Towards Ecosystem Conservation and Sustainable

Artisanal Fisheries in the Mediterranean basin

WP4: Characterization of the study area

Introduction to study areas ports and fleets

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Contents

Introduction

The field activities developed in the framework of ECOSAFIMED project seeks to assess the impact of the artisanal fisheries in three different areas of the Mediterranean Sea. Prior to these field work, which involves mainly onboard observations and ROV surveys, a full characterization of the study areas was carried out by project partners.

All the preliminary work has as result this report introducing ports and fleets of each study area, which is based on interviews, bibliographic search and previous experience of the scientists involved the project. Partners have agreed to present this information all together in order to present a more complete vision of the action area covered by ECOSAFIMED project and facilitate the comparison of similarities and differences among study areas.

SPAIN

STUDY AREA 1. Canal de Menorca, Balearic Islands

1. General characteristics of the area

The area of Menorca Channel is a marine corridor of 36 km minimum wide, located between the islands of Mallorca and Menorca, in the northeastern part of the archipelago of the Balearic Islands. This area is one of the most important and heterogeneous fishing grounds that exist in the Balearic Islands. The coastal shelf between the two islands (just 100 m deep) is characterized by a high environmental heterogeneity due to the occurrence of rocky bottoms, *Posidonia oceanica* meadows, sandy shores, detrital and gravel bottoms and maërl beds. These grounds have been well preserved due to the mainly developed artisanal fishing activity.

Artisanal boat of 8 meters fishing in the middle of the Minorca Channel. The Capdepera lighthouse marks the most western part of the Majorca Island

2.- Fleet and fishing tactics characterization

There are two main fishing ports in Menorca Island (Ciutadella and Maó) and three main ports in Mallorca Island (Pollença, Alcudia and Cala Rajada). Moreover, some vessels from Alcudia and Cala Rajada docks in three secondary harbors (Cala Bona depending from Cala Rajada harbor and, Colonia de Sant Pere and Can Picafort depending from Alcudia harbor).

The information regarding the characterization of the fleet and fishing tactics was gathered throughout questionnaires circulated around the skippers of artisanal vessels in each study area. The surveys consisted in interviewing those about three main aspects: 1) Dimension of the active artisanal fleet comprising technical information about the vessels (number of boats, total length, tonnage (GT), engine power (HP), year of construction, material used, technical devices, and crew number); 2) Seasonal fishing pattern, establishing target species and main gears used; and 3) Technical characteristics of gears employed for each fishing tactic or métier.

A total of 72 interviews with the skippers from the Minorca's Chanel area were done representing 60% of the total active artisanal vessels.

a- A traditional small boat in the Minorca Channel using a single roll machine to haul the trammel net. b – Accumulative impact of benthic species using trammel net.

The main fishery, in terms of number of boats registered (87% of the fleet) was the artisanal one. Trawlers (11% of the total number of boats) was composed by 16 vessels (4 in Cala Rajada, 4 in Alcudia, 4 in Ciutadella, 3 in Maó and 1 in Pollença harbor), however, accounted for about 74% of the fleet total tonnage and 41% of total fishing power in the area. Moreover, there are 2 surface long-line fishing boats in the Alcudia harbor.

The artisanal fleet is made up by 120 boats involving 170 fishermen. Technical characteristics of the artisanal fleet are summarized in Table 1. The average of the technical features are 7.96 m total length (±1.45 S.D.), 2.57 t GT (±1.51 S.D.) and an engine power of 48.3 HP (±30.2 S.D.).

The mean age of the vessels has been calculated referred to the year 2014, with a result of about thirty years old averaged aged fleet. The majority of vessels are made of fiberglass material (58% of mean of the total artisanal fleet).

HARBOUR	Nº BOATS	TOTAL LENGTH (m) (Mean ± SD)	HP (Mean ± SD)	GT (Mean ± SD)	MATERIAL (main %)	AGE (years) (Mean ± SD)	CREW (total nº)
CALA BONA	7	8.92 ± 1.47	70.0 ± 51.4	3.46 ± 1.62	57% Fiberglass	22.8 ± 12.2	12
CALA RAJADA	12	8.81 ± 1.33	72.3 ± 39.7	3.81 ± 1.80	92% Fiberglass	17.4 ± 7.7	21
COL. SANT PERE	4	8.68 ± 0.53	77.2 ± 35.3	3.73 ± 0.80	75% Fiberglass	10.0 ± 9.1	5
CAN PICAFORT	2	9.20 ± 0.08	36.0 ± 8.5	3.65 ± 0.84	100% Fiberglass	19.0 ± 5.6	4
ALCUDIA	23	8.47 ± 1.25	52.1 ± 22.3	3.05 ± 1.53	56% Fiberglass	29.0 ± 17.8	37
POLLENÇA	18	8.05 ± 1.03	39.6 ± 12.5	2.33 ± 0.84	55% Wood	32.3 ± 19.5	24
CIUTADELLA	20	8.30 ± 1.26	55.8 ± 30.3	2.77 ± 1.65	55% Wood	34.7 ± 14.7	27

MAÓ	34	6.71 ± 1.26	30.3 ± 19.7	1.44 ± 0.80	62% Fiberglass	36.9 ± 15.6	40
TOTAL	**120**	**7.96 ± 1.45**	**48.3 ± 30.2**	**2.57 ± 1.51**	**58% Fiberglass**	**30.4 ± 16.8**	**170**

Table 1.- Summary of technical characteristics of artisanal fleet in Minorca Channel

Fishing tactics

A total of 24 different fishing tactics or métiers were identified with the corresponding fishing period in the fishing area (Figure 1).

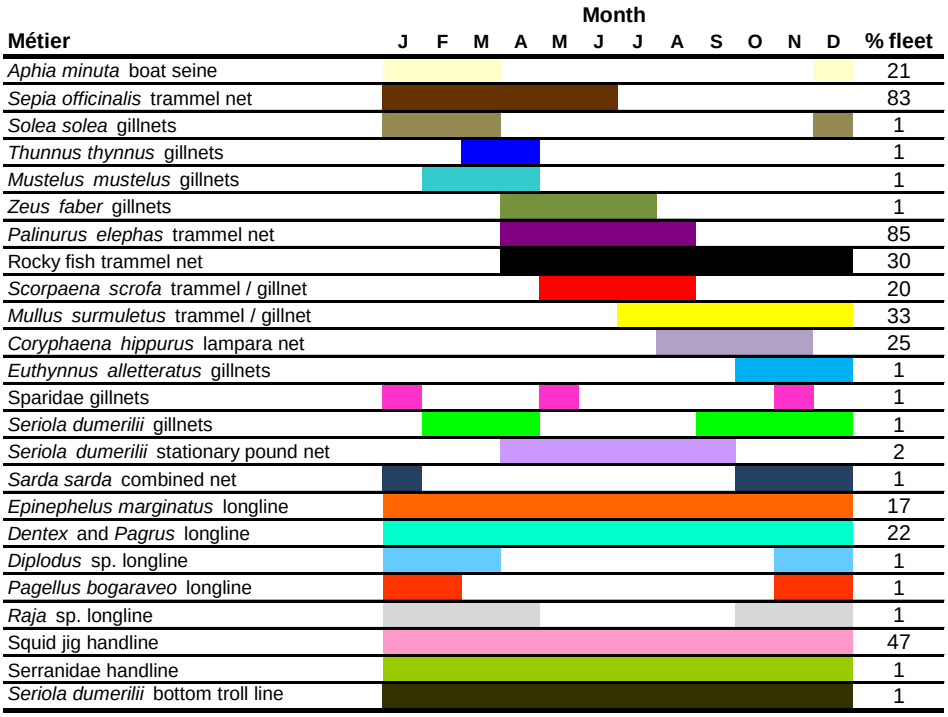


Figure 1.- Chronogram with seasonal fishing activity and percentage of artisanal fleet practicing each métier.

In the fishing area of Minorca's Chanel the main fishing gears used by the coastal fishery are trammel nets and in minor quantity gillnets. Trammel net is mainly used to target cuttlefish (*Sepia officinalis*) in winter and early spring; spiny lobster (*Palinurus elephas*) and red scorpionfish (*Scorpaena scrofa*) in summer. Gillnets are generally

employed to catch John dory (*Zeus faber*) in spring-summer, juveniles of greater amberjack *Seriola dumerilii* in late summer and autumn and red mullet in autumn. Bottom longlines are traditionally employed mainly to catch sparidae species (*Dentex dentex*, *Pagrus pagrus*, *Spondyliosoma cantharus*, *Pagellus erythrinus*, *Diplodus sargus* and *Diplodus vulgaris*) in autumn and winter, and groupers (*Epinephelus* sp.) in summer-autumn, though used by few vessels all over the year, or as a fishing method between seasons of main target species described before. Jigs for squids are used also as a common complementary fishing method during winter and summer.

Other gears, such as boat seine net for dolphinfish (*Coryphaena hippurus*) is used in autumn only in Mallorca Island. The technical characteristics of the main gears employed are detailed in Table 2.

