

MedTEK: The Mediterranean Traditional Ecological Knowledge on Small-Scale Fisheries

A snapshot from Malta, Pantelleria Island (Italy)
and Cabo de Gata (Spain)



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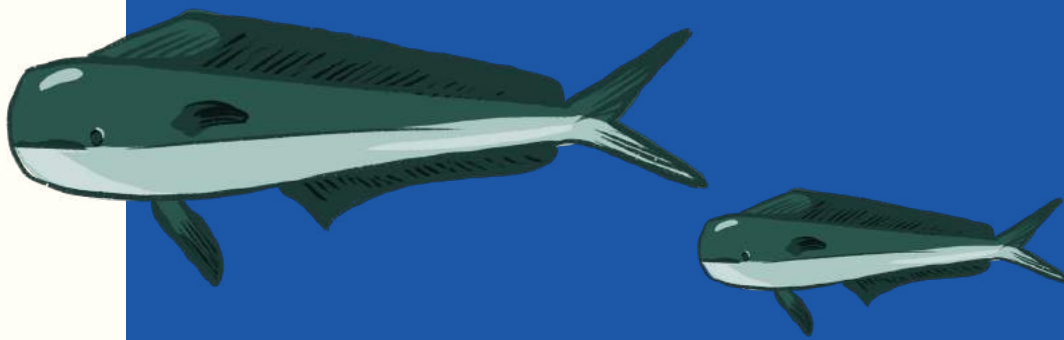
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Executive Summary

MedTEK report is a contribution resulting from a project within and for fishing communities aimed at the collection, recognition and recording of Mediterranean Traditional Ecological Knowledge (TEK).

We consider TEK to be the cumulative body of knowledge, practice and beliefs accumulated over time and passed to subsequent through generations.

This report compiled by the Low Impact Fishers of Europe deciphers and explicates part of the local and indigenous knowledge about small-scale fisheries as perceived and lived by local fishing communities. Our lens is deployed over the Mediterranean region where we compile the MedTEK of fishing community in Pantelleria islands of Italy, the Maltese Islands, and Cabo de Gata Marine Reserve area of influence in North Alboran Sea, in the south-west of Spain. This report elicits the various voices of fishers in their descriptions of how the ecological systems are shaped, and how they interact with them on a daily basis to fulfil their livelihoods. By grasping such locally-embedded and grounded knowledge, MedTEK explores the potential of traditional ecological knowledge to support a socially, economically and environmentally sustainable small-scale fishing sector within the Mediterranean. It does this by exploring the wide body of topics including ecological, resource, ecosystem, fishing practices, fishing communities and values, livelihoods, markets, governance and the interlink between these systems bound by geographical and socio-cultural contexts.

Worldwide, TEK is increasingly being considered as an important tool to inform fisheries management through localized understanding of marine ecosystems, as perceived and lived by locals. In the Mediterranean, such knowledge is definitely much needed to resolve the socio-ecological crisis hampering the small-scale fisheries. It is now shared wisdom that the Mediterranean Sea is in a bad shape, as fisheries are in danger of collapsing. This reality is also shared by fishers who are increasingly finding less fish in their nets. The data on these realities has remained scarce, making the collection of TEK more important than ever before. The various knowledges have been profiled through MedTEK to better understand fishers' interpretations of shifts in marine species, effects of overfishing and climate change, perceptions on policy and rules, threats from invasive/alien species, anthropogenic and wildlife conflicts. MedTEK also draws on existing initiatives and proposals implemented by the fishing communities, such as the role of traditional practices on the sustainability of stock in the Mediterranean, and identifies potential strategies aimed at minimizing the loss of ecological and cultural biodiversity of the fishing community stemming from a tradition dating back to thousands of years.

This report highlights the need of not only collecting MedTEK, but also promoting its use as a useful information source for policymaking, which could be especially relevant when co-management schemes of inshore fisheries is established. TEK can play a fundamental role in co-producing knowledge about fishing and fish stocks, as learnt and transferred within coastal and fishing communities through wisdom and experience. This is why MedTEK can help scientists and managers in better understanding the complexity of socio-ecological fisheries systems through enhanced data models based on multiple types of knowledges and provides a baseline for the inclusion of fisher's knowledge in future fisheries management. If capitalised on, we are convinced that the deployment of MedTEK in scientific advice and policy-making can enhance the potential to accomplish policy goals and achieve a better status of both the oceans and of the fishers in the Mediterranean.



