	18	19	22	1	1	1
Saut	24	24	24			

Here we shall try to present the breakdown of various kinds of net used per mesh category.

A look at the Figure below shows that the most frequent category of mesh for mesh nets, keepnets, mesh net for annular sea bream and trammel for shrimps is 20-24 mm. followed by the 26-28 mm. category.

For trammel net for cuttlefish and trammel for fishes, it is the 30-36 mm. category that is most used, followed by the 26-28 mm. category.

Finally, the nets used to make the '*Kiss'* mini-trawl and *sautades* all belong to the 20-24 mm. category.

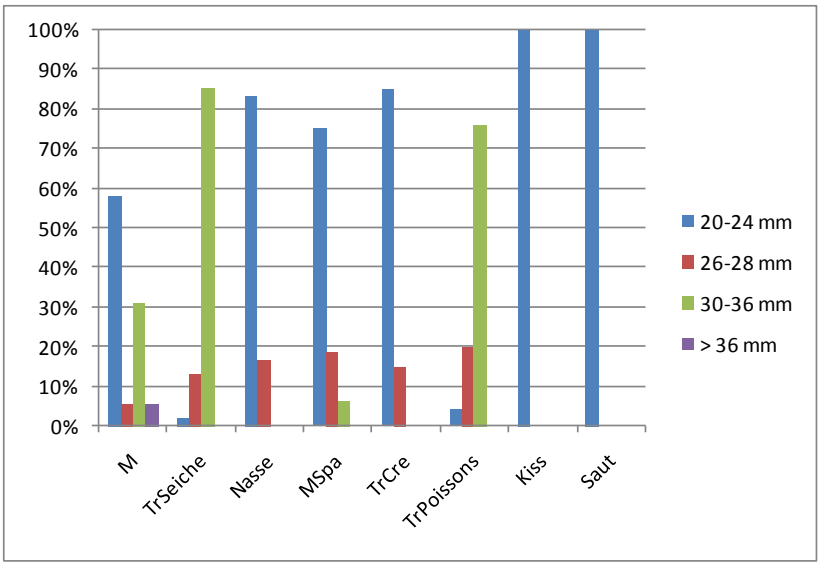


Fig. 19. Breakdown of the number of fishing gear used, by boat

5.4.1.2. Associations of fishing gear/species caught

In this part we shall group trammel nets for shrimps, for cuttlefish and for fishes in the same category, 'Trammel', and mesh nets and mesh nets for annular sea bream in the same category, 'Mesh'. As well as these main categories, we shall analyse keepnets, *Charfia* and the banned '*Kiss'* gear.

The other gear is mostly mono-specific, such as fishing for sponges, octopus pots and *sautade* for grey mullet.

Concerning palangres, unfortunately only one fisherman said he used them. He used palangres to fish for grouper, swordfish and dogfish.

5.4.1.2.1. Mesh nets

Mesh nets contain the widest range of species and groups of species caught by fishing gear used in the archipelago. 12 target species are present in the catch from mesh nets. The most important target species are annular sea bream, grey mullet, red mullet and gilt-head bream, with respectively 30, 22, 18 and 14% of total answers (see Table below).

A second batch of species is made up of *pageot, saupe* and sea bass.

The species considered as very much by-catch for mesh nets are garfish, octopus and cuttlefish, perch and shark, with 1.3% each.

The great pressure exerted by this gear means that, with the exception of the octopus, an under-exploited species, all the species are in a critical situation (INSTM, 2010).

Indeed, the annular sea bream, golden mullet, cuttlefish and *saupe* are in a state of maximum exploitation, and the red mullet, *pageot*, gilt-head bream, perch and sharks are in a state of over-exploitation. The cuttlefish, which after the octopus represents the greater part of the landings in the archipelago, requires more rational management; this should begin with a reduction of the fishing effort.

Moreover, the over-exploited species require specific improvement plans. It is vital that the GFCM's recommendations (GFCM/36/2012/3) on management measures for sharks, *rajidés* and angel sharks be followed.

Table 30. Occurrence of appearance of species targeted by mesh nets

Species	Occurrence	Share (%)
Annular sea bream	24	30,4%
Mullet	17	21,5%
Red mullet	14	17,7%
Gilt-head bream	11	13,9%
Pageot	3	3,8%
Saupe	3	3,8%
Sea bass	2	2,5%
Garfish	1	1,3%
Octopus	1	1,3%
Cuttlefish	1	1,3%
Perch	1	1,3%
Shark	1	1,3%

5.4.1.2.2. Trammel nets

Usually trammel nets contain a range of species and groups of species caught and are among the largest fishing gear used in Tunisia. But, given that we asked the fishermen to state which species were most targeted by the gear, and not all the species caught (target and by-catch), we only recorded 5 target species. Cuttlefish and octopus were at the top, with respective proportions of 44% and 34% (see Table below). Shrimps came next, with 17.6%.

Then came gilt-head bream and sole, with 2.4% each.

As regards trammel nets, except those for shrimps and octopus, species that are under-exploited, all the other species are either being optimally exploited, like the cuttlefish and the sole, or in a situation of over-exploitation, like the gilt-head bream (INSTM, 2010).

Table 31. Occurrence of appearance of species targeted by trammel nets

	Occurrence	Share (%)
Cuttlefish	37	43,5%
Octopus	29	34,1%
Shrimp	15	17,6%
Gilt-head bream	2	2,4%
Sole	2	2,4%

5.4.1.2.3. Fixed fisheries of the Charfia kind

7 species and groups of species are targeted by the *Charfia* (see Table below).

The annular sea bream is the species most targeted, with 30% of answers, then comes the gilt-head bream and octopus with 23% each, and lastly the cuttlefish with 13%. Species considered as by-catch are the goby, grey mullet and *saupe*, with 3.3% each.

Despite being passive forms of fishing and their high selectivity, the fixed fisheries target species that are over-exploited or are in a situation of maximum exploitation, which require specific management measures. By order of importance these are the gilt-head bream, the cuttlefish, the annular sea bream, the grey mullet and the *saupe* (INSTM, 2010).

Table 32. Occurrence of appearance of species targeted by keepnets and fixed fisheries of the *Charfia* kind

Species	Occurrence	Share (%)
Annular sea bream	9	30,0%
Gilt-head bream	7	23,3%
Octopus	7	23,3%
Cuttlefish	4	13,3%
Gobies	1	3,3%
Mullet	1	3,3%
Saupe	1	3,3%

5.4.1.2.4. Keepnets

Landings from keepnets contain 5 target species or groups of species. The octopus is by far the most sought-after species, for it is declared in about 76% of the answers. According to our interviews with the fishermen and the agents of the Kerkennah fishing administrations, the past 5 years have seen octopus pots replaced by plastic keepnets baited with crabs.

The other species targeted by this gear are red mullet, serran and annular sea bream with 6.9% each. The *pageot* represents a keepnet by-catch species.

Just like the fixed fisheries, the keepnets, considered to be selective gear, target species in a situation of over-exploitation like the red mullet and the *pageot* (INSTM, 2010).

Table 33. Occurrence of appearance of target species caught by rotating seine nets

Species	Occurrence	Share (%)
Octopus	22	75,9%
Red mullet	2	6,9%
Serran	2	6,9%
Annular sea bream	2	6,9%
Pageot	1	3,4%

5.4.1.2.5. The mini-trawl or 'Kiss'

This gear is highly destructive of habitats and marine resources and it is strictly forbidden. And yet its use is becoming increasingly common over the years in the absence of rigorous checking by the competent authorities.

According to the sampled '*Kiss'* fishermen's answers, there are 6 main target species. Usually, the range of catch is far greater and is mainly made up of juveniles. But the answers we received only contained the species appearing in the Table below.

The cuttlefish is the main target species (27.3%), followed by shrimps, octopus and the small octopus (*musqué*) with 18.2% each. The species considered as by-catch is the annular sea bream. Given that this gear is active at shallow depths, it applies very great pressure on the young of all target species. Thus it is vital that a radical solution be found for this practice that is very destructive for both biodiversity and for benthic habitats.

Table 34. Occurrence of appearance of species targeted by the 'Kiss'

Species	Occurrence	Share (%)
Cuttlefish	3	27,3%
Shrimps	2	18,2%
Small octopus	2	18,2%
octopus	2	18,2%
Red mullet	1	9,1%
Annular sea bream	1	9,1%

5.4.1.3. Fishing effort in annual number of trips per gear by fishing zone and by stratum of depth

The information collected, after being corrected and analysed, enabled us to grasp the importance of the activity of the gear used according to season, fishing area and stratum of depth.

First we shall try to make an annual overall analysis of use of the fishing gear in various fishing areas and per stratum of depth.

Then we shall make a more detailed analysis of the activity of fishing gear by season and by fishing area, while trying to highlight the most frequented depth stratum and the main target species that will be recorded on the maps by season.

5.4.1.3.1. Effort in annual number of trips per gear

First it should be said that the classification of the gear made in the section '3.1. Fishing gear' was based on frequency of possession of fishing gear by the fishermen surveyed. But below we try to show the importance of the effective use of gear during the fishing trips made by the fishermen interviewed.

According to the following Table, the total number of trips made by the fishermen surveyed is about 9,640 trips. This could seem incorrect in that the number of boats sampled is 45. But this figure is realistic, for the fishing boats surveyed can use on average 4 gear simultaneously

and for each of the gear used during one single trip we recorded 1 trip/gear. **So in everything that follows, we shall analyse the fishing effort in terms of trip/gear association.**

Thus we see that trammel for cuttlefish is by far the gear with which the Kerkennah fishermen made the most trips, representing a proportion of 21.5% of the annual number of trips. It is followed by mesh nets for fishing various fishes, with 16.5%, and keepnets, with 13.5%. A batch of three gear comes next, the mesh net for annular sea bream, *Charfias* and octopus pots, with proportions varying from 10-11%.

Table 35. Annual number of trips/gear by fishing gear in Kerkennah

Gears	Effort in annual number of trips/year	Proportion en %
TrSeiche	2070	21,5%
M	1586	16,5%
Nasse	1305	13,5%
MSpa	1049	10,9%
Charfia	990	10,3%
PotP	971	10,1%
TrPoissons	636	6,6%
TrCre	581	6,0%
Kiss	300	3,1%
Eponge	60	0,6%
Saut	60	0,6%
Pal	32	0,3%
Total	9640	100,0%

5.4.1.3.2. Annual number of trips/gear by fishing zone

The east/south-east Kerkennah zone constitutes a favoured zone for making fishing trips, with a proportion of 43% of the 9,640 trips/gear made by the fishermen surveyed. It is followed by the Gremdi fishing sites with 27.6%, the west Kerkennah zone with 16.3% and lastly the Rameh zone with 13.1% (see Table below).

Combining the gear with fishing areas shows that the trammel for cuttlefish, mesh nets for various fishes, and octopus pots are more used to make fishing trips in the Gremdi zone, whereas keepnets, mesh nets for annular sea bream, *Charfia*, and trammels for fishes and shrimps are more used for making fishing trips in the east/south-east Kerkennah area.

As for the banned '*Kiss'* gear, it is used in all fishing zones except Gremdi.