TECHNICAL CHARACTERISTICS OF GEARS

Trammelnets				
Target species	***S. officinalis***	***P. elephas***	***S. scrofa***	***M. surmuletus***
Inner mesh size (mm)	80	133-160	114	50
Depth (m)	2.3	1.7	1.9	1.5
Mean ± SD set total length (m)	1435 ± 711	664 ± 111	906 ± 556	1500 ± 800
Mean ± SD panel number/set	22 ± 10	14 ± 2	17 ± 9	30 ± 16
Mean ± SD number set haul/day	3 ± 1	4 ± 2	3 ± 2	3 ± 1
Material	PA	PA / PET	PA / PET	PA
Type of filament	twisted	twisted / MMF	twisted / MMF	twisted
Gillnets				
Target species	***E. alletteratus***	***M. surmuletus***	***S. dumerilii***	***Z. faber***
Mesh size (mm)	160	50	100	120
Depth (m)	4 - 6	1.5	4	4 - 6
Mean ± SD set total length (m)	500	880 ± 104	754 ± 516	750 ± 132
Mean ± SD panel number/set	5	18 ± 2	17 ± 11	14 ± 2
Mean ± SD number set haul/day	2	3 ± 1	3 ± 1	3 ± 1
Material	PA	PET	PET	PET
Type of filament	twisted	MF	MF	MMF
Longlines				
Target species	***E. marginatus***	***D. dentex***	**small Sparidae**	
Mean ± SD Line total length (m)	3923 ± 2558	5708 ± 3147	5280 ± 2877	
Mean ± SD hooks total number	565 ± 347	838 ± 457	780 ± 417	
Hook size (length/width (mm))	35/18	35/18	27/14	
Diameter main line (mm)	1.6	1.6	1.4	
Diameter branch line (mm)	1	1	0.9	
Length of branch line (m)	2.5	1.8	1.8	
Distance between hooks (m)	7	7	6	

Table 2.- Summary of technical characteristics of main gears used. PA = Polyamide, PET = Polyethylene; MF = monofilament, MMF = Multimonofilament.

STUDY AREA 2. Cap de Creus, Catalonia

1.- General characteristics of the area

The areas of Cap de Creus and Minorca's Chanel have been subjected of study in order to assess to its values in the frame of the Habitat Directive and Natura 2000 Network, as the LIFE+Indemares Project. This project has finished and the two areas are pending to be designated as Natura 2000 sites.

The littoral region of the Cap de Creus was the first marine-terrestrial park established in Catalonia, and it is located at the easternmost part of the Iberian Peninsula. The park covers a total area of 13886 ha, of which 10813 ha belongs to the terrestrial sector and3073 ha to the marine sector. The Cap de Creus Natura 2000 protection range is intended to extend the area of protection to approximately 90000 ha (900 km2) of offshore waters, covering the shelf, the shelf-break and the head of a submarine canyon in the region. The Cap de Creus hosts an outstanding diversity of marine benthic habitats in which valuable key vulnerable ecosystem components (KVECs) have been identified (Gili et al. 2011). Recent research in Mediterranean submarine canyons close to the Cap de Creus coast revealed rich habitats with a high degree of endemism (Orejas et al. 2009, Gili et al. 2011), indicating that these hotspots of biodiversity might play an important role in providing portions of migration routes and nurseries. Many of these KVECs often contribute to the three-dimensionality of an otherwise mainly flat substrate, enhancing the complexity of niches and habitats, such as rocky bottoms covered by coralligenous communities, maërl beds on top of muddy or sandy detritic environments or shallower environments, such as seagrass beds (*Posidonia oceanica*, *Cymodocea nodosa*) and or algae, all of which increase the diversity of sessile species.

View of a small boat in the tiny harbor of Portlligat (Cadaqués), different métiers are used by the fishermen in that harbout.

The presence of a submarine canyon in the area increases the ecological importance of the entire region. Plankton and benthic communities in the canyon benefit from a high concentration of particles as a consequence of strong current regimes (García et al. 2008, Tesi et al. 2010), thus increasing the presence of fish, seabird and cetacean species which use it as feeding ground (Gili et al. 2011, Würtz et al. 2012). Cold-water corals provide habitat for juveniles and larvae of several fish species, some of them with high commercial value, consequently acting as a refuge from fishing pressure and allowing the recovery of depleted stocks (Freiwald and Roberts 2005).

Fleet Characterization

2.- Fleet and fishing tactics characterization

The study area Cap de Creus includes a protected area in 1998 by her regional government of Catalonia (Generalitat de Catalunya) in order to protect and manage

natural resources. The Natural Park consists of both marine and terrestrial environment protected areas of the park's total area is 13,905 ha, of which 10,813 are terrestrial and 3092 are marine.

In the marine protected area are regulated activity artisanal fishing and nautical recreation. As far as the administrative side, there are four municipalities that cover the entire park, the population of Roses, Cadaqués, Port de la Selva and Llançà. All towns have ports that include artisanal fleet. This last resort only has a land area protected.

Most of the artisanal fleet in the Cap de Creus is composed of vessels between 6 and 12 meters. Different types of gear used. The purse seine and trawl presents an important activity in the area of Cap de Creus, but is not permitted within the area of the reserve.

The number of artisanal fishermen fishing in the Cape Creus area including 4 port is 34 vessels, the total number of fishermen is 78, 45% of these usually fishing in the area of the Natural Park. Vessels whose main harbor is Roses shows a high number of metiers, as they may exploit the wide sandy bay and the Gulf of Roses, while the other ports work mainly in rocky bottoms.

The information regarding the characterization of the fleet and fishing tactics was gathered throughout questionnaires circulated around the skippers of artisanal vessels in each study area. The surveys consisted in interviewing those about three main aspects: 1) Dimension of the active artisanal fleet comprising technical information about the vessels (number of boats, total length, tonnage (GT), engine power (HP), year of construction, material used, technical devices, and crew number); 2) Seasonal fishing pattern, establishing target species and main gears used; and 3) Technical characteristics of gears employed for each fishing tactic or métier (See Annex I).

A total of 23 interviews with the skippers from the Cap de Creus area were done representing 67% of the total active artisanal vessels,

Fishing tactics

In the area of Cap de Creus the presence of trammel net is widespread and covers the most part of the benthic fishing grounds from the Natural Park and adjacent areas outside. This kind of fishing occasionally exploited at depths of 250 meters and the farthest distance of the port does not exceed 7 nautical miles. The fleet of Cadaques and Port de la Selva which departs further offshore to works with this type of gear. The presence of trammel exceed 20% in each port, with the majority common fishing zone. (Figure 2).

In the port of Llança the most important metier is the bottom longline, with more than 35% presence, followed by fishing gear basically different fish nets and some very specific gear. In the area of Port de la Selva using Gillnets for different fish (especially *Sparus auratus*, *Pagellus acarne*, *Pagellus erythrinus*). Use of Gillnets are widely used in ports that have close an area of habitat is sandy, as is the port of Roses or Port de la Selva.

The use of pots in every harbor shows the importance of the *Octopus vulgaris* fishery, because this kind of métier could be used in combination of the other métiers throughout the year.

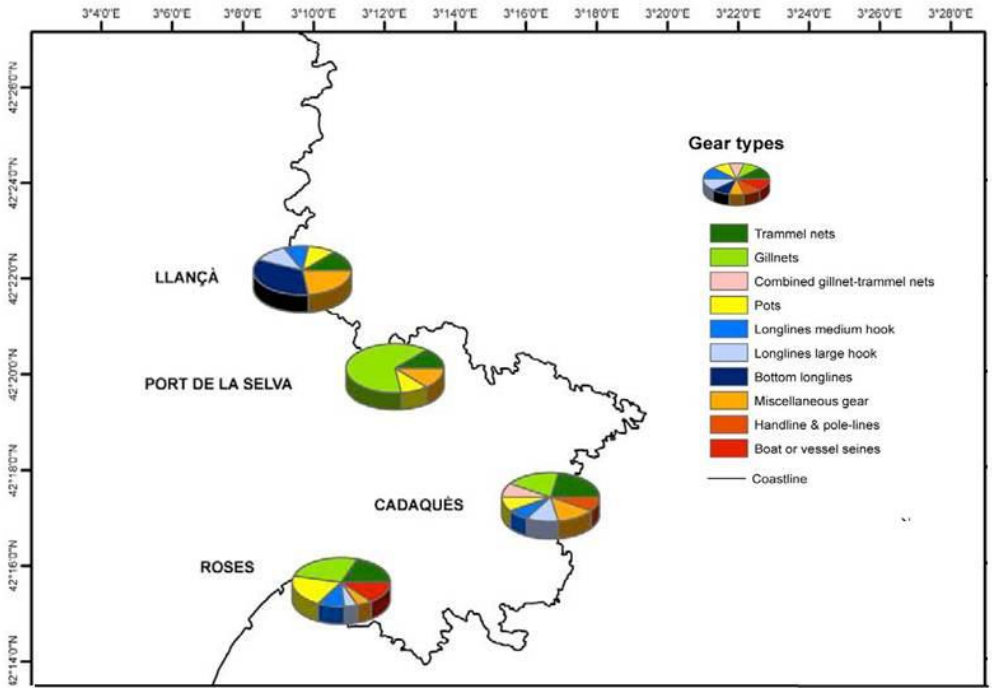


Figure 2. *Percentage of each métier for each harbor in area of Cap de Creus, north Catalonia.*

Exist common areas that are shared with the different métiers in the Cap de Creus, The use of the trammel net develop the activity close to the coastline, while the bottom longline is setting far away from the harbours, because this kind of métiers preferably is deployed over the rocky benthic bottoms and the target species in this area is the *Pagellus bogaraveo*. The gillnets set far away from the coast has the main target species the hake *Merlucius merlucius* and the areas close to the coastline has the main target species the Sparus aurata.(Fig 3)