Introduction

Small-scale fisheries play a key role in the Mediterranean Sea, representing over 84% of the total fishing fleet and employing nearly 62% of the total workforce on board fishing vessels. Normally, small-scale fisheries in the Mediterranean are considered small fishing vessels up to 12 m, normally being polyvalent using a wide range of fishing gears adapted to seasonality and not using towed gears. They are family-based enterprises, with the owners directly involved in the fishing activity. Traditional ecological knowledge about Mediterranean fisheries exists across small-scale fishers as they have gained it through years of experience; however, limited records of such knowledge is available. The MedTEK contribution is one of the very first attempts towards the compilation of a regional report on TEK, which covers the knowledge held by fishing communities in the Strait of Sicily (Malta and Pantelleria) and West Mediterranean (Alboran Sea).

Worldwide, TEK has been the focus of various disciplines looking at 'indigenous knowledge', 'local ecological knowledge', 'ethnoecology and ethnoichthyology', (Gadjil et al., 1993; Berkes et al., 2000). As a tool of knowledge, it is becoming increasingly used through scientific collaborations, where it is mobilized to inform particular data streams as implemented by scientists. Collaborative knowledge production in fisheries, based on decentralization and a bottom-up manner has become considered as a key method employed for the sustainable exploitation of marine resources (Hoefnagel et al., 2006) with numerous examples from across geographies and scales (Obura et al., 2002; van der Mollen et al., 2015; Schemmel et al., 2016).

Inspired by the ongoing efforts of marine-related knowledge from and with fishers, MedTEK aspires at building the regional picture knowledge sets as shared and imagined by fishing communities. In this regard, it aims at bringing to the forefront the wisdom and experience of Mediterranean fishers about fish stocks, seasonality, patterns of migration and climatic shifts, which is based on significant detail which is not yet conventionally collected through scientific approaches. Although some research in the Mediterranean has been implemented with the aim of understanding and tracking signals of change in Mediterranean fish by collating local or traditional ecological knowledge (Azzurro, Moschella, & Maynou, 2011), there remains major information gaps about the Mediterranean fisheries that would benefit from more input of the local communities TEK.

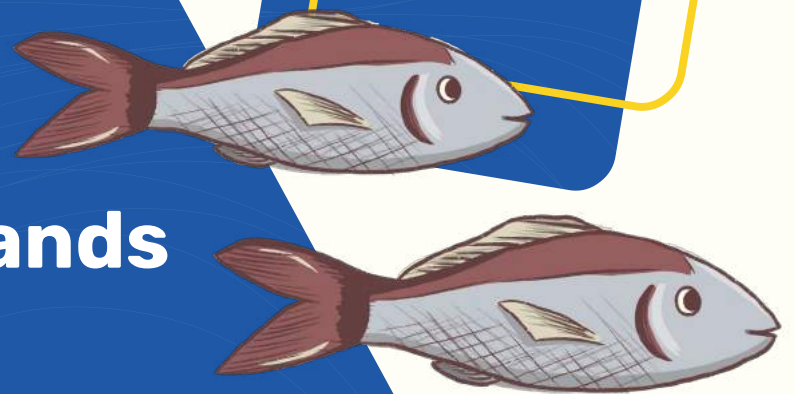
For example, the baseline knowledge of a number of resources targeted by SSF in the Mediterranean is unknown (Said et al 2018), hence, the collection of traditional ecological knowledge is needed to indicate important management steps that are essential to safeguard the key species that form part of the ecosystems within the Strait of Sicily and the Western Mediterranean, and the dependent fishing communities. In the next sections we will present part of the TEK as collected with fishers from Malta, Pantelleria, and Spain, where we focus on coastal, inshore and other remote areas. Here, we investigate what forms of traditional ecological knowledge

types could be brought together to enhance the knowledge about our seas, and also have more localized research focus. In this vein, we are certain that with the right momentum towards collaborative practices happening in various contexts to inform fisheries science, we would be in a better place to inform small-scale fisheries management.

The collection of TEK from LIFE in these (and other) sites will be continued on the following 2 years, hoping to deliver at the end of 2022 a complementary set of information more precise and ready to be used for management purposes.

CHAPTER 01

The Maltese Islands



MEDTEK: TRADITIONAL ECOLOGICAL
KNOWLEDGE OF MEDITERRANEAN
SMALL-SCALE FISHING COMMUNITIES.