It should be noted that the trammel for cuttlefish, mesh nets, keepnets, octopus pots and trammel for shrimps are used in the 4 zones, whereas the *sautade* and the palangre are only used in the Gremdi zone.

Table 36. Proportion of the annual number of trips/gear made by fishing gear in Kerkennah

Gears/Zone	Rameh	Gremdi	East/South-east Kerkennah	West Kerkennah	Total
TrSeiche	2,5%	8,7%	6,5%	3,8%	21,5%
M	3,6%	7,5%	3,1%	2,3%	16,5%
Nasse	2,0%	1,5%	9,4%	0,6%	13,5%
MSpa	0,2%	3,3%	4,1%	3,3%	10,9%
Charfia			7,8%	2,5%	10,3%
PotP	1,9%	4,5%	3,3%	0,5%	10,1%
TrPoissons	0,7%		4,7%	1,1%	6,6%
TrCre	1,4%	0,8%	2,8%	1,0%	6,0%
Kiss	0,6%		1,2%	1,2%	3,1%
Eponge	0,2%	0,5%			0,6%
Saut		0,6%			0,6%
Pal		0,3%			0,3%
Total	13,1%	27,6%	43,0%	16,3%	100,0%

5.4.1.3.3. Annual number of trips/gear by stratum of depth

A look at the Table below shows that of the 9,640 trips/gear, about 60% were made in the 1-5 m. depth stratum, followed by the 11-20 m. stratum (18.5%), then the 6-10 m. stratum with 16.6% and lastly the >20 m. stratum with nearly 5% (see Table below). These proportions highlight the great pressure exerted by coastal fishing on the shallows of the Kerkennah plateau, and which is partially responsible for the over-exploiting of this area's resources.

Combining the gear with the depth strata shows that except for the keepnets, trammels for shrimps and the banned '*Kiss'* gear, all the other gear are widely used in the shallowest parts of the water of the archipelago (1-5 m.).

Trammel for shrimps and the banned '*Kiss'* are more used in the 6-10 m. stratum, whereas the keepnets are more used in the 11-20 m. stratum.

It should be noted that the trammel for cuttlefish, the mesh nets for fishes and for annular sea bream, the octopus pots and the keepnets are used in all depth strata, while the *Charfia*, *sautade* and sponge fishing only appear in the 1-5 m. depth stratum.

Table 37. Proportion of the annual number of trips/gear made by depth stratum in Kerkennah

Gears/depth	1-5m	6-10m	11-20m	>20m	Total
TrSeiche	15,2%	4,4%	1,5%	0,3%	21,5%
M	11,1%	2,2%	2,1%	1,0%	16,5%
Nasse	3,3%	2,3%	7,4%	0,5%	13,5%
MSpa	6,9%	2,5%	1,3%	0,2%	10,9%
Charfia	10,3%				10,3%
PotP	5,2%	1,5%	2,9%	0,4%	10,1%
TrPoissons	5,6%			1,0%	6,6%
TrCre	1,1%	1,8%	2,1%	1,1%	6,0%
Kiss		1,9%	1,2%		3,1%
Eponge	0,6%				0,6%
Saut	0,6%				0,6%
Pal				0,3%	0,3%
General Total	59,9%	16,6%	18,5%	4,9%	100,0%

5.4.1.4. Spatial-temporal analysis of the effort in number of trips/gear used by fishing area and stratum of depth

To give a better grasp of the results on the spatial-temporal breakdown of the fishing effort and to allow comparisons of the use of fishing gear during trips made by the fishermen of Kerkennah, by depth stratum and by fishing area, we chose a mapped presentation by season. The map in Figure 20 corresponds to the hot season (C) whereas the map in Figure 21 shows activity during the cold season (F).

Firstly, a glance at these maps reveals that, irrespective of season, the number of trips/gear by the fishermen by fishing area follows the same annual classification as was shown above (see section 5.4.1.3.2.). The east/south-east zone comes first, followed by Gremdi, western Kerkennah and the Rameh zone. Yet, although for these three last zones the number of trips/gear made during the hot season is higher than that made in the cold season, the opposite happens in the east/south-east of Kerkennah where the fishermen surveyed made 2,127 trips/gear during the cold season as against 2,016 in the hot season. This is quite normal, for the cold season coincides with the period of great activity using *Charfia* and keepnets and octopus pots for fishing octopus, a species that is more abundant in that zone.

Below we shall attempt to analyse the combinations of fishing gear used and depth strata frequented to make fishing trips for each of the 4 fishing zones selected, drawing comparisons between the seasons:

- **East/south-east Kerkennah zone**: We note that the fishermen use 9 different gear during the hot season as against 8 during the cold season. The five main gear used in the hot season are, in order of importance, the mesh net for annular sea bream, the *Charfia*, the trammel for shrimps, the keepnets and the mesh net for various fishes. But during the cold season, the most used gear are keepnets, *Charfia*, trammel for cuttlefish, octopus pots and trammel for fishes. We also note that the banned '*Kiss'* is

used equally for the two seasons (about 3% of all trips/gear) and in the same depth stratum (11-20 m.).

In terms of depth stratum, it is the 1-5 m. stratum that is the most frequented, and then the 11-20 m. stratum. But although the >20 m. stratum comes in third position during the hot season, it is the 6-10 m. stratum that holds that position in the cold season. This is quite normal, because in the cold season, the meteorological conditions are less clement than in the hot season, and this forces the fishermen to remain in the more coastal areas.

Lastly, combining fishing gear and depth strata reveals that for most of the gear, the fishermen do not greatly change depth stratum between the hot and the cold season, except for the mesh net for various fishes, which is only used in the 1-5 m. stratum during the hot season, whereas it is used in the >20 m. and 11-20 m. strata during the cold season.

• **Gremdi zone**: In this zone the fishermen use 9 different gear during the hot season as against 7 in the cold season. Three gear are used in about 80% of the total number of trips/gear made during the hot season, being in order of importance the trammel for cuttlefish, the mesh net for various fishes, and the mesh for annular sea bream. Similarly, three main gear are used in about 84% of the total number of trips/gear made in the cold season, being in order of importance the mesh net for various fishes, the trammel for cuttlefish and the octopus pots. We also note that the *sautade* and palangres are only used in this zone and we note the disappearance of the banned '*Kiss'*.

In terms of depth stratum, it is the 1-5 m. stratum that is much the most frequented, with 65% of the total number of trips/gear made in this zone. Then comes the 6-10 m. stratum. But although the >20 m. stratum comes in third position during the hot season, it is the 11-20 m. stratum that holds that position in the cold season.

Lastly, combining fishing gear and depth stratum reveals that for most of the gear, exactly like the above zone, the fishermen do not greatly change depth stratum between the hot and the cold season, except for the keepnets, which are used in the 11-20 m. stratum, and the mesh net for annular sea bream in the 1-5 m. stratum during the cold season, as against respectively 1-5 m. and 6-10 m. in the hot season.

- **West Kerkennah zone**: In both the hot and cold season the fishermen use 8 different gear, except for the trammel for shrimps used during the hot season and replaced by octopus pots in the cold season. Irrespective of the season, four main gear are used in about 75% of the total number of fishing trips/gear made: the trammel for cuttlefish, the mesh net for annular sea bream, the *Charfia* and the trammel for various fishes. The order changes between the hot and the cold season. The mesh net for annular sea bream is the main gear used in the hot season but it leaves the position to the trammel for cuttlefish in the cold season. We also note that the banned '*Kiss'* gear is used to the same extent in both seasons (about 3% of all trips/gear) and in the same depth stratum (11-20 m.).

In terms of depth stratum, we note that the fishermen only frequent the 1-5 and 6-10 m. strata, and much prefer the first.

Lastly, combining the trips/gear and depth stratum show that, as in the other zones, most gear are used in the 1-5 m. stratum in both the hot and the cold season. The 6-10 m. stratum is

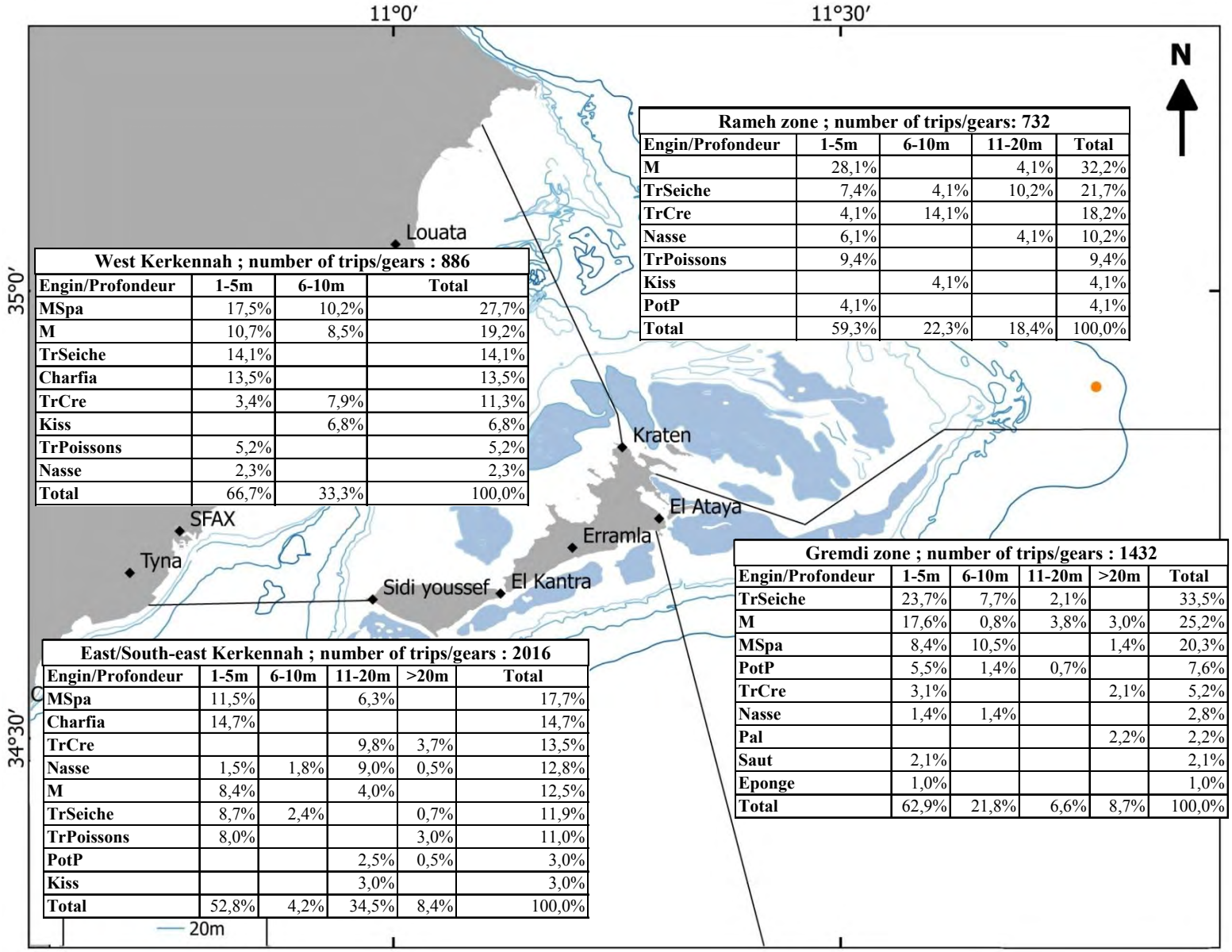
more favoured by the fishermen in this zone for the use of trammel nets for shrimps in the hot season and octopus pots in the cold season.