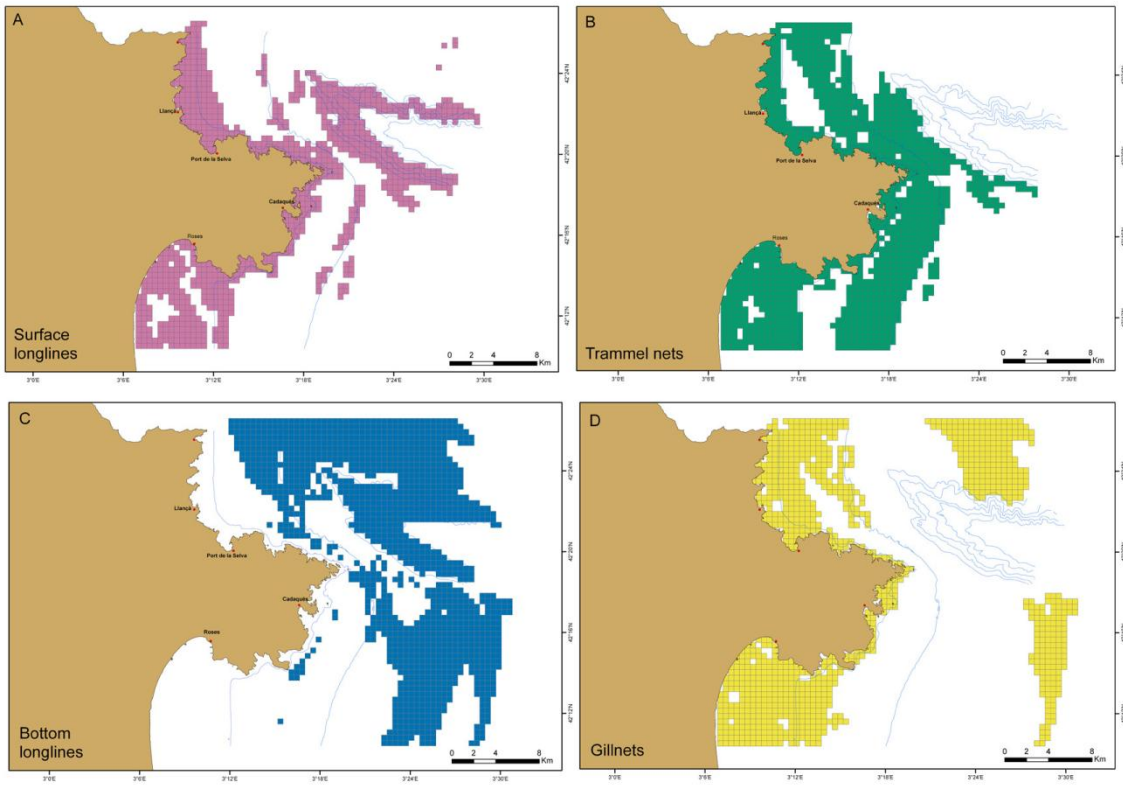


Figure 3. Map of the main métiers (Surface longlines, Trammle nets, Bottom longlines, Gillnets) using a 500m grid . Courtesy of Purroy et al, 201.

Fleet of the Llança Harbour in the north side (Mar d'amunt) of the cap de Creus

ITALY

STUDY AREA 1. Pontine Archipelago, Lazio

1.- General characteristics of the area

The Pontine Archipelago is situated off the coast of Lazio, in the central Italy, and is part of the administration of the Latina Province. The archipelago is situated in the Central Tyrrhenian Sea extending between the North parallels 40°47' and 40°59' N and the East meridians 12°50' and 13°30'.

Figure. 1 View of Ponza Island

It comprehends two groups of islands quite distant from each others: the northernmost group, 15 nm off the coasts of the Circeo Promontory, comprehends the islands of Zannone, Gavi, Ponza and Palmarola. The second group of islands, at about 20 nm South-East from the first one, comprehends the islands of Ventotene and St. Stefano. These two islands are far more closer to the northern coasts of Campania and Ischia island (NA) than to the Lazio coasts. Since 12th December 1997 they belong to the Marine Protected Area "Ventotene and St. Stefano Islands" established by the Ministry for the Environment under the law GU n° 45 del 24.2.1998.

The field activities of ECOSAFIMED, both onboard fishing surveys and ROV surveys, were conducted in the first group of islands, up to the Botte Shoal, at about 15 nm from the islands of Ventotene and St. Stefano.

The entire Pontine Archipelago was formed after the distensive phase that interested the Tyrrhenian area of the Apennines resulting in the characteristic tectonic structure. On these fractures, heading NW to SE, developed the volcanisms which in the

inferior Pleistocene formed the islands. The Pontine islands form, together with the large underwater basis from which they emerge, an important volcanic mass separated into various structures; Ventotene and St. Stefano islands for example represent the top of a single volcanic cone. Ponza (Fig. 1) represents the western part of a large volcanic cone, where two residual craters are still visible in the Ponza Bay and in the Inferno Bay. Palmarola represents the eastern part of a secondary eruptive cone, as well as the Botte Shoal. The Zannone Island is the only one, among all the Pontine islands, to be made by both volcanic rocks and metamorphic and sedimentary rocks of about 200 million years.

The coastal morphology of the Pontine Islands is generally variously articulated along the shores, with a series of bays and short beaches. The continental platform is poorly extended in the entire archipelago, especially towards the open sea, where 200 m depth sea bottoms are found at few hundred meters from the coast.

From the meteorological point of view, the islands are subjected to the same wave exposure for long period of times, especially to the wind forces of the III and IV quadrants. These forces strongly lashes the islands, being not diminished by a large continental platform. On the other hand, the waves produced by the wind forces of the I and II quadrants, coming from the Italian coast, show a smaller fetch and a lower intensity.

The Pontine Archipelago is interested by the mild northward Tyrrhenian current, moving from SW to NE. The intensity of this current is very low, less than 1 knot/h and therefore has no significative consequences on the sedimentary circulation. Local currents of variable direction and occasional strong intensity are in any case present.

The sea bottoms of the Pontine Archipelago are generally characterized by a steep slope and by numerous outcropping rocks, therefore in general the biocoenoses are those of hard bottoms, also at major depths. Along the natural beaches, formed nearby the most steep promontories, the detritic bottom hosts typical soft bottom biocoenoses. The islands are typically surrounded by a belt of Posidonia oceanica meadows starting from 10 m depth up to 40-50 m.

Description of the harbors and maritime authorities

In the study area, the harbor activities are concentrated in the area overlooking the village of Ponza, situated in the SE side of the island (Fig. 2). The harbor, built in a natural bay, is formed by a dock (Molo Musco), protected by an artificial reef directed parallel for about 30 m.

Figure. 2 View of Ponza Harbor

The internal part of the dock hosts a pier on a sea bottom of 3.5-3 m. From the base of the dock, along the South side of the bay, there is the dock Di Fazio (depth 2-3 m) and successively the new dock (depth 0.5-1 m). Along the piers of the harbor there is a narrow road representing basically all the harbor area on the ground. Various shops, fishing shops, stores and artisanal shops are present along the road related to the harbor activities.

So far, without any significative changes in the last 30 years, the stretch of water of the Ponza harbor is about 160000 sqr, whilst the overall length of the docking areas is less than 500 m.

The activities in the harbor related to the ship docking is generally confused due to diverging interests. Within the same limited stretch of water coexist a complex maritime traffic of ferries, the recreational traffic especially in the summer period, a large number of rental boats, a consistent number of touristic boats which guarantee the transport of tourist to the beaches not reachable by ground, numerous local and stranger fishing vessels docking in the harbor for long seasonal fishing activities.

On the island of Ponza there is another small harbor made of an artificial reef and an internal dock, but without possibility to have water, electricity and fuel supplies. It is the harbor of Le Forna (Cala Feola), the second small village in the centre of the island, where usually numerous touristic boast are anchored at the roadstead.

In the other two islands of the study area (Zannone, Gavi and Palmarola) there is no assisted docking.

Since April 2012, the Local Maritime Office of Ponza has been upgraded to Maritime District Office situated in via Molo Musco n. 7.

2.- Characteristics of the fleet

A total of 43 boats are registered at the mariner of Ponza (Fleet Register, 2014). Of these 43, three have ceased their activities while four carry out their work along the continent in Anzio (RM), Terracina (LT), S. F. Circeo (LT) e Gaeta (LT). The operative fishing fleet therefore is made of 36 boats: i) two boats are trawlers, fishing exclusively red and violet shrimps (*Aristeomorpha foliacea* and *Aristeus antennatus*) in late spring and summer, ii) two boats operating purse seine for anchovies (*Engraulis encrasicolus*), iii) 20 artisanal boats (lft <12 m) working seasonally with various sets of nets for different target species, iv) 12 polyvalent passive boats (fixed gears > 12 m) most of whom working predominantly in the summer season with middle water long lines dedicated to the sword fish (*Xiphias gladius*). During the research period two boats left the harbor of Ponza.

Figure. 3 Fishing fleet in Ponza

The technical characteristics of the Ponza fishing fleet (length, gross tonnage, power, crew members) are represented Fig. 4, 5, 6 and 7. The fleet has a significative number of boats, overall with small to medium size and tonnage, with engine power generally limited, with the exception of the vessels operating active gears such as trawlers and purse seine.