Preliminary Findings in Cabo de Gata (Spain), Malta
and Pantelleria island (Italy) sites

1.1 - Introduction

Traditional Ecological knowledge about Maltese fisheries exists across small-scale fishers as they have gained it through years of experience; however, no records of such knowledge is available, mainly because no research has actually been carried out on the ethno-ichthyology of Maltese small-scale fishers to date. With ongoing challenges in the Maltese fleet, and the problems related to intergenerational deficit and a greying population, this knowledge is slowly disappearing. This is the first attempt to compile TEK from Maltese fishers through an anthropological approach, which seeks to fill important knowledge gaps about the small-scale fisheries within the Maltese islands. As a phonetic type of data, based on wisdom and experience about fish stocks, seasonality, patterns of migration and climatic shifts, TEK is known to provide significant detail which is not conventionally collected through scientific approaches, and thus, a rigorous methodology that brings together these knowledge types is required to inform the sustainability through more localized management systems targeted towards of small-scale fisheries within the Mediterranean. The baseline knowledge, including the maximum sustainable yield, of key resources targeted by SSF are unknown, hence, the collection of traditional ecological knowledge is needed to indicate important steps that need to be undertaken to safeguard the key species that form part of the ecosystems within the Strait of Sicily, and the dependent fishing communities which form part of the fishery socio-ecological system. This report incorporates a series of fieldwork sessions with fishers from the Maltese fishing communities.



Image 1: Location of the Maltese islands in the Mediterranean

1.2 - Fishing activities in the Area described: Grounds, Species and Legacies

1.2.1 Fishing in Malta: A legacy

The geographical location of Malta - an island with high accessibility to the sea - has always been fundamental to human beings' link to marine resources. The small-scale fisheries sector, more than any other, represents this link, one that dates back hundreds of years with fishing occupying many stretches of the accessible coastline around the island. The legacy of fishing has been sustained for centuries with traditional

know-how and fishing vessels being passed from one generation to the next. Fishers have been using the same techniques and fishing areas since their ancestors' times, with the knowledge about fishing zones, seasons and knowhow being passed from one generation to another, providing an important baseline for fisheries self-governance within fishing communities. These fisheries have always been characterized by small family enterprises engaging in traditional low-impact small-scale fishing methods to produce small volumes of high-value products (Dimech *et al.* 2009).

The commercial fleet is composed of both large and small-scale vessels, with the latter comprising over 93% of the fleet, 50% of which are less than 6 metres, as highlighted in Table 1. 40% of the commercial boats are considered as full-time vessels, whilst the rest are part-time. In terms of catches, part-time vessels produce landings that amount to approximately 10% of what full-time vessels produce by weight and value, and in terms of fishing activity, part-timers conduct fewer and shorter trips than the commercial counterpart (Dimech *et al.* 2009).



Image 2: Role of women in fishing; 2.1) octopus caught by trammel nets; 2.2) hand-held seine for white bait; 2.3) fish handling from the luzzu, a traditional fishing vessel

Alongside the commercial segment exists the recreational fleet composed of 1935 vessels, and which are lawfully permitted to engage in various fishing activities including long-lines, pots and traps, leisure tuna fishing, as well as trolling (Said *et al.* 2018)

Size of vessel (meters)	<6	6<12	12<18	18<24	24<40	Total
Total Number of vessels	504	431	24	33	10	1002
Percentage of Fleet	50.3%	43%	2.4%	3.3%	1%	100%

Table 1: The commercial fleet. Data supplied by Government of Malta, 2014

Women play an important role in the fishing sector, especially as support providers in the general running of the enterprise including selling of fish, although women as boat owners and deckhands are also present, as illustrated in Figure 1. Women are involved in fish sales, which is mostly done through the central fish marketplace (*pixkerija*), and through direct sales to consumers in such a way that provides higher profit margins to the fisher. Consumers consist of hotels, restaurants and individuals who buy fish at the famous fish market in Marsaxlokk on Sundays, or else from the local fisher-owned vending trucks. The legacy of the fishing sector can also be witnessed in the type of vessels which are used in the fishery, which are predominantly smaller than 12 metres, and the most traditional being the wooden boats, known as *luzzu* or *kajjiek* (Image 3). Although still present in many fishing ports, these traditional vessels are increasingly giving way to the fibre-glass-based vessels which are more popular due to their low maintenance. Over time and through technological advancement, the small-scale fleet has become better equipped with navigation systems and fish finding equipment that facilitate the search for good fishing grounds, as well as with motorized winches that make fishing relatively less strenuous. Despite becoming more efficient in terms of fishing activity, small-scale fisheries have retained their small-scale fishing practices.