The banned '*Kiss'* gear is only used in the 6-10 m. stratum, whatever the season.

- **Rameh zone**: Irrespective of the season, the fishermen use 7 different gear, but the trammel for shrimps and the trammel for fishes used in the hot season are replaced by the mesh net for annular sea bream and sponge fishing during the cold season. The four main gear used in the hot season (83% of the total trips) are in order of importance mesh net for various fishes, trammel for cuttlefish, trammel for shrimps and keepnets. But during the cold season, the most used gear (88% of total trips) are octopus pots, keepnets, mesh nets for various fishes, and trammel for cuttlefish. The banned '*Kiss'* is relatively more used in the cold season in the 11-20 m. stratum.

In terms of depth stratum, we note the absence of activity in the >20 m. stratum. The 1-5 m. stratum is much the most frequented, with proportions of about 60 and 67 % of the total number of trips/gear during the hot season and the cold season respectively. But although the 6-10 m. stratum comes in second position during the hot season, it is the 11-20 m. stratum that holds this place during the cold season.

Combining gear and depth stratum shows that, for most of the gear, the fishermen prefer the 1-5 m. stratum, except for the trammel for shrimps used in the 6-10 m. stratum and the trammel for cuttlefish in depths of 11-20 m. in the hot season. Keepnets are relatively more used in the 11-20 m. stratum during the cold season.



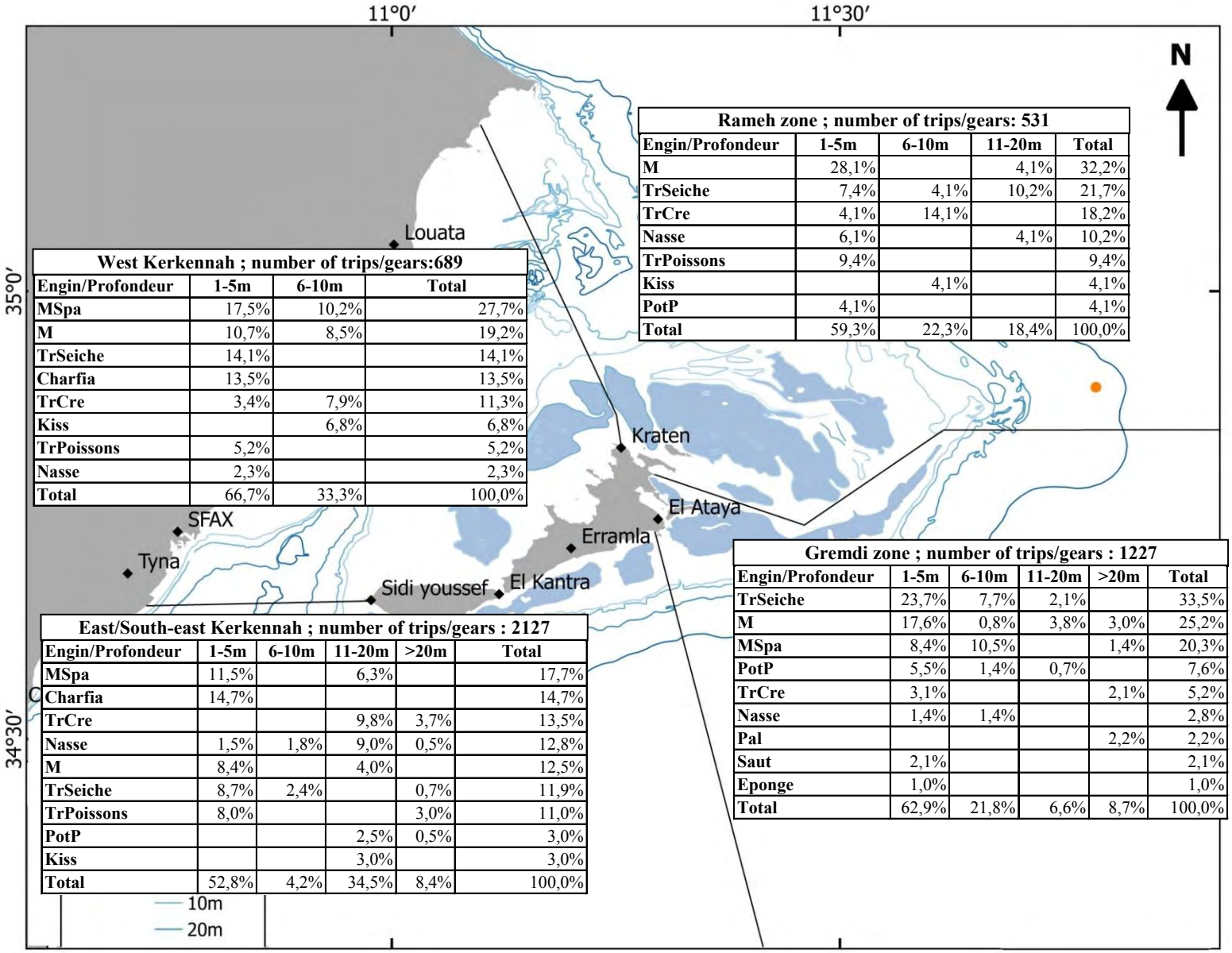
Rameh zone ; number of trips/gears: 732				
Engin/Profondeur	1-5m	6-10m	11-20m	Total
M	28,1%		4,1%	32,2%
TrSeiche	7,4%	4,1%	10,2%	21,7%
TrCre	4,1%	14,1%		18,2%
Nasse	6,1%		4,1%	10,2%
TrPoissons	9,4%			9,4%
Kiss		4,1%		4,1%
PotP	4,1%			4,1%
Total	59,3%	22,3%	18,4%	100,0%

West Kerkennah ; number of trips/gears : 886			
Engin/Profondeur	1-5m	6-10m	Total
MSpa	17,5%	10,2%	27,7%
M	10,7%	8,5%	19,2%
TrSeiche	14,1%		14,1%
Charfia	13,5%		13,5%
TrCre	3,4%	7,9%	11,3%
Kiss		6,8%	6,8%
TrPoissons	5,2%		5,2%
Nasse	2,3%		2,3%
Total	66,7%	33,3%	100,0%

East/South-east Kerkennah ; number of trips/gears : 2016					
Engin/Profondeur	1-5m	6-10m	11-20m	>20m	Total
MSpa	11,5%		6,3%		17,7%
Charfia	14,7%				14,7%
TrCre			9,8%	3,7%	13,5%
Nasse	1,5%	1,8%	9,0%	0,5%	12,8%
M	8,4%		4,0%		12,5%
TrSeiche	8,7%	2,4%		0,7%	11,9%
TrPoissons	8,0%			3,0%	11,0%
PotP			2,5%	0,5%	3,0%
Kiss			3,0%		3,0%
Total	52,8%	4,2%	34,5%	8,4%	100,0%

Gremdi zone ; number of trips/gears : 1432					
Engin/Profondeur	1-5m	6-10m	11-20m	>20m	Total
TrSeiche	23,7%	7,7%	2,1%		33,5%
M	17,6%	0,8%	3,8%	3,0%	25,2%
MSpa	8,4%	10,5%		1,4%	20,3%
PotP	5,5%	1,4%	0,7%		7,6%
TrCre	3,1%			2,1%	5,2%
Nasse	1,4%	1,4%			2,8%
Pal				2,2%	2,2%
Saut	2,1%				2,1%
Eponge	1,0%				1,0%
Total	62,9%	21,8%	6,6%	8,7%	100,0%

Fig. 20. Breakdown of the effort in number of trips/gear used, by fishing area and by depth stratum during the hot season



West Kerkennah ; number of trips/gears:689			
Engin/Profondeur	1-5m	6-10m	Total
MSpa	17,5%	10,2%	27,7%
M	10,7%	8,5%	19,2%
TrSeiche	14,1%		14,1%
Charfia	13,5%		13,5%
TrCre	3,4%	7,9%	11,3%
Kiss		6,8%	6,8%
TrPoissons	5,2%		5,2%
Nasse	2,3%		2,3%
Total	66,7%	33,3%	100,0%

Rameh zone ; number of trips/gears: 531				
Engin/Profondeur	1-5m	6-10m	11-20m	Total
M	28,1%		4,1%	32,2%
TrSeiche	7,4%	4,1%	10,2%	21,7%
TrCre	4,1%	14,1%		18,2%
Nasse	6,1%		4,1%	10,2%
TrPoissons	9,4%			9,4%
Kiss		4,1%		4,1%
PotP	4,1%			4,1%
Total	59,3%	22,3%	18,4%	100,0%

East/South-east Kerkennah ; number of trips/gears : 2127					
Engin/Profondeur	1-5m	6-10m	11-20m	>20m	Total
MSpa	11,5%		6,3%		17,7%
Charfia	14,7%				14,7%
TrCre			9,8%	3,7%	13,5%
Nasse	1,5%	1,8%	9,0%	0,5%	12,8%
M	8,4%		4,0%		12,5%
TrSeiche	8,7%	2,4%		0,7%	11,9%
TrPoissons	8,0%			3,0%	11,0%
PotP			2,5%	0,5%	3,0%
Kiss			3,0%		3,0%
Total	52,8%	4,2%	34,5%	8,4%	100,0%

Gremdi zone ; number of trips/gears : 1227					
Engin/Profondeur	1-5m	6-10m	11-20m	>20m	Total
TrSeiche	23,7%	7,7%	2,1%		33,5%
M	17,6%	0,8%	3,8%	3,0%	25,2%
MSpa	8,4%	10,5%		1,4%	20,3%
PotP	5,5%	1,4%	0,7%		7,6%
TrCre	3,1%			2,1%	5,2%
Nasse	1,4%	1,4%			2,8%
Pal				2,2%	2,2%
Saut	2,1%				2,1%
Eponge	1,0%				1,0%
Total	62,9%	21,8%	6,6%	8,7%	100,0%

Fig. 21. Breakdown of the effort in number of trips/gear used, by fishing area and by depth stratum during the cold season

5.4.1.5. Spatial-temporal analysis of composition of catch by fishing area and by depth stratum

It should be remembered that the species that will be analysed are those declared to be 'main target' of the fishing gear used by the fishermen interviewed, and not all the species that make up the catch in the Kerkennah archipelago. Also, the variable we shall analyse is the occurrence of species in the fishermen's answers. As in the analysis of the fishing effort, we have chosen a mapped presentation by season. The map in Fig. 22 corresponds to the hot season (C), whereas the map in Fig. 23 reflects activity in the cold season (F).

Below we attempt to analyse the combination between target species and depth stratum frequented for making fishing trips for each of the 4 selected fishing areas, drawing comparisons between seasons:

- **East/south-east Kerkennah zone**: We note that the fishermen target 15 different species and groups of species during the hot season as against 13 during the cold season. Octopus is much the most often declared species, especially during the cold season. Then come cuttlefish, annular sea bream and gilt-head bream. These 4 species represent 76% and 88% of occurrences of species in the fishermen's answers in the hot and the cold season respectively.