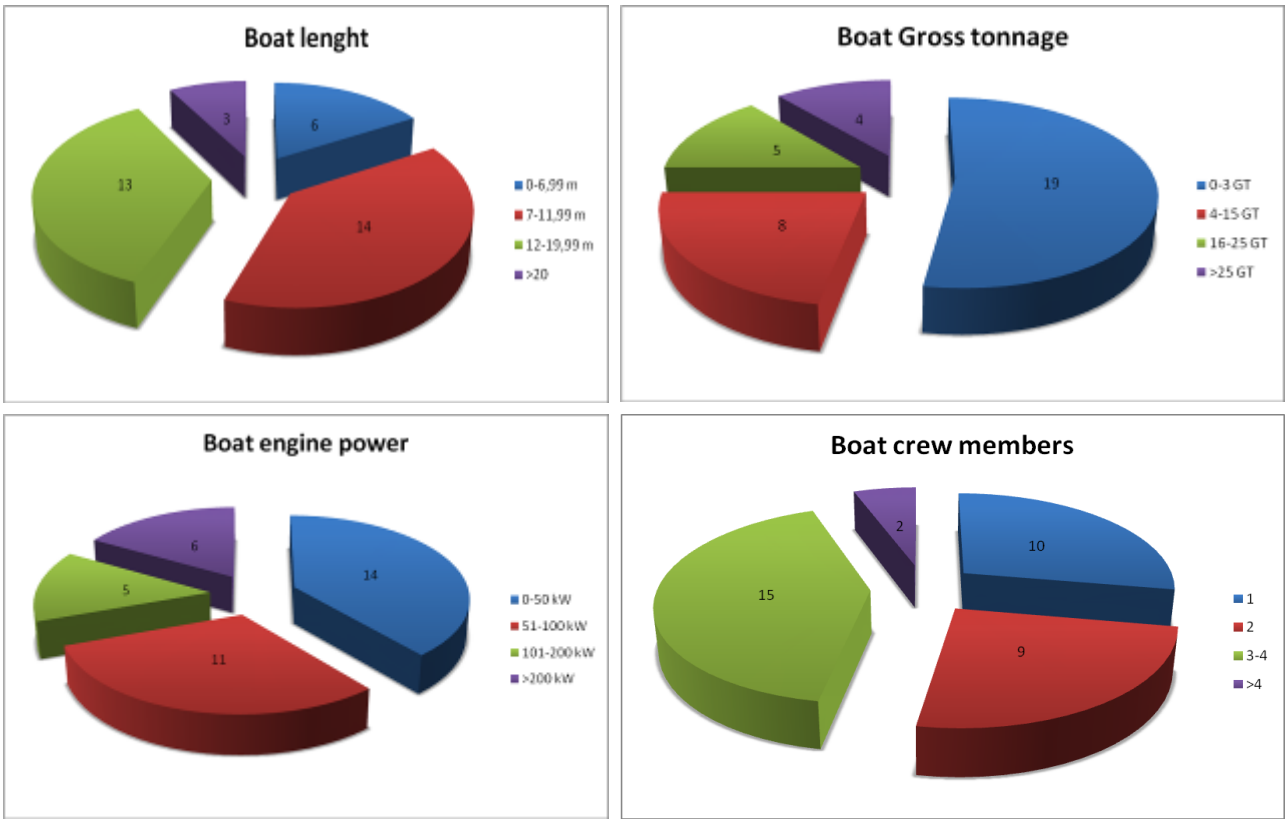


Figure. 4, 5, 6, 7 Technical characteristics of the Ponza fleet

The fishing enterprises are individuals or family-based. Various times, researchers and local fishermen failed to succeed in the creation of cooperatives as well as production organizations.

The artisanal fleet

For the ECOSAFIMED project, artisanal fishing boat is intended as the those vessels operating with fixed gears or mobile but not due to human action such as drifting long lines, independently from the length over all, which may be larger than what commonly used to define artisanal boat (<12m).

With respect to the 32 boats respecting these criteria, 12 interviews were carried out to the captains of the vessels with the aim of identifying a representative sub-sample of data to depict the artisanal fishing reality of the island. Some fishermen did not collaborated while others were not contactable, however 12 was sufficient to draw a good picture of the fleet. The interviews were focused on gathering more details on some technical and social aspects of the artisanal fishing activities, such as typology and characteristics of the gears, seasonality, fishing grounds, crews, features of the vessels (Fig. 8).

Of the 32 artisanal fishing boats operating with fixed gears, four fish cod with gillnets for the entire year, while other four alternate this activity, carried out in winter and spring, with the sword fish long line fishing in late spring and summer. There are also 15 boats operating two distinct gears: trammel nets for lobsters from 1st of April to 31st of August and gillnets for cuttlefish and rocky bottom fish on shallow bottoms (0-100m depth). Of these latter boats, the majority does not work in the winter period (1st of January to 31st of March) due to the limited size and power of the vessels that does not allow safe operations in unstable climatic conditions. Four other vessels carry out exclusively the sword fish fishing with long lines closing the activity during the legislative stop, one boat works all the year round with cods fished with long lines, three boats operate gillnets for cuttlefish and rocky bottom fish on shallow bottoms (0-100m depth), while one boat is dedicated to the fishing of *Spicara smaris* during the reproductive period from April to May or in the dispersal period, from September to November.

The characteristics of the gears may vary also within the same fishing activity focused on the catch of a specific target. In the case of cod, for example, even if all vessels operate with gillnets monofilament in nylon, there are some distinctions relatively to the length of the gears, going from 3000 to 5000 m depending on the size of the boat, the number of crew members, the size and diameter of the filament of the mesh. In this sense, while in the summer period all the boats operate cod fishing using 4.2m tall nets, mesh 50-56mm and monofilament diameter 0.25-0.28mm, in winter time some boats (usually 4/8) use larger nets (5.5 tall, 80 mm mesh, diameter 0.35mm), and the remaining use the summer asset.

For what concern the lobster trammel nets, the technical characteristics of this gear is basically the same for all the boats. They use heavy trammel nets (filament 210/12, in other cases 210/9, 210/16) with an inner mesh size of 100mm and a height of 1.2-1.5m. The length of this gear is limited (500-750m) due to the fact they are used to surround outcropping rocks situated in the mud or coralligenous platforms. Usually

each vessel operates with a certain number of these gears, usually 5. The lobster trammel nets fish for 48-72 hours, giving them time to arm.

Another very common typology of net used by the interviewed boats during the legislative closure of the lobster fishing is the gillnet for rocky bottom fish on shallow bottoms (0-100m depth). It is a net with a nylon filament relatively thick (0.30mm) with large mesh (100mm) and significative height (4m). Among the various gears there is also the gillnet for *Spicara smaris*, which is operated by only one vessel in Ponza in the spring and autumn time. It is a common gillnet, relatively short (200m) in nylon monofilament with a 0.20mm diameter, mesh 40.8mm and 4 m height.

Some of the interviewed boats, in the late spring and summer, use deep long lines for the sword fish catch. These are drifting gears, which do not contact with the bottom, and are set far from the coast, at 20 nm on very deep bottoms (1000-3000m). These gears contact with the bottom only accidentally, in case the current drift them towards 500-600m depth. For this reason the impact of deep sword fish long lines on the benthic communities is considered not significative. In Ponza it is possible to affirm that the professional use of long lines has no relevant impact on the benthic communities.

On the other hand, recreational fishermen use at least two typologies of bottom long lines, to catch *Pagrus pagrus*, *Dentex dentex, Trachinus radiates*, *Spondyliosoma cantharus* and *Diplodus vulgaris*. In the onboard surveys, the professional fishermen tried these two gears to simulate this activity. These two typologies differ for the diameter of the monofilament used for the branches and the main line, for the length of the branches, the distance among the branches and the size of the hooks. The long line targeted for *Pagrus pagrus* and *Dentex dentex* have 500 hooks with a nylon monofilament of 1.2mm, 4m long branches, distanced 10m, in nylon monofilament of 0.70mm and hook size n°7 (length 26mm, width 14mm). The long lines targeting *Spondyliosoma cantharus* and *Diplodus vulgaris* use 400 hooks. It is a lighter gear, with a main line of 0.70mm in diameter, shorter branches (2m long, distanced 10m) in nylon monofilament with a 0.40mm in diameter, ending with a hook n°10 (length 23mm, width 10mm).

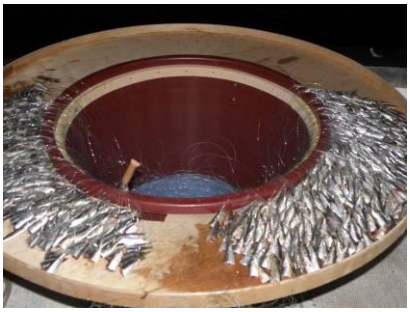


Figure. 8 Some gears used in Ponza

STUDY AREA 2. Gulf of Patti, Sicily

1.- General characteristics of the area

The Gulf of Patti extends from Cape Calavà to Cape Milazzo, for an extension of 60 km of coastline. The area is characterized by several rocky promontories, like Cape Lo Schino, Capo Calavà, Cape Tindari and Cape Milazzo, alternating with beaches and sandy coasts (Fig. 1). Under Cape Tindari these beaches form an interesting system of dunes with brackish lakes (lakes of Marinello) covering an area of about 400 hectares and declared a natural reserve (Decree No. 745/44 of the Sicilian Region). This area forms a small bay that seems to be an important nursery area for many fish.