Image 3: Traditional luzzu vessel

1.2.2 Fishing Grounds and Practices

Fishing with small-scale fishing gear is very versatile and dynamic since fishers might fish with a trammel net one day and then deploy a bottom long-line the next day. Basically, this multi-gear system which includes the use of trammel nets, gillnets, pots, traps, hand-held seines, bottom and surface long-lines, trolling, and pole lines, is very typical both in Malta and in other Mediterranean countries (Leiva et al. 1998; Tzanatos et al. 2006; Battaglia et al. 2010). Locally, these fishing gears are majorly deployed within the 12 nautical mile zone, although fishing within the 25 nautical mile zone, especially with set bottom long-lines is also very common. Fishing grounds closer to the mainland within the 3 nautical mile circumference are also popular amongst small-scale fishers (Stelzenmüller et al. 2008; Said et al. 2017).

On average, the coastal demersal trips with small-scale fishing gear within the 3, 12 or 25 nautical mile zones take between half-a-day to two days' maximum, and the actual geographical location of the fishing is mostly determined by the richness of the fishing grounds. Fishers explain that demersal

fisheries depend on the depth of the water and the sea bathymetry, and that there are different fishing grounds that are good for specific fish enlisted in Table 1. A detailed description of the different types of fishing gear used, and their specificities including the type of fishing ground as well as the bait and number of units normally used by fishers is provided to better explain the practices and the targeted species in Table 2.

Fishing Type	Season	Use of Gear	Bait used	Target species	Type of sea bottom & depth
Bogue traps	June - November	Set one by one in different areas, the position of which is determined by the orientation to specific landmarks. Traps are made out of cane, and are left to fish for around 1 hour, and retrieved.	Broadbeans mixture with anchovies	Bogues	Up to 50 m depth, suspended, mostly in sandy or coralline seabeds.
Octopus pots	All-year	Set in a mainline with multiple pots branching out every few metres. The pots are made out of chickenwire (a type of metal) and the pots are deployed and checked every few days, where they are rebaited and re-deployed. Number of units vary from 50 to 400 per vessel.	Bread with mackerels or salmon offcuts	Octopus and demersal species	Up to 50m depth, laid, mostly on sandy or coralline seabeds.
Trammel nets	All-year	Set in specific fishing grounds determined by the season and targeted species. Deployed in a specific way to avoid entangling. One trammel net (unit) is normally 60 metres long, and number of units deployed varies from 6 to 60 per vessel.	No Bait	Sargus, groupers, breams, lobsters, scorpionfish	Up to 100m depending on species, either sandy or rocky seabeds.
Gillnets	All-year	Set in specific fishing grounds determined by the season and targeted species. Deployed in a specific way to avoid entangling. One gillnet (unit) is normally 60 metres long, and number of units deployed in one day varies from 6 to 60 per vessel.	No Bait	Bogues, mackerels	Deployed in pelagic waters.
Bottom long-lines	All-year	Set in different fishing grounds depending on the targeted species, with bathymetry varying from 40 to 400m, and number of hooks varies from 100 to 1000. Larger number of hooks requires more than one person on board, and the fishing trip may take more than one day.	Mackerels, beef, aliceshad	Sargus, groupers, breams, dentex, zeus faber	Up to 1000 metres depending on the species. Either muddy or rocky seabeds.

Hand-line Kulpara	October – February	Carried out during dusk, with light-aided system on board, using a single line of 1-5 artificial lures to attract squid. The activity is done within coastal areas and can last from 5 to 20 hours.	Artificial lure	Squids and Cuttlefish	Up to 20 metres, in meso-pelagic waters.
Boat-operated Hand seine (tartarun)	June – August	Carried out in around 5 specific zones within the coastal areas, where the fishery is present, about. The gear consists of a surrounding net with two wings and a central bag. It is hand-hauled and not a towed gear. It is used by around 35 fishers.	No bait	Rossetto, white bait, bogues	Up to 30 metres, close to seagrass meadows.
Handline and trolling	June – August	Used either stationary or through trolling behind a moving vessel, these handlines attract small and large pelagics. The activity is practised by artisanal vessels, as well as recreational ones.	Mackarel	Bluefin tuna, bullet tuna, albacore	Deployed in pelagic waters, in deep seas ranging from 80m above.
Entangling nets and FADs	August – December	A tradition of dolphinfish fishery with a total of 130 licenses operating on a yearly basis, with trips taking between 1 and 3 days depending on the catches. Each vessel is assigned one FAD line, onto which 100 to 400 FADs are deployed on a yearly basis. FAD is an aggregating device used to attract pelagic fisheries mostly dolphinfish.	Floating aggregated devices (palm fronds)	Dolphinfish, amberjack and pilotfish	Deployed in offshore areas, starting from the 8 nautical mile zone, up to 90 miles.
Surface long-lines	All-year except closed season	Set in specific areas which are popular for swordfish and bluefin tuna, using either set surface long-lines or drifting lines with not more than 2800k hooks each. The fishery	Mackarels and alice shad	Swordfish and Bluefin tuna (quota regulated)	Deployed in offshore areas, in specific areas.