  Combining species and depth stratum reveals that, irrespective of the season, the main species are more frequent in the 1-5 m. stratum, shrimps and small octopus in the 11-20 m. stratum, and the swordfish and sharks in the >20 m. stratum. Only the octopus and cuttlefish are declared in all depth strata irrespective of season.

  The species that present seasonal differences in their frequencies by depth stratum are the red mullet, present in the 1-5 m. stratum in the hot season and in the 11-20 m. stratum in the cold season. Similarly, the *pageot* is more frequent in the 11-20 m. stratum during the hot period and in the >20 m. stratum in the cold period.

- **Gremdi zone**: We note that the fishermen target 15 different species and groups of species during the hot season as against 9 during the cold season. The five species or groups of species most declared by the fishermen are, in order of importance, octopus, cuttlefish, grey mullet, annular sea bream and red mullet. They represent 78% and 84% in the hot and in the cold season respectively.

  Combining species and depth stratum reveals that, irrespective of the season, the main species are most frequent in the 1-5 m. stratum whereas the sharks and *pageot* are declared in the >20 m. stratum. Note that only the octopus is declared in all the depth strata whatever the season.

  Some species only appear in the hot season. These are shrimps, swordfish and grouper in the >20 m. stratum, sole in the 6-10 m. stratum and *saupe* in the 11-20 m. stratum.

- **West Kerkennah zone**: Here the fishermen target 10 different species and groups of species in the hot season as against 9 during the cold season. The four species or groups of species that recur most often in the fishermen's answers are, in order of importance, octopus, cuttlefish, annular sea bream and gilt-head bream. They represent about 79% of the answers in both the hot and cold seasons.

Combining species and depth stratum reveals that, irrespective of the season, the main species are also most frequent in the 1-5 m. stratum, and shrimps and red mullet in the 6-10 m. stratum. Note that only the octopus, cuttlefish and annular sea bream are declared in the 2 depth strata of this zone whatever the season.

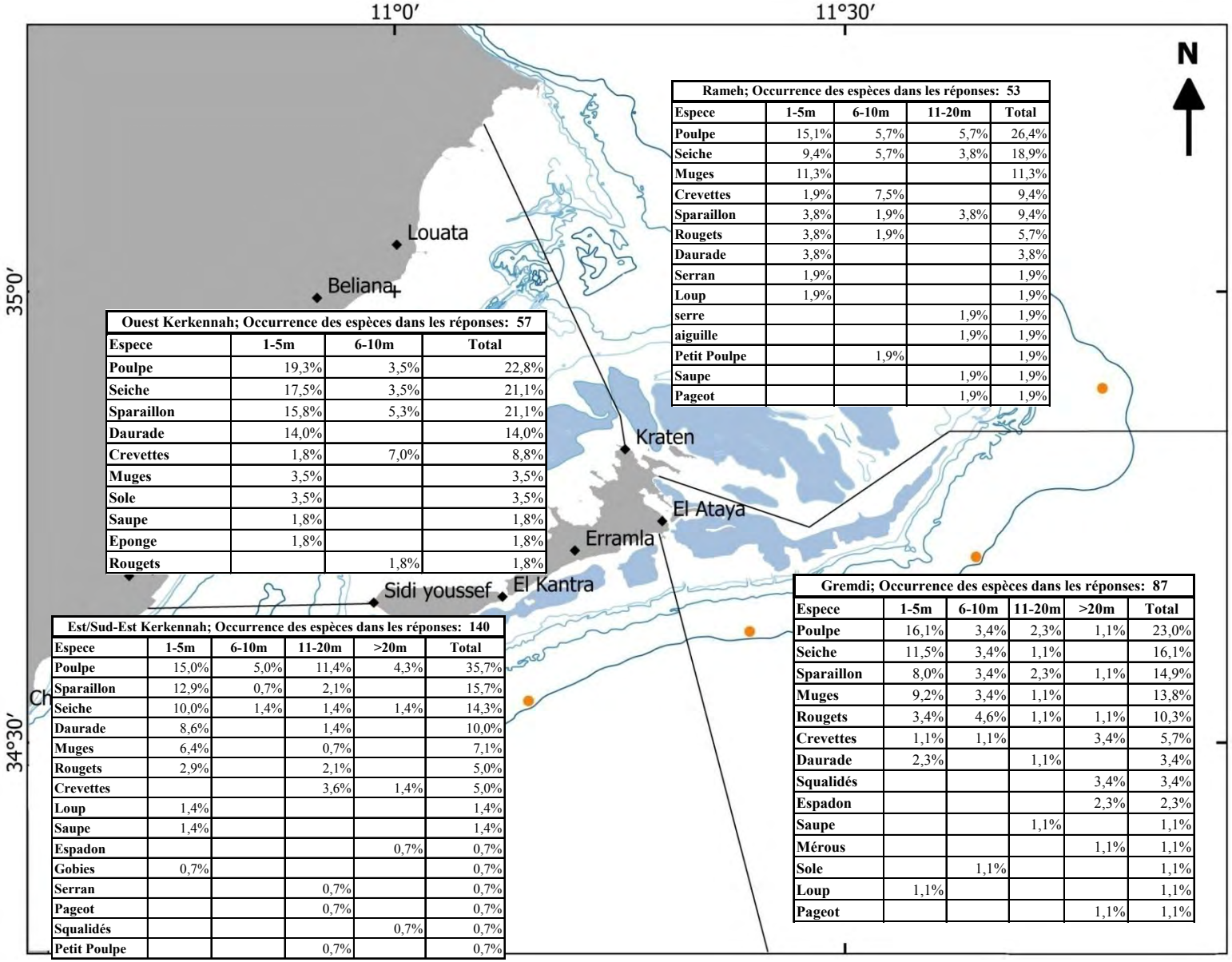
Lastly, sponges are only mentioned in the hot season in the 1-5 m. depth stratum.

- **Rameh zone**: We see 15 target species and groups of species in the hot season as against 9 during the cold season. The octopus and then the cuttlefish are the species most often declared by the fishermen, together representing 45% and 54% of answers in the hot season and cold season respectively. During the hot season, these two species are followed by the grey mullet, shrimps and annular sea bream, while in the cold season octopus and cuttlefish are replaced by gilt-head bream and annular sea bream.

  Combining species and depth stratum reveals that, irrespective of the season, the main species are also most frequent in the 1-5 m. stratum, the little octopus in the 6-10 m. stratum, and the *pageot* in the 11-20 m. stratum. Note that only the octopus and cuttlefish are declared in the three depth strata of the Rameh zone whatever the season.

  The species that present seasonal differences in their frequency by depth stratum are the red mullet, present in the 1-5 m. stratum in the hot season and in the 6-10 m. stratum in the cold season.

  Moreover, some species only appear in the hot season. These are serran and sea-bass in the 1-5 m. depth stratum and the *serre*, garfish and *saupe* in the 11-20 m. stratum. Sponges are only gathered in the cold season in the 1-5 m. stratum.



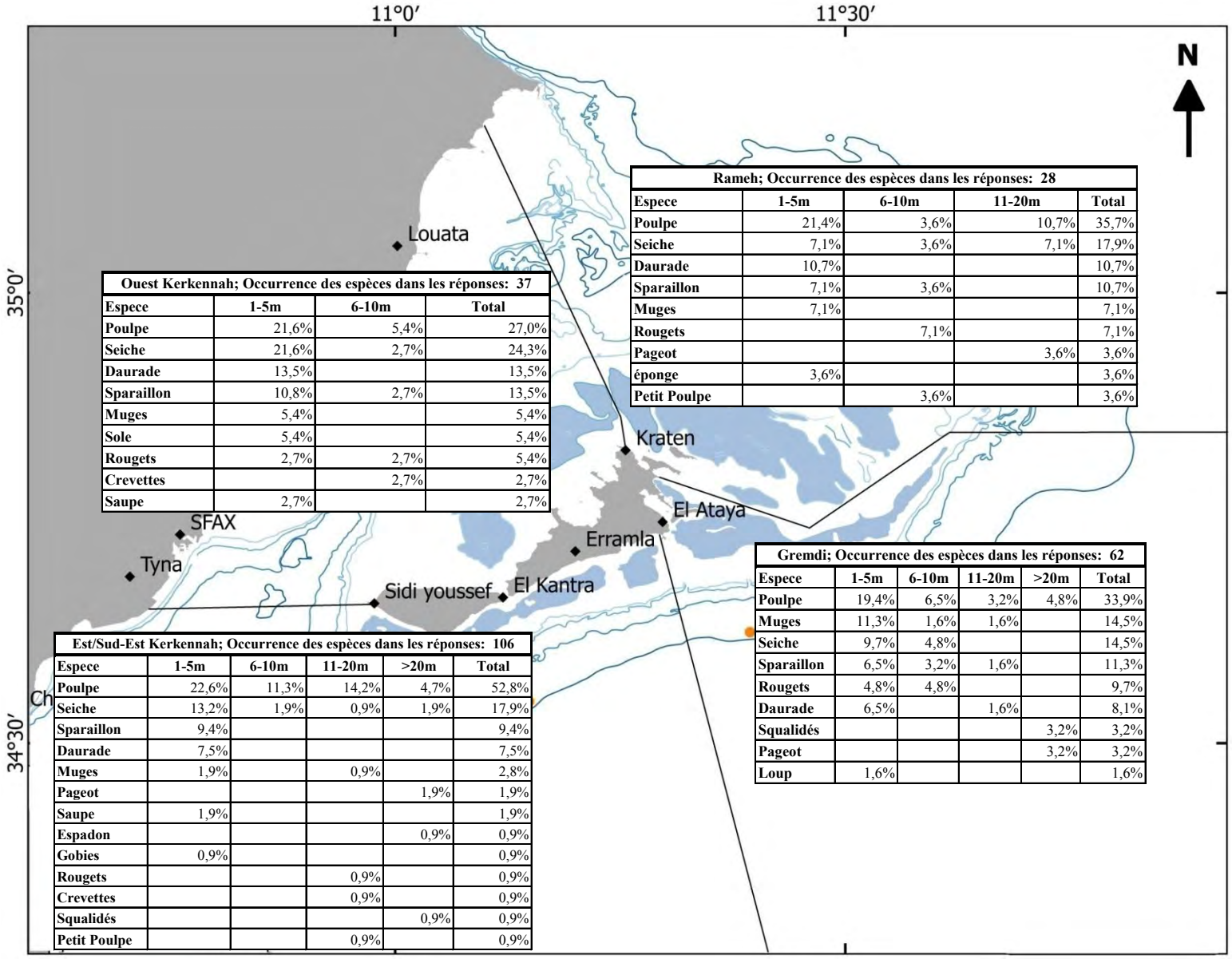
Rameh; Occurrence des espèces dans les réponses: 53				
Espece	1-5m	6-10m	11-20m	Total
Poulpe	15,1%	5,7%	5,7%	26,4%
Seiche	9,4%	5,7%	3,8%	18,9%
Muges	11,3%			11,3%
Crevettes	1,9%	7,5%		9,4%
Sparaillon	3,8%	1,9%	3,8%	9,4%
Rougets	3,8%	1,9%		5,7%
Daurade	3,8%			3,8%
Serran	1,9%			1,9%
Loup	1,9%			1,9%
serre			1,9%	1,9%
aiguille			1,9%	1,9%
Petit Poulpe		1,9%		1,9%
Saupe			1,9%	1,9%
Pageot			1,9%	1,9%