The seabed of the Gulf of Patti is mostly sandy or muddy, with large *Posidonia oceanica* meadows and, in some areas, of *Cymodocea nodosa*, which alternate shoals and rocky bottoms, particularly near the cliffs overlooking the sea, such as Cape Calavà and Capo Milazzo. Other areas with rocky bottom and important benthic biological communities are the "Patti shoal", a big rock that come from a depth of about 50 m in front of the town of Patti Marina, and Tindari shoal, at Cape Tindari. The continental shelf in this area is very narrow and high depths are reached very quickly.

Figure. 1 View of the Milazzo Cape

Description of the harbors and maritime authorities

There is an uneven harbour system in the gulf area and several deficiencies in infrastructure, because the fishing boats are scattered along the coast, in the ports situated along the sandy shores. Although in the area there are two major ports, Milazzo and Portorosa, they are not fishing ports. Milazzo harbour is an important

commercial port, for the shipping of oil and goods, and is the largest touristic and resident boarding port to the Aeolian Islands, while Portorosa is mainly doomed to yachting. Therefore, the fishing boats are hosted only in small port areas, almost totally lacking in services and infrastructure suitable for the landing of fish and for the improvement of the fishing industry. Besides these landing sites along the coast there are many points of recovery and hauling of small boats (San Giorgio, Patti Marina, Oliveri, Calderà and Vaccarella), which need to be beached after each fishing expedition, except for some summer day when the weather conditions are favourable (Fig. 2).

The Port of Milazzo includes the fishing communities of Milazzo and Patti and boats are recorded in the NN.MM.GG registers of the Port authorities of Milazzo and the Delegation of Beach Patti. Despite this latter fishing community is situated outside of the Gulf of Patti, it includes vessels that normally operate in this area.

Considering both Port authorities, there is a total of 152 registered fishing boats:

Local command	N° Registered boats
Port authorities of Milazzo	93
Beach district of Patti	59
Total	152

All the area down to 500 m depth comprised within the linear conjunction between Cape Milazzo and Cape Calavà is a trawl-banned area since 15 years (Sicilian Regional Law of 7 August 1990 n. 25 GURS August 11, 1990).

Figure 2. *View of the Milazzo Cape*

2.- Characteristics of the fleet

The fleet of the Gulf is distinctly artisanal and is divided into demersal and pelagic fishery (for small, medium and large pelagic species). A high percentage of vessels has a length overall under 12 m considered as the limit for artisanal boats. The mean length of 152 vessels registered is 7.8 m of length overall, with mean values of tonnage and engine power respectively of 4.4 tonnes (Gross Tonnage) and 54.5 kW (Fig. 3).

Figure 3. Artisanal boats in Patti

In the following table there is a summary of the technical characteristics of the boats below the authorities of Milazzo and Patti:

Local command	Boats registered	<12 m Length overall		<10 Gross Tonnage		<20 kW	
		N	%	N	%		N
Port authorities of Milazzo	93	82	88,2	81	87,1	61	65,6
Beach district of Patti	59	52	88,1	55	93,2	45	76,3
Total	**152**	**134**	**88,5**	**136**	**83,9**	**106**	**65,4**

Given the strong adaptability and strong seasonality between the different types of fisheries, it is not possible to classify vessels based on fishing methods. Particularly common among boats are the licenses to use longlines (93.5%) and gillnets (88.2%), while the number of licenses for seiners is lower (60.2%).

Fishery with bottom trawls is practiced only by 3 boats (one from the port of Milazzo, the other two from the port of Portorosa). The boats are all registered at the Port authorities of Milazzo and have a length overall > 18 m. These trawlers operate just outside the joining line between Capo Calavà and Capo Milazzo, and have as target the red and blue and red shrimp (*Aristeomorpha foliacea* and *Aristeus antennatus*). This kind of fishery, after the implementation of management measures in the Gulf, was the one that had to undergo major changes. Once widely practiced in the Gulf, it is now limited to deep waters (600-700 m); for this reason, a large number of resources available, particularly the white shrimp (*Parapenaeus longirostris*), have been more exploited.

The artisanal fleet

The seafarers who work in the Gulf of Patti (updated to 2014) consists of 264 units, with an average of two people on board the boat. The mean age is about 49 years.

As elsewhere in Italy and other regions of the Mediterranean Sea, the artisanal fleet in the Gulf is characterized by a high variability of the fishing activities throughout the seasons, determined by a rotation and an adaptation of the gears in accordance to

the presence of certain target species (Fig. 4). Fishing expeditions also are short and rarely last more than 24 hours. The most commonly used fishing gear is the long-line, particularly the deep one, specific to fish hake and white hake (*Merluccius merluccius* and *Phycis blennoides*) even if, in recent years, this fishing gear is also used for fishing silver scabbard fish (*Lepidopus caudatus*), which happens to be an abundant resource and is turning into an important resource for the local market. This fishing activity is practiced mainly during the winter months. Small driftnets (*ferrettare*) are used in the autumn and winter months to catch smaller species of pelagic fish (*Auxis thazard thazard* and *Euthynnus alletteratus*). Another typically seasonal fishing activity, practiced in autumn, is the purse seine practiced with the help of floating palm fronds (Fish Aggregating Devices - FADs) which has, as target species, dolphinfish (*Coryphaena hippurus*). In the summer months, the purse seine, is practiced with a light source to catch small pelagic fish (anchovies and sardines). Once, this fishery, was widespread. Today, the strong decrease in stocks of small pelagic and high management costs, have compromised this activity. In the summer period is practiced also the large pelagic fishery (swordfish and albacore) with surface longliners and squid fishery with lines.

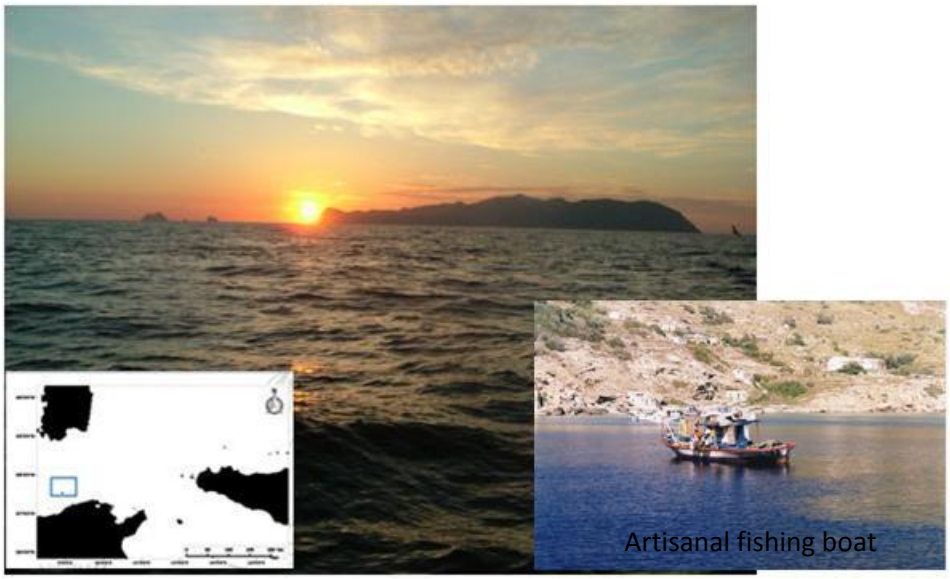
The harbour areas of the gulf are almost completely without services and infrastructures suitable for landing fish or for improving the fishing industry. The sale of fish is made in retail, often directly on the beach, after the boat is beached at the end of the fishing expeditions (Fig. 5).

Figure. 5 Sale of fish on the beach

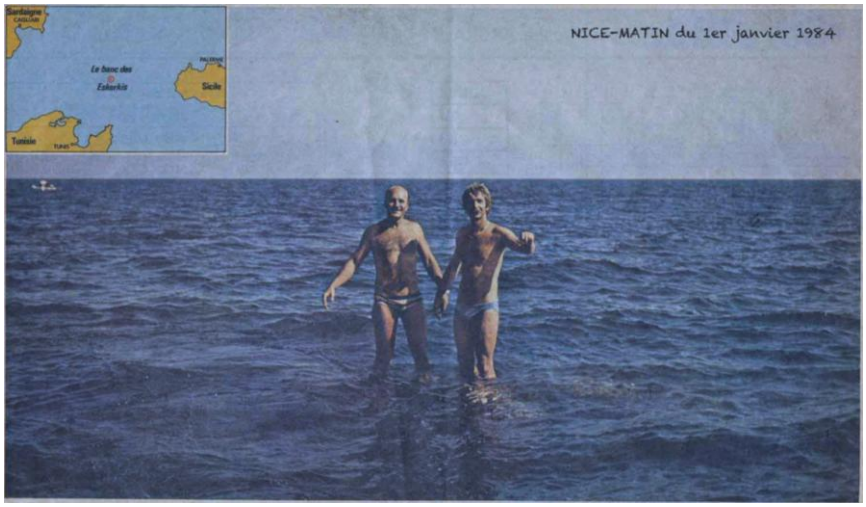
There are no data, or references, on recreational fisheries, that, however, is strongly present and practiced within the Gulf. This kind of fishery is a serious threat to the protection of the resource, given lack of strict controls and frequent dangerous conflicts with professional fishermen.