Image 3: Table 2: Main fishing “metiers” in Malta: corresponding fishing gears, target species, practices and grounds. Source: Collected from Fishers 2019

Its operation follows that of Physical Depredation Mitigation Devices (PDMD) previously adapted to longlines to reduce interactions of toothed whales, designed to provide a physical barrier of various shapes and materials that remains clear of the hooks during the soak period and then slides down the branch line over the caught fish when this is caught (Figure 12; Figure 13) or during the haul (Figure 14) (Hamer et al., 2010; Goetz et al., 2011).

Other variants of the umbrella-and-stones system, like the DEPRED device, consider a double physical action put into practice by many streamers of which the upper ones freely move around the fish (deterrent effect) and the lower ones are weighted, covering the fish (protective effect) (Figure 15; Figure 16). However, despite the umbrella systems were quite effective in preventing the accidental by-catch of seabirds and toothed whales, as well as depredation events, it causes a significant reduction of the catches, so their negative effects undermine the benefits (Hamer et al., 2010; Rabearisoa et al., 2015).

Since cetaceans are protected by numerous national and international agreements and many species are present on the Red List of the International Union for Conservation of Nature (IUCN), not all methods and devices to avoid fishing-cetacean interaction are allowed. Among the prohibited practices and devices towards marine mammals there are explosives, firearms, live ammunition, taste/smell deterrents, chemical irritants, poisons and toxins, and anti-predator netting (Long et al. 2015). The fishing activities vary across the year; however, some fishing gears are more popular than others, mostly due to their open access nature. The use of trammel nets, gillnets, pots and traps, bottom long-lines and other gears is open to all commercial fishers with no restrictions on fishing effort or landings, except for some closed areas and seasonal closures as defined in the national law (Cap 425.01). In other words, those owning a commercial fishing license (full-time and part-time) can utilize these fishing gears without specific permits. On the other hand, offshore fisheries do not host a large number of fishers since the Bluefin tuna fishery is restricted by a fishing quota and a permit system, whilst the dolphin-fish fishery is restricted to 130 vessels. Although the activities vary across the year, they remain more or less the same, and a snapshot from the frequency of the activities and the total landings derived from the Maltese fleet is provided in Table 3.

Fishing Gear	Gear type	Targeted species / species assemblage	Number of vessels	Number of fishing trips in 2017	Number of fishing days in 2017	Landings (tons) in 2017	Units deployed (average)
Traps	Pots and Traps	Demersal species	236	3219	3219	53,11	5-200
Nets	Gillnets	Demersal species	103	475	476	25,72	5-50
	Gillnets	Large Pelagic fish and Small-Pelagic	10	62	62	5,01	5-50
	Trammel nets	Demersal species	366	3890	3893	66,56	5-80
	Lampara	Large Pelagic fish and Small-Pelagic	90	755	833	231,81	1 (large)
Hook-and-line	Hand and Pole line	Cephalopods	241	1761	1762	9,59	1 per vessel at a time
	Hand and Pole line	Finfish	95	744	744	8,18	1 per vessel at a time
	Hand and Pole line	Large pelagic fish	225	1579	2444	409,30	1 per vessel at a time
	Long-lines	Demersal species	306	2509	2848	278,32	100-4000 hooks
	Trolling lines	Large pelagic fish	220	914	914	14,76	1 - 3 per vessel at a time
MISC	Others	Cephalopods	10	36	36	0,04	1 per vessel
	Others	Demersal species	81	364	364	4,42	1 per vessel
	Others	Large pelagic fish	3	7	8	0,57	n.a
	Others	Mixed Pelagic and Demersal	125	823	823	9,27	n.a

Table 3: Fishing Activities by Maltese Fleet in 2017; Source: Annual Report, DC-MAP, Malta-Gov 2018



Image 4: Fishing species targeted by trammel nets and bottom-longlines

1.3 - Challenges at Sea and on Land

1.3.1 Conflict with Marine Uses

Small-scale fishing in Malta is under intense spatial competition as the coastal zone is fragmented by multiple uses and designations including maritime transport, infrastructure, industrial fisheries, aquaculture, tourism and recreation. A recent study shows how fishers have been forced to give up fishing grounds or co-exist with other uses, making their fishing increasingly challenging.