Ouest Kerkennah; Occurrence des espèces dans les réponses: 57			
Espece	1-5m	6-10m	Total
Poulpe	19,3%	3,5%	22,8%
Seiche	17,5%	3,5%	21,1%
Sparaillon	15,8%	5,3%	21,1%
Daurade	14,0%		14,0%
Crevettes	1,8%	7,0%	8,8%
Muges	3,5%		3,5%
Sole	3,5%		3,5%
Saupe	1,8%		1,8%
Eponge	1,8%		1,8%
Rougets		1,8%	1,8%

Est/Sud-Est Kerkennah; Occurrence des espèces dans les réponses: 140					
Espece	1-5m	6-10m	11-20m	>20m	Total
Poulpe	15,0%	5,0%	11,4%	4,3%	35,7%
Sparaillon	12,9%	0,7%	2,1%		15,7%
Seiche	10,0%	1,4%	1,4%	1,4%	14,3%
Daurade	8,6%		1,4%		10,0%
Muges	6,4%		0,7%		7,1%
Rougets	2,9%		2,1%		5,0%
Crevettes			3,6%	1,4%	5,0%
Loup	1,4%				1,4%
Saupe	1,4%				1,4%
Espadon				0,7%	0,7%
Gobies	0,7%				0,7%
Serran			0,7%		0,7%
Pageot			0,7%		0,7%
Squalidés				0,7%	0,7%
Petit Poulpe			0,7%		0,7%

Gremdi; Occurrence des espèces dans les réponses: 87					
Espece	1-5m	6-10m	11-20m	>20m	Total
Poulpe	16,1%	3,4%	2,3%	1,1%	23,0%
Seiche	11,5%	3,4%	1,1%		16,1%
Sparaillon	8,0%	3,4%	2,3%	1,1%	14,9%
Muges	9,2%	3,4%	1,1%		13,8%
Rougets	3,4%	4,6%	1,1%	1,1%	10,3%
Crevettes	1,1%	1,1%		3,4%	5,7%
Daurade	2,3%		1,1%		3,4%
Squalidés				3,4%	3,4%
Espadon				2,3%	2,3%
Saupe			1,1%		1,1%
Mérous				1,1%	1,1%
Sole		1,1%			1,1%
Loup	1,1%				1,1%
Pageot				1,1%	1,1%

Fig. 22. Breakdown of composition of catch by fishing area and by depth stratum during the hot season



Ouest Kerkennah; Occurrence des espèces dans les réponses: 37			
Espece	1-5m	6-10m	Total
Poulpe	21,6%	5,4%	27,0%
Seiche	21,6%	2,7%	24,3%
Daurade	13,5%		13,5%
Sparaillon	10,8%	2,7%	13,5%
Muges	5,4%		5,4%
Sole	5,4%		5,4%
Rougets	2,7%	2,7%	5,4%
Crevettes		2,7%	2,7%
Saupe	2,7%		2,7%

Rameh; Occurrence des espèces dans les réponses: 28				
Espece	1-5m	6-10m	11-20m	Total
Poulpe	21,4%	3,6%	10,7%	35,7%
Seiche	7,1%	3,6%	7,1%	17,9%
Daurade	10,7%			10,7%
Sparaillon	7,1%	3,6%		10,7%
Muges	7,1%			7,1%
Rougets		7,1%		7,1%
Pageot			3,6%	3,6%
éponge	3,6%			3,6%
Petit Poulpe		3,6%		3,6%

Gremdi; Occurrence des espèces dans les réponses: 62					
Espece	1-5m	6-10m	11-20m	>20m	Total
Poulpe	19,4%	6,5%	3,2%	4,8%	33,9%
Muges	11,3%	1,6%	1,6%		14,5%
Seiche	9,7%	4,8%			14,5%
Sparaillon	6,5%	3,2%	1,6%		11,3%
Rougets	4,8%	4,8%			9,7%
Daurade	6,5%		1,6%		8,1%
Squalidés				3,2%	3,2%
Pageot				3,2%	3,2%
Loup	1,6%				1,6%

Est/Sud-Est Kerkennah; Occurrence des espèces dans les réponses: 106					
Espece	1-5m	6-10m	11-20m	>20m	Total
Poulpe	22,6%	11,3%	14,2%	4,7%	52,8%
Seiche	13,2%	1,9%	0,9%	1,9%	17,9%
Sparaillon	9,4%				9,4%
Daurade	7,5%				7,5%
Muges	1,9%		0,9%		2,8%
Pageot				1,9%	1,9%
Saupe	1,9%				1,9%
Espadon				0,9%	0,9%
Gobies	0,9%				0,9%
Rougets			0,9%		0,9%
Crevettes			0,9%		0,9%
Squalidés				0,9%	0,9%
Petit Poulpe			0,9%		0,9%

Fig. 23. Breakdown of composition of catch by fishing area and by depth stratum during the cold season

5.4.1.6. Spatial-temporal variation of average production of fishing gear by trip

In this section, we shall give the breakdown of average catch per fishing gear trip by season and by zone. These are takes per unit of effort (PUE) for each fishing method. The description of the PUEs will give an idea about the impact of each fishing gear on the halieutic resources.

We are particularly interested in the PUEs obtained during the average season to compare fishing gear. The reader will get an idea about all the average PUEs by consulting Table 38.

Irrespective of fishing zone, we note that in the archipelago and during the hot season, the palangres have the maximum PUE, with an average 200 Kg/trip, whereas sponge fishing has the minimum PUE with 0.3 Kg/trip. These techniques are in reality not comparable since the palangres target sharks and the very heavy swordfish, while sponges do not weigh much. But we found the banned '*Kiss'* gear in the second position with 82 Kg/trip while the gear judged above as most used in fishing trips in Kerkennah, such as trammel for cuttlefish, mesh nets and keepnets, come behind the *sautade* and octopus pots with PUEs of 17, 25 and 20 Kg/trip respectively.

Combining gear used and fishing area reveals that in the east/south-east Kerkennah zone the gear that have the relatively best PUEs compared with their use in the other zones are octopus pots, trammel for shrimps, and keepnets. In Gremdi, it is the palangres and mesh nets that are more productive than in the other fishing zones. In the west Kerkennah zone, the PUEs held by the banned '*Kiss'*, mesh net for annular sea bream and the *Charfia* are higher than for their use in other zones. Lastly, trammels for cuttlefish and for fishes have good PUEs in the Rameh zone.

During the cold season, throughout the archipelago, the banned '*Kiss'* comes in first position, followed by the mesh net for various fishes, the *sautade*, octopus pots, keepnets and the trammel for cuttlefish. The trammel for fishes comes in last position with 4 Kg/trip.

Combining gear used and fishing area reveals that in the east/south-east Kerkennah zone the gear that have the relatively better PUEs compared with their use in the other zones are keepnets, trammel for cuttlefish, and trammel for fishes. In the west Kerkennah zone, the PUEs held by the banned '*Kiss'* and the *Charfia* are higher than for their use in other zones. Lastly, octopus pots, mesh nets for annular sea bream and sponge fishing have good PUEs in the Rameh zone.

The gear that improve their PUE during the cold season are only the mesh net for various fishes and sponge fishing. The opposite happens for the mesh nets for annular sea bream and the trammel for cuttlefish, as well as octopus pots, keepnets and trammel for fishes.

Table 38. Average production per trip or PUE by gear and by fishing area in the Kerkennah archipelago

		Fishing zoner				
Season	**Gear**	**East/Southern-East Kerkennah**	**Gremdi**	**Ouest Kerkennah**	**Rameh**	**Total Kerkennah**
Hot	**Pal**		200			**200**
	Kiss	85		100	60	**82**
	Saut		30			**30**
	PotP	35	16,5		30	**26,6**
	M	7	41	6	26	**25**
	TrCre	33	13	7	21	**22**
	Nasse	23	8	6	19	**20**
	TrSeiche	16	12	18	28	**17**
	MSpa	8	12	14		**11**
	TrPoissons	7		2	15	**7**
	Charfia	4		8		**5**
	Eponge		0,3			**0,3**
Cold	**Kiss**	85		100	60	**82**
	M	152	27	4	16	**41**
	Saut		30			**30**
	PotP	29	21	20	30	**26**
	Nasse	22	8	6	14	**19**
	TrSeiche	15	11	9	14	**13**
	MSpa	5	4	6	10	**6**
	Eponge		0,3		10	**5**
	Charfia	4		8		**5**
	TrPoissons	4		2		**4**

5.4.2. Bibliographic summary on traditional fishing using the *Charfia* in Kerkennah

This fishing technique, one of the most selective in the world, is an ancestral model of a fixed fishery that is unique in the Mediterranean and constitutes a true heritage for the Kerkennah area, which is particularly favourable for this activity: the bed is shallow and the tidal range is large.

'*Charfia'* are passive fishing gear with a fixed position. The principle is, using palm-branch palisades, to intercept fishes as they swim and send them into holding chambers that end in keepnets.

Bradai & Bouain (1994) state that the gear is formed by arms or 'walls' and holding chambers. From the shore a rectilinear wall, built out of palms, extends about 500 m. and ends in two palm rows (80 and 100 m.) in the shape of an open V whose tip points out to sea (pulling in walls). At the tip of the V is an entrance corridor that ends in a holding chamber. This, the '*Dar'*, gives access to several keepnets where the fishes, carried by the ebb tide, are trapped at low tide. The holding chambers are made of palm fronds supported by palm wood beams with keepnets made out of palm bunches.

From this basic structure the fishermen who fish in this way suit their *Charfia* to the depth of the water, the size of the band and the space they have at their disposal; thus we note the presence of single *Charfias* (1 main wall and two pulling in walls) or multiple *Charfias* (joining together 2, 3 or 4 single *Charfias*).

According to Aloui-Bejaoui (1995), a lot of families, of great market value, are represented in the list of species caught in fixed fisheries. These are: Sparidae (gilt-head bream, *pagre*, *oblade*, *pageot*, *marbre, saupe*, dentex and annular sea bream), Mugilidae, Mullidae (red rock mullet, barbet red mullet), Moronidae and Serranidae. Comestible cephalopod species are also found, like the common squid, the common octopus, the octopus musqué and the cuttlefish.

The Kerkennah archipelago used to have 1,200 units but now has only about 400. This activity is considered to be dying for many reasons: young people have lost interest and prefer easier, more lucrative, activities, and also there has been a fall in profitability linked to the dwindling production (average daily production was about 14.5 kilos in 1999 (INSTM, 1999) and 12.7 kilos in 2007 (Ben Atitallah, 2008) for the Kerkennah fisheries and increasing maintenance costs (because of the degradation of the islands' palm groves, the fishermen are forced to import palms from the Gabès region).