TUNISIA

The Galite archipelago and the Esquerquis benches (ECOSAFIMED Tunisian study areas) are located far aways Tunisian coasts; about 51 nautical miles respectively on the north-east and north-west of Bizerte. The description of these areas is done in the report concerning maps and selected study area. The majority of artisanal boats fishing in Galite and Esquerquis are those of the governorates of Bizerte and Nabeul. Therefore, in this part of the project report we will describe fishing harbors, artisanal fleet and gears of Nabeul and Bizerte regions. The data are collected from inquiries and the data bases of the General Directorate of Fisheries and Aquaculture of Agriculture Ministry.



Galite Archipelago



Esquerquis banks

STUDY AREA 1. Region of Bizerte

1 Overview of the Bizerte region

The region of Bizerte is located in the extreme north of the country, it is a very important opening on the Mediterranean sea and the maritime lanes of the Strait of Sicily which gives it a strategic position.

The Bizerte region enjoys a unique ecological setting combining the sea (200 km coastline), the mountain and the forest. It is distinguished by the natural park of Ichkeul listed as World Cultural and Natural Heritage of UNESCO.

The fisheries of Bizerte region are exploited by different operating modes namely artisanal fishing, benthic trawling, purse seine and lagoon fishing. This part of Tunisia is also distinguished in some fishing practices targeting especially spiny lobster and red coral.

It is also at the port of Bizerte that the first experience of north-south partnership was created as part of joint ventures in trawl fishing, purse seine fishing and long line fishing (1999).

Port infrastructure:

The Bizerte region has a complete port infrastructure which include one (1) deep-sea port and four (4) coastal ports (Table 1). These ports are:

- **The deep-sea port of Bizerte** is located near the city of "Zarzouna" in proximity of the east jetty of the commercial por. The construction of the fishing port of Bizerte was completed in 1985. It is a deep-sea fishing port which has important

links with processing units of marine products and exporters mainly in partnership with Europe.

- **The coastal port of Sidi Mechreg** is located in a small cove about 1.5 km to the east of the locality of Sidi Mechreg between Cap Negro and Cap Serrat. This cove is open to the North West, and thereby greatly exposed to dangerous swells. The port of Sidi Mechreg has been realized in 1997 with the aim to fix the maritime population on the site, improve the conditions for the exercise of their activity, increase their income and to develop the artisanal fishing activity.

- **The coastal port of Menzel Abderrahmane** is located inside the Bizerte lagoon. It has been constructed in 1995 with the aim to fix the maritime population of the lagoon of Bizerte in their cities.

- **The coastal port of Cape Zebib** occupies the bottom of a small cove near the cape at its eastern side. It has been accomplished in 1997.

- **The coastal port of Ghar Melh** is located in the north-west of the Gulf of Tunis. It was built in 1975 along the shoreline resulting from the contributions of the Greatest tunisian river "Oued Medjerda". It has recently undergone rehabilitation and extension works.

Importance of artisanal fishing in the Bizerte region:

The Bizerte region hosts a fleet of 1535 fishing vessels whose 1472 artisanal vessels, 20 trawlers and 43 seiners (Table 1). The motorization rate of the artisanal fleet is around 43%. The active maritime population in artisanal fisheries was around 4253 individuals in 2011.

In the Bizerte region artisanal fishing activity is present in all the ports with varying importance from one port to another. This importance could be seen through the following points:

- The artisanal units are more concentrated in the port of Bizerte with a percentage of 51% of the total fleet followed by the port of Ghar Melh (18%) and the port of Menzel Abderahmen (15%);

- As consequence of this concentration of artisanal fleet the production of the port of Bizerte is the largest both in weight and value followed by the port of Cape Zebib;

- The artisanal fleet of the port of Menzel Abderahmen holds the highest unit price of products of the artisanal fishing activity (11,6 DT / kg) followed by the port of Bizerte with 10,1 DT / Kg. The lowest values are recorded in the ports of Ghar Melh (4,5 DT / Kg) and Cape Zebib (5,7 DT / Kg) where landings of the artisanal boats is

composed mainly by small pelagic species and mendole (*Spicara maena*) with low commercial value;

- For the comparison by port we note that in relative terms, artisanal fishing is exclusively engaged in the ports of Sidi Mechreg Menzel Abderahmen and Cape Zebib. While in the ports of Ghar Melh and Bizerte, artisanal fishing activity is not a big part of the total fisheries production due to the existence of highly developed purse seine fishing and trawl fishing respectively in the ports of Bizerte and Ghar Melh.

- Finally, we note that the active artisanal fleet in the study areas of ECOSAFIMED project is attached to the port of Bizerte. The units of the port of Sidi Mechreg and Cap Zebib are small and do not fish away from their home sites. While those of the port of Menzel Abderahmen are only active in the Bizerte lagoon and never go out in the open sea. For artisanal boats from the port of Ghar Melh, they practice mainly lagoon fishing in the lagoon of Ghar Melh and the rest go fishing in the shallows close to the port and rarely fish in the ECOSAFIMED project study areas.

Ports		Deep-Sea	Coastal			
		Bizerte	Sidi Mechreg	Menzel abderahmen	Cap Zebib	Ghar Melh
Docks (m)		1035	340	126	263	460
Halls (Number)		1	1			1
Wholesale market (Number)		1	1	1	1	1
Repair Shops (Nb (Surface))		24 (1500m²)	1 (50 m²)		1 (80 m²)	1 (150 m²)
Dry up equipment (capacity in Tons)		110	15		15	15
Shipyard (Number)		7				2
Local fishermen (Nb (Surface))		89	20 (142 m²)		10 (112 m²)	2 (60 m²)
Social purpose premises (Yes / No)		Yes	Yes		Yes	Yes
Ice plant (Tons / day)		42	2,5		10	20
Ice silos (Tons)		70	15		20	16
Cold chambers (Tons)		70	5		8	47
Freezing chambers (Tons)		250				1,5
Freezing tunnels (Tons / day)		32				
Number of trawlers		20				
Number of purse seiners		16				27
Artisanal fleet (attached to the port)	**Motorised**	239	26	76	42	129
	Non Motorised	182	48	148	32	134
Artisanal fleet (close Sites)	**Motorised**	107			18	
	Non Motorised	230			61	
Production by weight (tons)	**Artisanal fishery**	603	60	44	322	278
	% (Artisanal/Total)	**17%**	**100%**	**100%**	**100%**	**14%**
Production value (Thousand DT)	**Artisanal fishery**	6116,4	413	509	1838	1260
	% (Artisanal/Total)	**28%**	**100%**	**100%**	**100%**	**18%**
Average price (DT/Kg)		**10,1**	**6,9**	**11,6**	**5,7**	**4,5**

Table 1. Infrastructures, superstructures artisanal fishing activity in the ports of Bizerte region

2 Artisanal Fleet and Fishing tactics in the region of Bizerte

The artisanal fleet, fishing in Galite and Esquerquis areas, is composed by 112 boats involving 565 fishermen; about 67% of this fleet has Bizerte as homeport. Technical characteristics of this fleet are summarized in Table 2. The average of the technical features are 13.48 m total length (±2.53 S.D.), 18.2 t GT (±9.22 S.D.) and an engine power of 176 HP (±96.7 S.D.). Additionally, the quasi-totality of artisanal boats is made of wood material. We note that the fleet of Sidi Mechreg harbor has limited characteristics allowing them to work frequently near the coast of Bizerte.

Harbour	**Number**	**Total Length (m)**(Mean±SD)	**HP** (Mean±SD)	**GT (tonnes)** (Mean±SD)	**Total Crew Number**
Bizerte	75	13.45±2.77	165.35±102.99	17.77±10.56	365
Cap Zbib	2	16.47±0.767	375.00±106.10	25.88±1.59	12
Ghar el Melh	32	13.76±1.42	201.00±51.10	19.87±3.93	181
Sidi Mechreg	3	9.54±0.059	59.67±14.500	6.60±0.71	7
Total	112	13.48±2.53	176.00±96.70	18.20±9.22	565

Table 2. Technical characteristics of the artisanal fleet of Bizerte region

A total of 14 different fishing tactics or métiers were identified in the region of Bizerte with the corresponding fishing period in the fishing area (Figure 1). We note that these métiers are practiced in the two study areas of La Galite and Banc of Esquerquis.