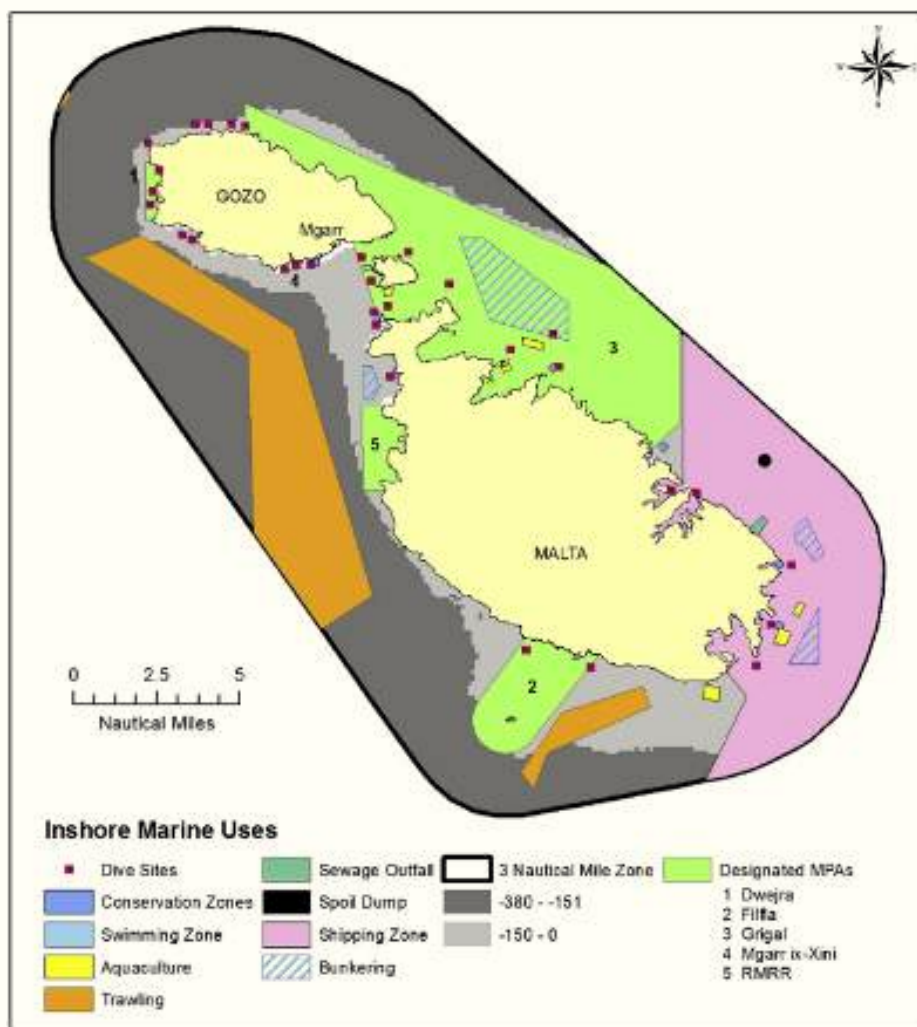


Image 5: Fishing in a congested sea: Marine uses around Malta's inshore fishing zone; (Source Said et al. 2017)

For instance, in the area designated for shipping routes a number of fishers stated that they have lost their gear. Bunkering, which involves the anchoring practices of large ships, allegedly affects the productivity of fishing grounds and unintentionally damages the fishing gear due to the continuous scouring of heavy chains and anchors.