The making of the *Charfia* has undergone a real change over the years, with a tendency to replace natural materials (palms, both fronds and trunk) with synthetic materials such as polyamide nets and PVC or even steel tubing (Table 2). Even if the general look of the fishery seems to be respected, it would be important to make a critical analysis as to the impacts of this modernisation and to try to minimize as far as possible the danger of detracting from the traditional and aesthetic side of the *Charfia*, whose authenticity is an intrinsic part of the marine landscape of Kerkennah.

Table 39. Comparison of traditional and modern elements of a *Charfia*

Elements	Traditional Charfia	Today's Charfia
Sea arm	Palm	Palm
Earth wall	Palm	Palm + polyamide or polyethylene 20 mm. mesh
Holding chamber	Frond	Polyamide or polyethylene net with 18-20 mm. mesh
Support elements	Palm trunk	160 mm. diameter PVC tube **and, newly, 160 mm. steel tube**
Keepnets (Nasses)	Palm bunches	Polyamide net + iron structure Metal mesh + iron structure
Installation	Annual	Continuous
Impacts	Biodegradable and ecological	Non-degradable, polluting

DGEQV, 2012

Charfias can be either the property of the state and in this case are rented out after annual auctions (only native fishermen specialised in this kind of fishing are permitted to take part in the auction), and the price can be over 1,000 dinars for single fisheries, or privately owned (on the grounds of temporary occupation permits for the maritime public domain as stipulated by the Decree of 5 February 1931), belonging to one or several persons (private individuals or families).

Unfortunately, nothing is being done to make the fishermen who go in for this activity more professional – like the entire population of traditional fisheries – what mattered was readiness for hard work and a good knowledge of the local environment. Thus, up to now, no organisation (groups, fishermen's mutual societies, associations etc.) has emerged to have the skills and expertise of the workers in this fishery recognised, which constitutes a real brake on any project to promote and develop this activity.

Many lines of development can be exploited around the *Charfias*, basically:

- **Programme to develop a brand and a quality sign**

Consumer awareness about the origin and healthiness of the fishing products was responsible for the continuous development of a brand name and quality signs that are now vital to making best use of these products. This branding approach is closely linked with the collective mobilisation of all the actors in the field, particularly the traditional *Charfia* fishermen, while making sure that the necessary financial, human and organisational measures of support are introduced.

Because this is a very selective fishing activity, the high quality of whose products is recognised, it deserves to be promoted through official signs identifying quality and origin. Other means can strengthen the position of the professional fishermen such as **eco-labelling** to boost well-developed fisheries, like the **Marine Stewardship Council (MSC), or ISO 65 Friend of the Sea, certification**

- **Developing eco-tourism around the *Charfia* fisheries**

With a long coastline and a valuable area suitable for developing ecological tourism, the Kerkennah *Charfia* fishermen can bank on ichthyo-tourism, mobilising a class of tourists who are eager to see at first hand how their fisheries are being exploited; this could be a substantial way of diversifying their income, already being compromised by a clear drop in productivity.

These fishermen will be encouraged to promote the idea and principles of sustainable fishing and the part they play in managing marine resources, and could thus enhance the image of their produce. Moreover, the fact that the archipelago is a typical example of a fragile territory hosting land and marine ecosystems that are unique with striking specific features like diversified beds, unique geological features and exceptional landscapes gives it a certain potential to develop an eco-tourism from which the fishermen can benefit.

The above-mentioned lines of development will require that the fishermen are beforehand organised around a well-structured, dynamic professional body, and the improvement of the basic infrastructure especially regarding sheltered sites and ports. It is also important to wipe out the hold the intermediaries (shady operators) have over the fishermen; by providing them with services of every kind they end up by dictating the purchase price, thus compromising the economic viability of the small fishermen.

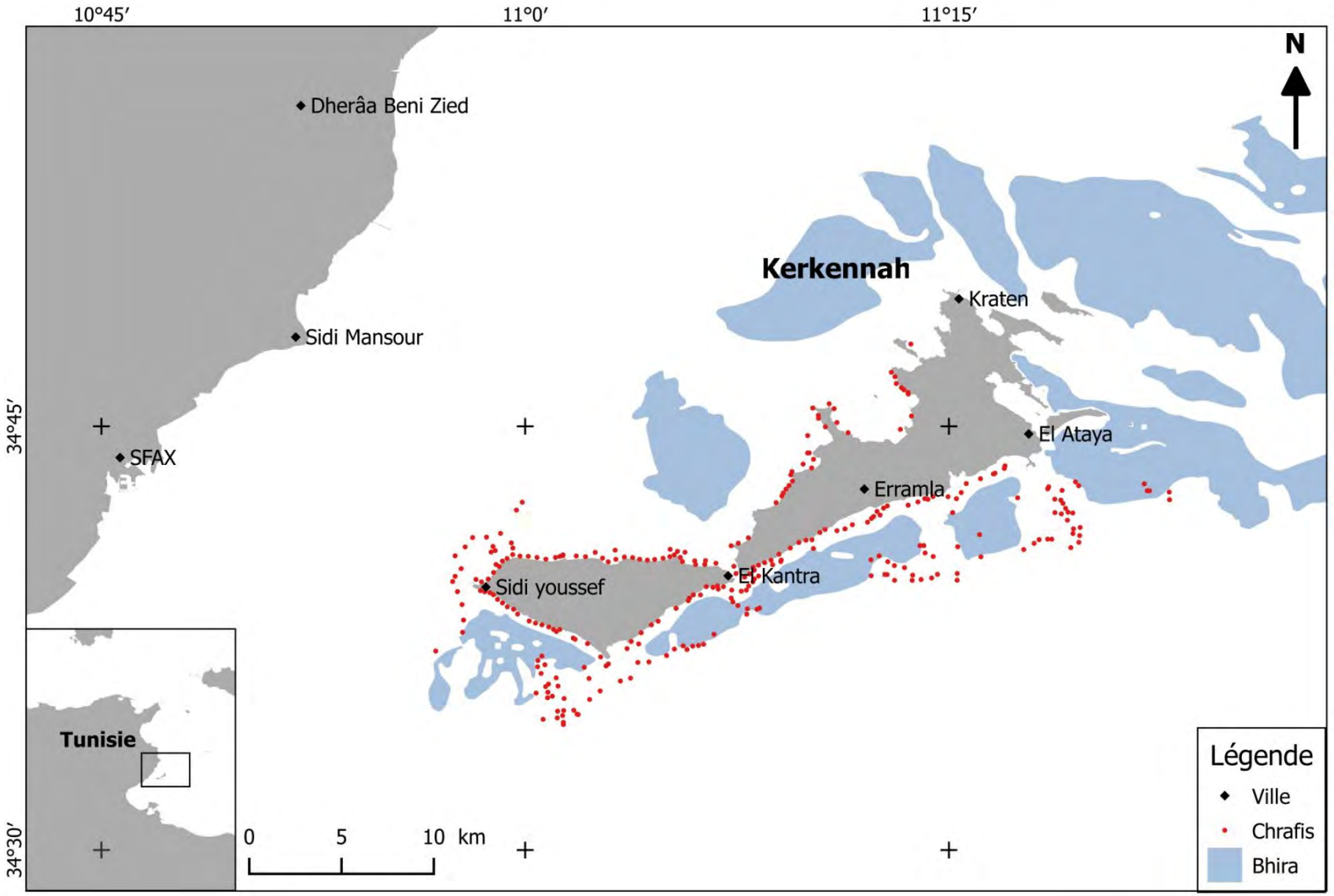


Fig. 24. Map of distribution of Kerkennah *Charfias* (Geomatix-DGPA, 2014)

5.4.3. Bibliographic summary on fishing using the banned '*Kiss'* around the Kerkennah archipelago

This is a gear that is absolutely forbidden in Tunisian law (Decree of the Minister of Agriculture of September 28 1995 regulating the exercise of fishing); originally it was used by some traditional fishermen in reaction to the incursion of trawlers into shallow coastal areas. The recrudescence of this phenomenon, especially over the past twenty years over the Tunisian coasts as a whole, particularly in the Gulf of Gabès, has been responsible for much of the collapse of benthic stocks and thus the dramatic drop in profitability for all categories of fishing unit.

Without an effective system of checking and monitoring the fishing activity either on land or at sea, many traditional fishermen in the archipelago – with the excuse of reducing the costs of exploitation and to make easy money – have had recourse to this banned fishing technique.

The people of Kerkennah have always used rowboats and sailing boats. Since 1960, the '*Kiss'* (little trawler) appeared, then making way in 1975 for the big '*Kiss'*. Research work and studies have been numerous and unanimous on the harmful impacts of and damage done by the '*Kiss'* on the marine environment:

- **Bradai *et al*., (1995).** As well as destroying Posidonia and Cymodocea meadows, fishing with the *tartaronne* involves the taking of a big amount of immature small fishes which cannot be sold and are then thrown back into the sea
- **Bel Hadj Hamida (2005**). Note that the effect of a mini-trawl are very harmful because this is used at shallow depths, usually no more than 15 m., which explains the mass presence of small individuals. This causes stocks to be depleted before the period of recruitment
- **Ben Hamida (2014**). This way of fishing degrades the stock of juveniles which exist in the shallows of the Kerkennah Islands, and also destroys a very important *Posidonia oceanica* ecosystem existing in this area
- **Rehouma (2006**). Fixed fisheries are worked essentially in the south-west of Gharbi Island between Sidi Youssef and El Kantara and between El Attaya and El Kantara. But the balance was broken when trawlers and boats with the *tartaronne* ('*Kiss'*) broke into this traditional system, acting completely illegally
- **APAL (2012**). There are many reasons for this situation of deep crisis of fishing in the Kerkennah Islands. The most important is the illegal and abusive use of the '*Kiss'* (*tartaronne*). This banned gear is becoming increasing common, mainly in the shallows around the Kerkennah Islands.

It seems that an entire industry has grown up for adapting fishing units to the '*Kiss'* gear; today we are witnessing an alarming increase in the number of boats which practise this technique – from 4 in 1980 to 195 in 2005. In the whole Gulf of Gabès, there are now over 2,000 units.

In the light of the harmful effects this fishing technique has on the stock of the resource and the marine environment, the future of the sector is endangered, as is the country's credibility as to its commitments made to the struggle against unauthorized and undeclared illicit (INN) fishing and for the protection of halieutic resources in territorial waters. The Tunisian administrations are thus called on to further their efforts to wipe out this scourge, which greatly compromises the sustainability of our marine resources, by:

- supporting the programme to fit out the Gulf of Gabès with artificial reefs in the threatened fishing zones
- enhancing and backing the system of monitoring and controlling the fishing activity on land and at sea
- extending the (VSM) satellite monitoring system for fishing units that have an overall length of more than 15 metres.

It is noteworthy that during the biological rest period of 2015 (July-September 2015), urgent measures have been taken by the Ministry of Agriculture, Water Resources and Fisheries against fishermen using prohibited gear "Kiss", which consist in particular the suspension of the fuel subsidy for fishing units who continue to practice this type of fishing. This has partly contributed to the decline of the practice of "Kiss" till up to 25%, according to the charge of fishing in the archipelago.