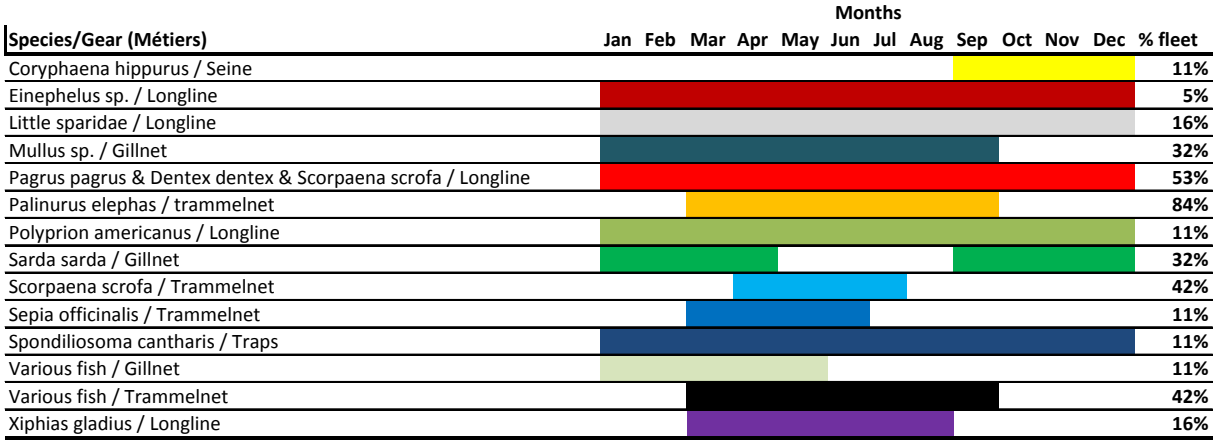


Figure 1. *Chronogram with seasonal fishing activity and percentage of artisanal fleet practicing each métier in the region of Bizerte.*

In the region of Bizerte the main fishing gears used by the coastal fishery are trammel nets followed by longlines and by gillnets. Trammel net is mainly used

to target spiny lobster (*Palinurus elephas*) in spring and summer, red scorpionfish (*Scorpaena scrofa*) in spring and summer, various fish (*mullus sp*., little sparidae, etc.) also in spring and summer and finally the cuttlefish (*Sepia officinalis*) in spring and early summer. The second métier in terms of % of fleet practicing it in the region of Bizerte is longlines targeting the red porgy (*Pagrus pagrus*), the Commun dentex (*Dentex dentex*) and the red scorpionfish (*Scorpaena scrofa*) all year round. Another type of métier which is specific for the region of Bizerte is longlines targeting the Polyprion americanus all year round. For the Gillnets there are two types generally employed to catch Mullets (*Mullus sp*.) From January to September and Bonito (*Sarda sarda*) in autumn, winter and spring.

With minor importance we find some métiers such as longlines targeting little sparidae and various species of grouper *(Epeniphelus sp*.) with predominance of speckled grouper *(Epeniphelus marginatus*) all year round and traps targeting the black sea bream (*Spondyliosoma cantharus*) in winter-spring. Among all the northern region of Tunisia; the last métier is encountred only in the port of Bizerte.

We note that the new métier boat seine net for dolphinfish (*Coryphaena hippurus*) is practiced since 2010 in the region of Bizerte and it is used from September to December.

The technical characteristics of the main gears employed in the region of Bizerte are detailed in Table 3 below.

TECHNICAL CHARACTERISTICS OF GEARS IN THE REGION OF BIZERTE

Gillnets					
Target species		**Mullus sp.**	**Sarda sarda**	**Spicara maena**	**Various fish**
Mean of Inner mesh size		54	82	56	64
Min of Inner mesh size		52	70	56	52
Max of Inner mesh size		60	90	56	70
Mean ± SD of Depth of the net (m)		2,8 ± 0,8	9 ± 4,8	1,5 ± 0	1,2 ± 0,1
Mean ± SD of Set total length (m)		1203 ± 406	3150 ± 1401	1400±	650 ± 87
Mean ± SD of panel number /set		21 ± 7,0	70 ± 32,6	40 ± 0	15 ± 0
Mean ± SD of number set haul/day		3,3 ± 2,1	1,7 ± 0,5	1,0 ± 0	2,7 ± 1,2
Material		PET	PET	PET	PET/PA
Type of filament		MF	MF	MF	MF/MMF
Trammelnets					
Target species	**Dentex dentex**	**Mullus sp.**	**Palinurus Elephas**	**Scorpaena Scrofa**	**Sepia officinalis**	**Various fish**
Mean of Inner mesh size	70	48	138	70	67	64
Min of Inner mesh size	70	48	80	60	60	52
Max of Inner mesh size	70	48	160	80	70	70
Mean ± SD of Depth of the net (m)	1,2 ± 0,05	1,5 ± 0,05	1,7 ± 0,8	1,3 ± 0,9	1,6 ± 0,2	1,7 ± 0,6
Mean ± SD of Set total length (m)	750 ± 0	1250 ± 0	603 ± 138	554 ± 213	850 ± 132	600 ± 122
Mean ± SD of panel number /set	15 ± 0	25 ± 0	13 ± 3,0	14 ± 4,6	16 ± 3,2	14± 1,6
Mean ± SD of number set haul/day	2 ± 0	2 ± 0	7,4 ± 2,1	4 ± 1,7	3,7 ± 2,3	3,6 ± 2,7
Material	PA	PET	PA	PA	PET^{+}/PA	PA^{+}/PET
Type of filament	Twisted/MMF	MF	Twisted/MMF	Twisted/MMF	MF/MMF	MMF/MF
Longlines					
Target species		**Epinephelus sp.**	**Little sparidae**	**Pagrus pagrus & Dentex dentex & Scorpaena scrofa**	**Polyprion americanus**	**Xiphias gladius**
Mean ± SD of Lengh of main line (m)		850 ± 71	767 ± 404	1084 ± 453	1400 ± 566	10875 ± 16126
Mean ± SD of Diameter of main line (mm)		3 ± 0	1,8 ± 0,3	2,4 ± 0,4	7,5 ± 0,7	1,6 ± 0,3
Mean ± SD of Lengh of branch line (m)		1,0 ± 0	1,3 ± 0,7	1,0 ± 0,1	1,1 ± 0,1	5,4 ± 2
Mean ± SD of Diameter of branch line (mm)		1,2 ± 0	0,9 ± 0,3	0,8 ± 0,1	2,2 ± 1,1	1,4 ± 0,4
Mean ± SD of Hook number		225 ± 106	285 ± 0	295 ± 145	185 ± 92	420 ± 333
Hook size		4-5	10-11-12	10-11	3-4	3-4-5
Average Distance between branches or hooks (m)		4,8	2,7	3,8	6,9	25,8

Table 3. Summary of technical characteristics of main gears used. PA = Polyamide, PET = Polyethylene; MF = monofilament, MMF = Multimonofilament. $^{+}$ Mainly used Material

The most striking fact is that some fishermen in the region de Bizerte tend to replace the intermediate net of trammelnets targetting Mullets (*Mullus sp.*), the cuttle fish (*Sepia officinalis*) and little sparidae by a polyethylene monofilament nets instead of polyamide multifilament nets.

Artisanal fishing boat in Bizerte port

STUDY AREA 2. Region of Nabeul

1. Overview of Nabeul *region*

The Nabeul region is located in the north east of Tunisia and covers 2822 km² representing 1,8% of the total area of the country. It is characterized by an important strategic location with 300km of coastline representing 20% of the total Tunisian coastline in that it forms a peninsula opening the Sicily Channel with Sicily island and closes the Gulf of Tunis.

The Nabeul region and in particular the zone of Kelibia has always strong traditions related to fishing activities particularly small pelagic fishing activity using purse seines. The seine or lamparo commonly called "diablo" made its first appearance in the region during the period 1948-1949.

Port infrastructure:

The Nabeul region has a complete port infrastructure which includes one (1) deep-sea port and four (4) coastal ports (Table 4). These ports are:

- **The deep-sea port of Kelibia, built in 1964,** is installed on the Eastern facade of the Cape Bon in a mountainous coastal area that has a steep-terrain north of the city and lowlands where sandy beaches are spread more or less developed sometimes lined with sand dunes and

sebkhas. It should be noted that it advances in sea about 400 m in the SW of a rocky point (Cape Mostefa)

- **The coastal port of Sidi Daoud** is located on the western coast of the peninsula of Cape Bon. It is located to the north of a bay about 2 km wide and 1,3 km deep. Its construction was completed in 1983

- **The coastal port of Haouaria** is located on the eastern facade of the Cape Bon peninsula, south of Ras Addrag, it is about 4 km from the city with the same name in the right of a popular beach frequented by fishermen and vacationers. Protection work recently completed this year since the port had problems with silting and accumulation of algae.

- **The coastal port of Beni Khiar** was built since 1984. It has been the object of protection works against silting and agitation in 1998. This port opens on the Gulf of Hammamet and the fleet which is attached to it does not fish in the ECOSAFIMED project study areas.

- The region also contains two little sites hosting non motorized artisanal boats: **Hammamet Slimen.**

Importance of artisanal fishing in the region of Nabeul

The fishing fleet of the Nabeul region accounts for 446 fishing units including 368 artisanal vessels, 19 trawlers and 59 purse seiners (Table 4). The motorization rate of the artisanal fleet is relatively higher than that of Bizerte region with 73% of artisanal units equipped with engines. The active maritime population in artisanal fisheries was around 1833 individuals in 2011

In the region of Nabeul artisanal fishing activity is present in all the ports with varying importance from one port to another. This importance could be seen through the following points:

- The artisanal units are more concentrated in the ports of Beni Khiar and Sidi Daoud with respective percentages of 35% and 34% of the total number. They are followed by the port of Kelibia (23%) and the port of Haouaria (8%);
- The production of artisanal fishing activity in the port of Sidi Daoud is the largest compared to other ports both in weight and value. So, it stands out from the Port of Bni Khiar hosting almost the same number of artisanal boats. This indicates a better working efficiency and hence higher yields per boat in the port of Sidi Daoud;
- The port of Kelibia holds the highest unit price of products of artisanal fisheries (7,2 DT / kg) because of its fish marketing pole status in the northern region of Tunisia and that serving the multitude tourist restaurants

of the city of Kelibia. The lowest unit price is recorded in the port of Sidi Daoud (3,9 DT / Kg) where artisanal units fish large quantities of small tuna like species that have low commercial value;

- For the comparison by port we note that in relative terms, artisanal fishing is exclusively engaged in the port of Haouaria. Then comes the port of Sidi Daoud where artisanal fishing activity contributes by 60% in weight and 80% in value of total fisheries production due to the coexistence of purse seine fishing (targeting small pelagics). Finally, we note that in the port of Kelibia, artisanal fishing activity has not an important place in the total fisheries production due to the existence of highly developed purse seine and trawl fishing activities;
- Finally, we note that the active artisanal fleet in the study areas of ECOSAFIMED project is attached to the port of Sidi Daoud and Kelibia. The units of port Haouaria are small and do not fish away from their home site. While those of the port of Beni Khiar are only active in the Gulf of Hammamet and rarely fish in the ECOSAFIMED project study areas.