A quantitative insight at the different types of reported competition and impact, resulting from area overlapping between maritime uses and artisanal fishing is provided in Table 3. This table presents a quantitative illustration of the area occupied by the different marine uses within the <150 metre bathymetric contour, and the percentage of fishing activity that has been registered within these zones between 2014 and 2015. Fishing within the coastal areas mostly happens within the <150 metre bathymetric contour (light grey), with intensive competition making fishing very difficult. The 3 nautical miles are congested with fishing, leading to heightened conflicts in this zone. In other words, from the whole sea that people can imagine, fishers can only fish in these areas due to the bathymetry and fish habitats. Furthermore, most of these areas provide 'weather-friendly' shelters on windy days, especially in the winter season when offshore fishing is less popular, making these areas crucial for fishers' income during these seasons. Hence on a good fishing day, competition for fishing spots can be quite fierce, especially in the fact of constant reduction in available fishing areas. Daily challenges while fishing are also noted due to impact on fishing gear caused by other marine activities. The table below, through the shaded boxes presents a typology of competition and/or impact created by the different uses within the 3NM as reported by the fishermen during the interviews or as witnessed by the author during fishing trips. Most of the impacts happen due to anchoring and bunkering, where fishers explain that the fishing grounds have been obliterated due to extensive deployment of large anchors used by international ships stopping in Malta for bunkering services. Fishers also report loss of fishing gear resulting from such activity, especially when

anchors are deployed on fishing pots, traps and/or nets.

The establishment of aquaculture and tuna ranching farms within the territorial zone and on relatively shallow areas which are good fishing spots also reduced the available fishing space. This comes along the diving sites and swimming areas which occupy important coastal areas traditionally used by fishers especially during the winter areas due to their sheltered position from bad weather.

Competition with recreational fishers has been mentioned many times by small-scale fishers during the research trip, predominantly due to the scarce fishing spots and resources therein. Recreational fishers target the same species, utilizing very similar gear like pots and traps, as well as long-lines for demersal species. In some cases, artisanal professional fishers cannot compete for fish with the recreational fishermen as the latter often have larger engines (as they are not restricted by EU KW and GT tonnage) which allows them to reach the fishing grounds more quickly to find the best spots, and to fish for longer. Recreational fishers are restricted from selling their catches, in line with EU Mediterranean Regulation, however data shows cases of market issues related to the commercialization of recreational catches. Some recreational fishers explained that they would like to be commercial fishers, but are unable to join the fleet given the price tag of commercial vessels, thus resort to catching fish using recreational fishing boats.

Marine Uses		Spatial Overlap within the 150m		Type of Reported Competition			Type of Reported Impact		
		%age of area covered by marine uses	% of fishing activity in the area	Fish Resources	Sea-space/seabed		Unintended fishing gear damage	Seabed/ ecosystem impact	Hindered/ Restricted access
					Permanent seabed closure	Forced co-existence			
Recreation/ Tourism	Diving	0.49	0.9						
	Sport-fishing	n/a	n/a						
	Swim zones	0.21	0						
	No stop areas	0.26	0						
Maritime Transport	Shipping traffic	32	55						
	Bunkering	5	10						
Infrastructure	Energy	n/a	n/a						
	Sewage	0.11	0.6						
	Spoil dump	0.09	0						
Fishing and Aquaculture	Aquaculture	0.54	5		*Partial access				
	Trawling	2.5	0.5						
Conservation	MPAs	42	44	No impact to date since MPAs are not fully implemented					

1.3.2 Intra-sectoral conflict

Competition also exists with recreational fishers and industrial fishing, including trawling and lampara fisheries, which targets the same species and fishing grounds, making the space intensely contested. As one artisanal fishers said “it is very common to find recreational fishers in the areas where we usually fish”. Intra-sectoral conflict amongst the artisanal and small-scale sector exists between fishers using different fishing gears (e.g. trammel nets vs. long-lines) and fishers using the same gears which compete for the same fishing grounds. The latter is especially in the case when small-scale fishers deploy large number of trammel nets, reducing the area available for others to deploy their nets.