Coastal boats using the banned '*Kiss*' gear in the port of Sidi Youssef

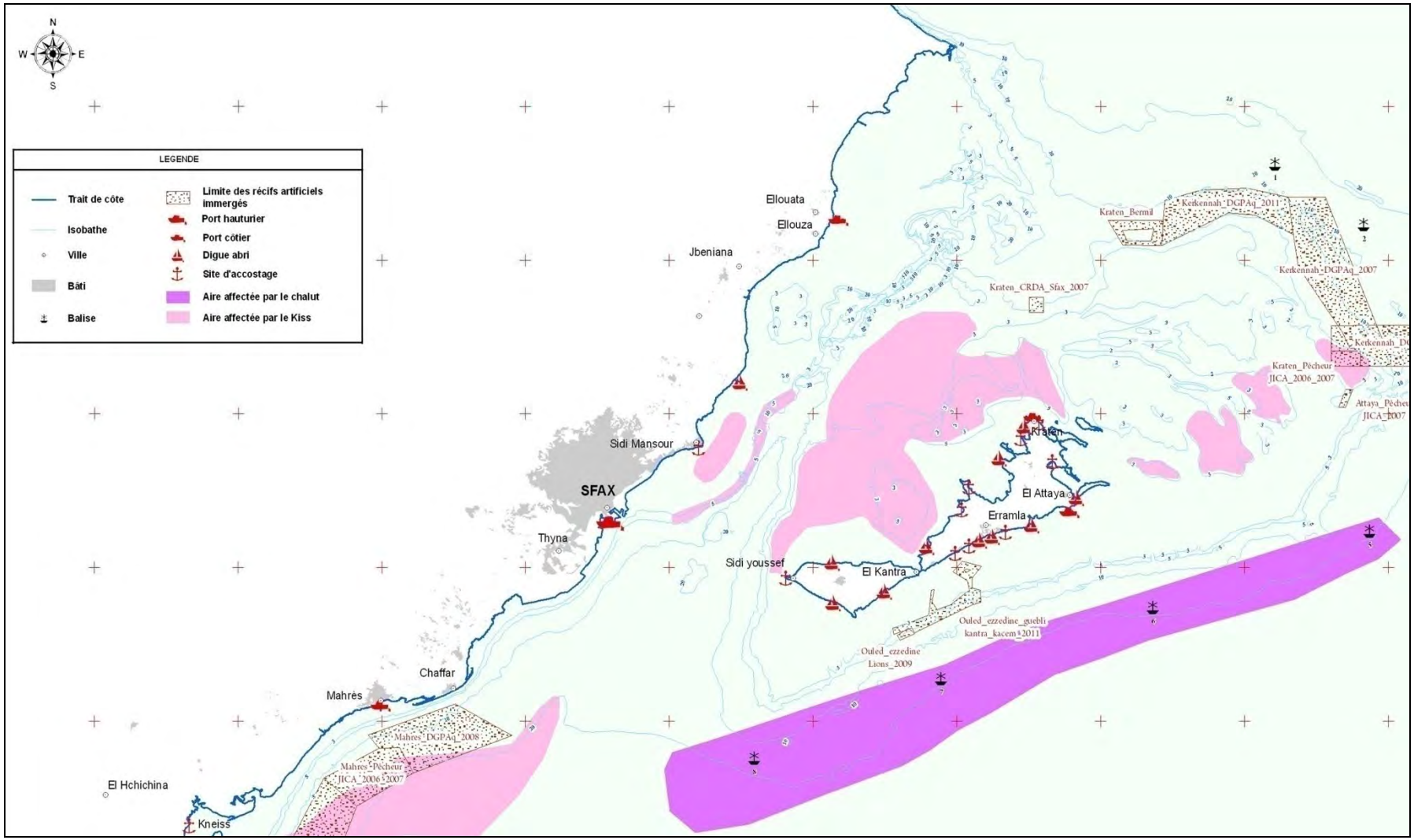


Fig. 25. Map of distribution of fishing using the banned 'Kiss' gear and illegal trawling by trawlers (Geomatix-DGPA, 2014)

VI. CONCLUSION

The aesthetic value of the island landscape and the inclusion of a large number of rare species that becomed endangered in the Mediterranean with a high heritage value confirms the importance of protecting the archipelago. Indeed, Kerkennah *Posidonia* meadow is the wider at the Tunisian coast, the *Pinna nobilis*, rare species and the Mediterranean *Gibbula umbilicaris latior* species with its albino form, are to be protected.
In addition, the study area contains the elements of a rich archaeological and cultural heritage as Borj El H'sar, the Roman city of Cercina and its former port, which need to be consolidated and upgraded to meet, among others, the objectives of the ecotourism development.

Demographically, the population of Kerkennah accounts 15500 inhabitants and is characterized by the fact that old age above 60 years age group represents 18.4% of the total population. This highlights the significant migration phenomenon that affects the archipelago since the independence. Indeed, young people are leaving their homeland to continue their studies or to find other employment opportunities within the country. This would explain the gradual reduction of the workforce offer in particular in the fisheries sector in Kerkennah.

The interest shown by the population of the study area to education is very well represented by an illiteracy rate below the national average. The school attendance rates in basic education exceed well the average of Sfax Governorate and the national average.
In addition, the Kerkennah region is marked by an excessively low unemployment.

Concerning the economic activities, the scarcity of water resources, soil salinity and frequency of winds are factors that have not favored the development of agriculture and livestock activities that remained subsistence activities.
Industrial activity in the study area is also located in a marginal state. However, the gas extraction sector has grown in importance in the archipelago since production of its reservoirs represented 14.33% of the national production of natural gas.

As regards tourism sector, the small beaches, the degradation of the natural environment, the inadequate transport (no air transport), the qualitative and quantitative lack of hotel infrastructure as well as basic infrastructure constitute factors that are causing a modest tourist industry, in crisis and in decline.
As for craft activity, although it is an important source of income for families in the archipelago, many products are endangered which requires taking urgent measures to promote this ancient knowledge.

Finally, the fishing industry is a very old tradition around which economic structure and social life in the archipelago. Moreover, we emphasize the complexity of the fishing activity in the Kerkennah islands in terms of fishing fleet, multitude of used gears, including handicrafts, variety of target species and popular fishing areas.
The gear analysis could highlight the importance of using trammel to 21.5% in squid fishing trips made by kerkennian fishermen. This is followed by gill nets for catching various fish, gillnet sparaillons, of charfias and octopus pots. We also note the worrying development of the practice of kiss that has even surpassed some selective gear such as longlines and sautade.

In terms of species catching, with the exception of shrimp, octopus, marbled and pelagic fish species which are underexploited, all other species are in critical situation.
Indeed, for gillnets, we note that except the octopus, underexploited species, all other species are in critical situation. Indeed, the annular seabream, the golden mullet, the cuttlefish and the salema porgy are in maximum exploitation condition while the red mullet, the bream, the greenhouse and squalidae are overexploited. Thus, the cuttlefish is with the octopus, the largest landed fishes in the archipelago and require more rational management that should started by a reduction in fishing effort.

In addition, overexploited species require specific management plans. Moreover, it is imperative to follow the recommendations of the GFCM (GFCM / 36/2012/3) on squalidae management measures, rajids and angelfish.
For species that undergo great pressure by trammel nets, we note that except shrimp and octopus species which are underexploited, all other species are either in optimal exploitation conditions such as cuttlefish and sole, or overexploited such as bream.

Despite their passivity and their high selectivity, fixed fisheries target overexploited species, which require special management measures. These are, in order of importance, sea bream, cuttlefish, annular sea bream, mullet and salema porgy.

Finally for Kiss, and given that this gear is active in the shallow depths, it applies a very high pressure on the young fraction of all species that target. Therefore, it is imperative to find a radical solution for this very destructive practice as well as for biodiversity to benthic habitats.

In terms of fishing areas, we notice that the east/southeast area of Kerkennah, including El Bhiret Abbassya El Kellebine, Ouled Kacem and Sidi Youssef, is the preferred area for fishing as it represents 43% ofv the activity according to respondents' fishermen. It is followed by the fishing areas of Gremdi (Bhiret Gremdi), the West zone of Kerkennah (Bhiret El H'sar and Bhiret El Khdam) and finally the Rameh area (including Ghdir Rameh). We stress an increased concentration of fishing effort in the stratum depths of 1-5 m with a preponderance of use of trammel nets for cuttlefish, gillnets, traps, of charfias and octopus pots. The prohibited "Kiss" gear is more practiced in the 6-10m depths.

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Annex (*in french*)

Field survey (questionnaire) used for the study of the socio-economic environment of the fishing activity in the Kerkennah islands

1. Pêcheur :

- Age : ……. Lieu de résidence :……..- Etat civil : □ Célibataire □ Marié

-Ville d'origine ……. Distance du lieu de travail……..

- Nombre d'individus dans votre ménage (vous-même inclus) :…….

-Membres de votre famille qui exercent la pêche (entre frères, père et fils)……..

- Êtes-vous affilié à la CNSS): □ Oui □Non Expérience dans la pêche ? ……ans

- Qualité (poste de travail) : □Armateur □Patron □Marin pêcheur □Autres:…….....

-Formé □ Oui □ Non □ autre (préciser……)

- La pêche est votre principale source de revenu? □ Oui □ Non (si Non remplir tableau) :

Sources de revenus	Part dans le revenu total%
Pêche	
Agriculture (spécifiez) :……	
Elevage (spécifiez) :……	
Commerce (spécifiez) :……	
Autres (spécifiez) :……	

2. Recettes et dépenses

- Veuillez indiquer les principales recettes et dépenses annuelles chez vous (par an).

Principales recettes

Poste	Montant	%
Pêche……		
Agriculture ……		
Elevage ……..		
Commerce ……		
Autres ……..		
Autres ……..		
Total		

Principales dépenses

Poste	Montant	%
Alimentation		
Loyer		
Education		
Santé		
Activité de pêche		
Autre		
Total		

3. Financement

- Avez-vous reçu des aides ou encouragements de la part des institutions locales, régionales ou nationales ? □Oui (spécifiez) ……...□Non Combien ? ……
- Avez-vous obtenu un prêt pour financer vos besoins de consommation familiale □Oui …...□Non ou pour votre activité de pêche ? □Oui □Non (si Oui remplir tableau)

Prêteur	Montant (pour le ménage)	Montant (pour l'activité de pêche)
BTS		
BNA		
Autres Banques Privées		
Mareyeur(s)		
Un Ami		
Famille		
Autres (spécifiez) :…….		

4. Associations

- Veuillez indiquer l'association à laquelle (les associations auxquelles) vous adhérez.

Nom d'association (Cotisant)	Objectif d'organisation
A-Syndicat de pêcheurs (rattaché à UTAP)	
B-Groupement de Développement de la Pêche (GDP)	
C-Autres……..	

- Pourquoi adhérez-vous à cette association (ces associations) ?

Ex : Volontaire ou poussé…. (mettre le code A, B ou C)

- Quel est le mérité/défauts de cette association (ces associations) pour vous en tant qu'adhérant ?

(mettre le code A, B ou C)

5. Conditions des infrastructures

- Les articles indiqués ci-dessous sont-ils disponibles chez vous ?