Ports		Deep-Sea	Coastal ports		
		Kélibia	Sidi	Haouari	Bni Khiar
Docks (m)		1179	587	295	450
Halls (Number)		2	1		
Wholesale market (Number)		1	1	1	1
Repair Shops (Nb (Surface))		10 (2106m²)	1 (54 m²)		1 (60 m²)
Dry up equipment (capacity in Tons)		250	25	15	17
Shipyard (Number)		2			1
Local fishermen (Nb (Surface))		72 (1988m²)	38 (328	9 (63	41(1920
Social purpose premises (Yes / No)		Yes	Yes	Yes	Yes
Ice plant (Tons / day)		68	11	2	23
Ice silos (Tons)		220	5	9	80
Cold chambers (Tons)		170	500	2,5	100
Freezing chambers (Tons)		100	50		20
Freezing tunnels (Tons / day)		13	15		
Number of trawlers		19			
Number of purse seiners		45	10		4
Artisanal fleet (attached to the port)	Motorised	73	53	17	85
	Non Motorised	10	42	11	7
Artisanal fleet (close Sites)	Motorised		12		30
	Non Motorised		20		8
Production by weight (tons)	Artisanal fishery	530,2	1052	21	490

	%	4%	61%	100%	30%
Production value (Thousand DT)	Artisanal fishery	3830	4074	112	2607
	%	14%	83%	100%	39%
Average price (DT/Kg)		7,2	3,9	5,3	5,3

Table 4. Infrastructures, superstructures artisanal fishing activity in the ports of Nabeul region.

2 Artisanal Fleet and Fishing tactics in the region of Nabeul

The artisanal fleet, exploiting Galite and Esquerquis areas, is composed by 102 boats involving 526 fishermen. Kelibia and Sidi Daoued harbors are the homeport of respectively 55% and 32% of the artisanal fleet working in our study area. Technical characteristics of this fleet are summarized in Table 5. The average of the technical features are 12.14 m total length (±1.73 S.D.), 14.14 t GT (±5.84 S.D.) and an engine power of 117.12 HP (±55.07 S.D.). As the case of Bizerte fleet the quasi-totality of Nabeul artisanal fleet is made of wood material. We note that the fleet of Haouaria harbor is generally installed at Sidi Daoued and Kélibia harbors.

Harbour	Number	Total Length (m)(Mean±SD)	HP (CV) (Mean±SD)	GT (tonnes) (Mean±SD)	Total Crew Number
SIDI DAOUED	33	12.08 ± 1.40	116.91 ± 50.62	14.12 ± 4.06	160
HAOUARIA	13	11.97 ± 1.51	114.69 ± 58.88	14.26 ± 4.56	60
KELIBIA	56	12.22 ± 1.95	117.83± 57.66	14.12 ± 6.96	306
Total	102	12.14 ± 1.73	117.12 ± 55.07	14.14 ± 5.84	526

Table 5. Technical characteristics of the artisanal fleet of Nabeul region

Fishing tactics in the region of Nabeul

In the region of Nabeul we had identified 10 associations Species/Gear or métiers which are practiced dominantly in the Banc of Esquerquis (Figure 2).
The most important métier in this region is the gilnet targetting Bonito (*Sarda sarda*) from march to june and from october to december. This métier is declared by all the boats sampled in the region of Nabeul. In second position we find the métier of longlines targetting the swordfish (*Xiphias gladius* : 96% of the fleet) in Winter, spring and summer, this métier is followed by the boat seine net for dolphinfish (*Coryphaena hippurus*). In forth position we find two métiers : Long lines targetting the red porgy *(Pagrus pagrus*), the Commun dentex

(*Dentex dentex*) and the red scorpionfish (*Scorpaena scrofa*) all year round and Long lines targeting various species of grouper (*Epeniphelus sp.*) with predominance of speckled grouper (*Epeniphelus marginatus*) in spring, late summer, autumn and early winter.

Unlike to the region of Bizerte, the métiers using trammel nets are not very practiced in the region of Nabeul. Among the trammel net métiers that one targeting the spiny lobster is the most practiced (30% of the boats sampled) from March to September. The boats targeting the spiny lobster are more localized in the port of Sidi Daoud.

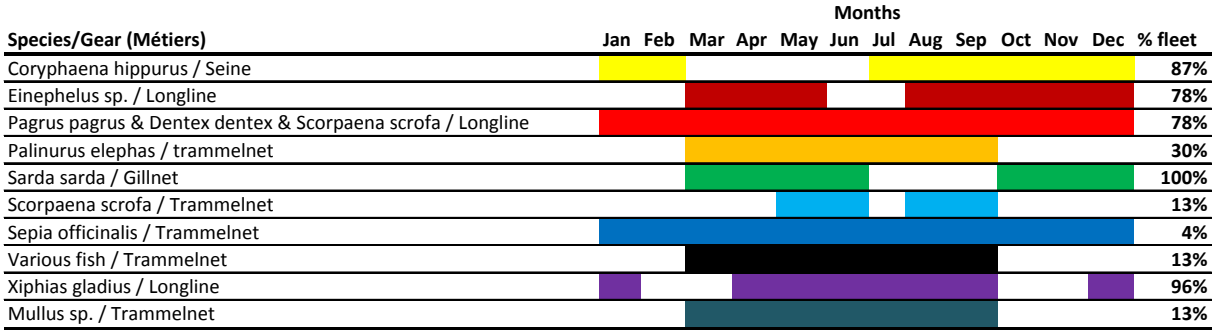


Figure 2- Chronogram with seasonal fishing activity and percentage of artisanal fleet practicing each métier in the region of Nabeul.

The technical characteristics of the main gears employed in the region of Nabeul are detailed in Table 6.

TECHNICAL CHARACTERISTICS OF GEARS IN THE REGION OF NABEUL

Gear	Gillnets	Trammelnets					
Target species	**Sarda sarda**	**Mullus sp.**	**Palinurus Elephas**	**Sarpa salpa**	**Scorpaena Scrofa**	**Sepia officinalis**	**Various fish**
Mean of Inner mesh size	79	50	137	60	52	65	100
Min of Inner mesh size	60	48	100	60	52	60	100
Max of Inner mesh size	90	52	160	60	52	70	100
Mean ± SD of Depth of the net (m)	10 ± 3,5	1,3 ± 0,5	1,6 ± 0,5	1,2 ± 0	2 ± 0	1,5 ± 0,7	1,5 ± 0
Mean ± SD of Set total length (m)	4300 ± 1802	650 ± 173	779 ± 27	700 ± 0	500 ± 0	1450 ± 71	500 ±
Mean ± SD of panel number /set	78 ± 34	10 ± 0	12 ± 2,7	10 ± 0	10 ± 0	27 ± 4,9	10 ± 0
Mean ± SD of number set haul/day	1,6 ± 0,5	2,8 ± 2,1	4,3 ± 2,7	1 ± 0	1 ± 0	2 ± 0	1 ± 0
Material	PET+/PA	PA	PA	PA	PA	PA	PA
Type of filament	MF/MMF	Twisted/MMF	Twisted/MMF	Twisted/MMF	Twisted/MMF	Twisted/MMF	Twisted/MMF

	Longlines		
Target species	**Epinephelus sp.**	**Pagrus pagrus & Dentex dentex & Scorpaena scrofa**	**Xiphias gladius**
Mean ± SD of Lengh of main line (m)	1742 ± 271	1506 ± 618	12182 ± 6702
Mean ± SD of Diameter of main line (mm)	2,8 ± 0,8	2,5 ± 0,8	1,8 ± 0,7
Mean ± SD of Lengh of branch line (m)	2,3 ± 1,4	1,6 ± 0,5	5,8 ± 2
Mean ± SD of Diameter of branch line (mm)	1,4 ± 0,4	1,2 ± 0,5	1,3 ± 0,2
Mean ± SD of Hook number	275 ± 31	347 ± 225	698 ± 478
Hook size	4-5	7-8	3-4
Average Distance between branches or hooks (m)	5,8	4,4	22,1

Table 6. Summary of technical characteristics of main gears used. PA = Polyamide, PET = Polyethylene; MF = monofilament, MMF = Multimonofilament. + Mainly used Material

Artisanal fleet of Kélibia port

Artisanal fishing Boat in Sidi Daoued port