Article	Oui	Non	Commentaires
Propriétaire maison			
Électricité			
Eau de robinet			
Téléphone fixe			
Téléphone portable			
Télévision			
Radio			
Internet			
Réseau Social (Facebook, Twitter, etc.)			

6. Unité de Pêche

- Type de l'unité de pêche : □BCM □BCNM □Senneur □Eponges

- Port d'opération principal (port d'attache) :……..
- Etes-vous propriétaire de l'unité de pêche Oui □ Non□(spécifiez ex : location) .....
- Date d'acquisition : …… Age de l'unité……..
- Date et % de rénovation……..….
- Longueur HT:.....m Jauge : ..... TJB
- Propulsion : □Rames □Voile □Moteur Puissance CV
- Equipage :

	Age	Expérience de pêche(ans)
Patron		
Mécanicien		
Marine pêcheur 1		
Marine pêcheur 2		
Marine pêcheur 3		
Marine pêcheur 4		

- Comment est réparti le revenu (production) entre les membres de l'équipage ?

.....

.....

Poste	**Part (%)**
Armateur	
Patron	
Mécanicien	
Pécheur	
Autres (cuisinier,….)	

7. Engins de pêche utilisés.

Engins	Oui/Non	Période (Mois)	fréquence d'opération par mois	TailleMaille/ N° hameçon	Zone de pêche	Espèces cibles	Haute saison Quantité/jour	Saison Moyenne Quantité/jour	Basse Saison Quantité/jour
Filet Maillant						**1.** **2.**			
Filet Trémail						**1.** **2.**			
Filet Combiné						**1.** **2.**			
Palangre						**1.** **2.**			
Senne tournante						**1.** **2.**			
Senne à aiguille						**1.** **2.**			
Senne à Coryphène						**1.** **2.**			
Sautade (pour muges)						**1.** **2.**			
Pots et pierres à poulpe						**1.** **2.**			
Nasses						**1.** **2.**			
Pêcherie fixe (Charfia)						**1.** **2.**			
Pêche aux éponges (plongée)						**1.** **2.**			
Autre :…… (Kiss, etc.)						**1.** **2.**			

8. Lieu de pêche de chaque saison

Veuillez indiquer votre lieu de pêche par technique et par saison et remplir le tableau dans la page suivante:.

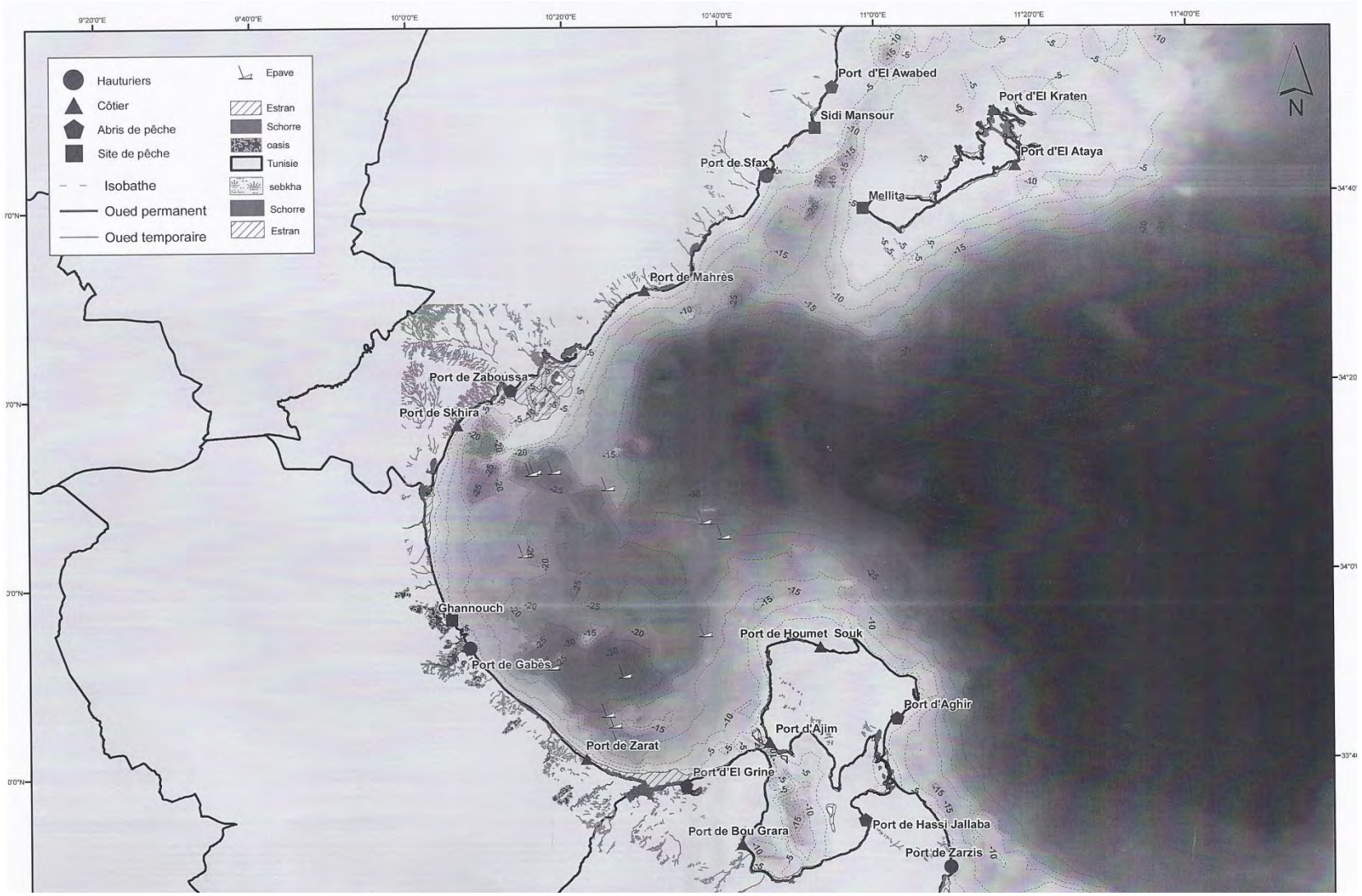

Tableau de répartition spatio-temporelle de l'effort de pêche

	Coordonnées	Profondeur	Espèces	Saison
Zone de pêche1 ……				
Zone de pêche2 ……				
Zone de pêche3 ……				
Zone de pêche4 ……				
Zone de pêche5 ……				
Zone de pêche6 ……				
Zone de pêche7 ……				
Zone de pêche8 ……				
Zone de pêche9 ……				

9. Commercialisation

- Parmi les alternatives suivantes la/les quelle(s) suivez-vous pour vendre votre poisson ? (s'il y a plus d'une alternative indiquez approximativement le pourcentage de vente) :

Halle du port	%	poissonnier de la région	%	A une unité de transformation	%
Directement aux consommateurs	%	Autoconsommation	%	Au marché des poissons des villes riveraines	%
A un mareyeur	%	Restauration/ hôtellerie	%	Autre (Spécifiez)	%

- Dans le cas où vous vendez votre production à un mareyeur, veuillez indiquer le type de négociation entre vous et votre (vos) mareyeur(s).

Type de négociation	Réponse
Négociation du prix avec un seul mareyeur	
Après la négociation avec plusieurs mareyeurs, je vends à celui qui a proposé le meilleur prix.	
C'est le mareyeur qui décide le prix à cause de ma dette envers lui.	
Après la négociation entre l'association (coopérative) de pêche et les mareyeurs, le prix est fixé.	
Autres (spécifiez) :……..	

10. Règlementations de pêche

a. Zones interdites à la pêche

Connaissez-vous les zones interdites indiquées ci-dessous ? Et est-ce que vous respecter cette réglementation ?

	Zone interdite à la pêche	Connaissance de la	Respect de la

		réglementation		réglementation		
		Oui	Non	Oui	Non	RAS*
7)	Chalutage dans la zone de moins de 50 m de profondeur, à l'exception de la saison de pêche de la crevette.					
8)	Pêche à la senne tournante avec lampes dans la zone de moins de 35 m de profondeur. Si sans lampe, pêche dans la zone de moins de 20 m de profondeur.					

*** RAS : Rien à Signaler**

Si vous ne respectez pas, c'est pour quelles raisons ?

Par habitude (comme font les autres pêcheurs)…..
Par ignorance de la loi……
Pour des raisons économiques……
Autres (spécifier)…..

b. Maillage des filets

Connaissez-vous la règlementation sur les tailles minimales des mailles indiquées ci-dessous ? Et est-ce que vous respectez cette réglementation ?

	Engin	Taille minimale autorisée (côté de maille)	Connaissance de la réglementation		Respect de la réglementation		
			Oui	Non	Oui	Non	RAS*
9)	Filet maillant, trémail	-Maillant : 30 mm -Trémail :24-26 mm , extérieur : 90 mm					
10)	Chalut	20 mm					
11)	Senne tournante	12 mm					
12)	Senne tournante du thon	50 mm					
13)	Nasse, casier (maille carrée)	20 mm					
14)	Nasse, casier (maille triangulaire)	30 mm					

*** RAS : Rien à Signaler**

Si vous ne respectez pas, c'est pour quelles raisons ?

Par habitude (comme font les autres pêcheurs)…..
Par ignorance de la loi……
Pour des raisons économiques……
Autres (spécifier)…..

c. Règlementations sur la taille minimale des captures

Connaissez-vous la règlementation sur la taille minimale de capture des espèces indiquées ci-dessous ? Et est-ce que vous respectez cette réglementation ?

	Espèce	Taille minimale autorisée	Connaissance de la réglementation		Respect de la réglementation		
			Oui	Non	Oui	Non	RAS*
15)	Poulpe	1 kg					
16)	Seiche	10 cm (longueur du manteau)					
17)	Sardine	12 cm					
18)	Loup, maquereau, daurade, pagre, mulet cabot, sole	20 cm					

19)	Palourde	35 mm (taille de coquille)					
20)	Huitre	50 mm (taille de coquille)					

*** RAS : Rien à Signaler**

Si vous ne respectez pas, c'est pour quelles raisons ?

Par habitude (comme font les autres pêcheurs)…..
Par ignorance de la loi……
Pour des raisons économiques……
Autres (spécifier)…..

d. Méthodes de pêche interdites

Connaissez-vous les méthodes de pêche interdites indiquées ci-dessous ? Est-ce que vous respectez cette réglementation ? Et est-ce que vous respectez cette réglementation ?

	Méthodes de pêche interdites	**Connaissance de la réglementation**		**Respect de la réglementation**		
		Oui	**Non**	**Oui**	**Non**	**RAS***
21)	Pêche au « Kiss »					
22)	Pêche des éponges à la gangave (drague)					
23)	Utilisation des sennes de plage (Hlig et Tilla)					
24)	Filets dérivants					
25)	Pêche à la dynamite					
26)	Pêche à l'épervier					

*** RAS : Rien à Signaler**

Si vous ne respectez pas, c'est pour quelles raisons ?

Par habitude (comme font les autres pêcheurs)…..
Par ignorance de la loi……
Pour des raisons économiques……
Autres (spécifier)…..