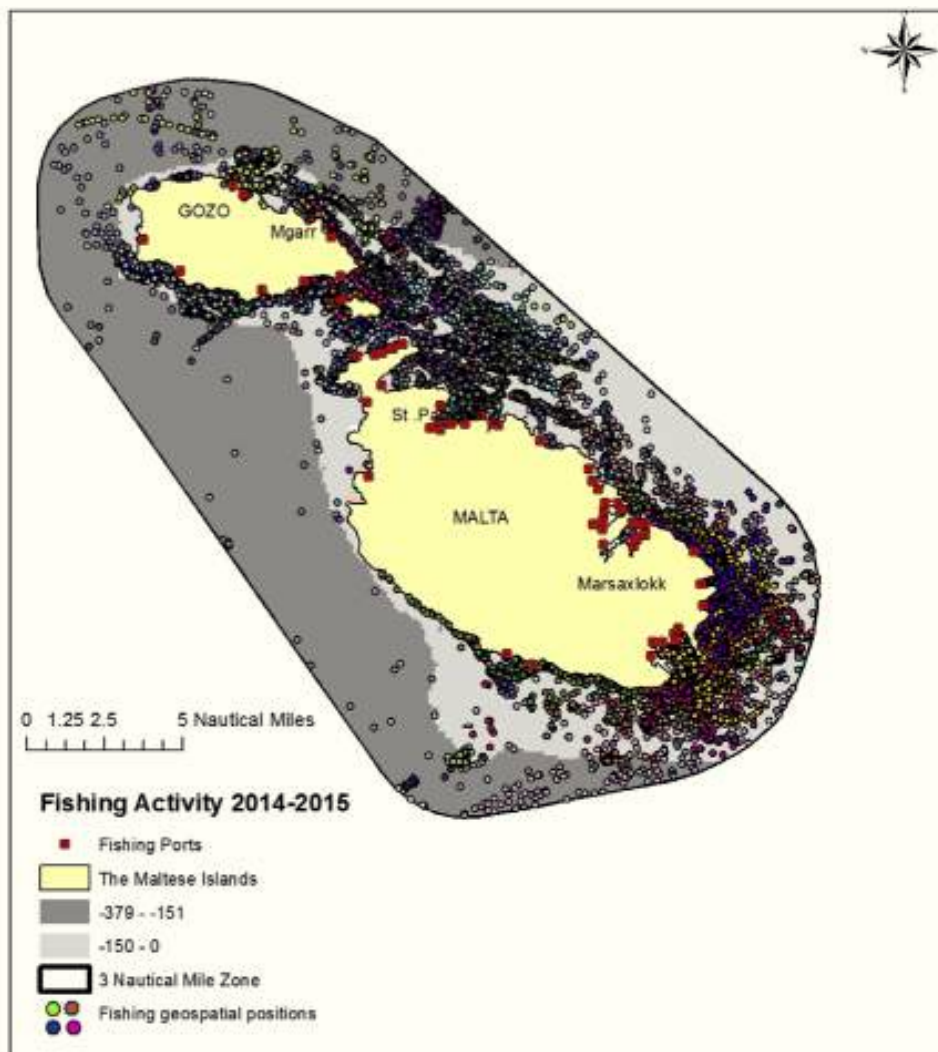


Image 6: Intra-sectoral competition between small-scale fishers utilizing the same coastal fishing grounds. Source: Said et al. 2017

1.4 - Fishers' ecological knowledge on ecosystems changes and threats

1.4.1 Fish Stocks Are Decreasing

Competition for fisheries resources within Malta's FMZ is increasingly contested among industrial trawlers, artisanal-commercial vessels and the recreational fleet leading to intensified fishing effort (Image 7). The fieldwork has confirmed the findings of a recent study which has shown how this competition has resulted directly due to enabling policy measures taken since EU accession, including the creation of a recreational fleet segment to act as a spill-over register from commercial to recreational, as well as the increase number of trawlers operating in Malta's territorial zone (Said et al. 2018).

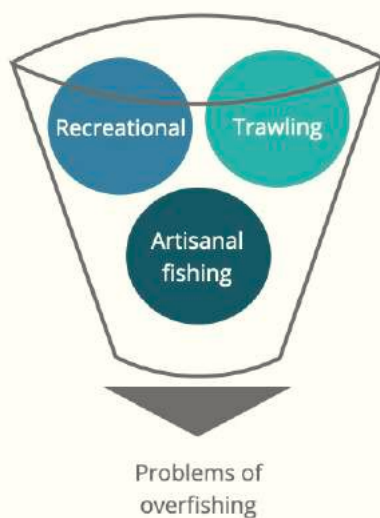


Image 7: Cumulative Fishing effort requires a holistic management framework.

The industrial trawling fleet, which was previously restricted as a measure to protect the small-scale sector (Camilleri, 2002), has been allowed to increase its coastal fisheries catch by 148% (MSDEC, 2013a) extending its fishing effort into coastal areas, even within the 3 nautical-mile zone. Moreover, the recreational segment has increased exponentially in the past 20 years, and there has been relatively no control on the fishing effort and landings of this segment, contributing highly to the hidden harvests. The continuous competition is leading to a blame-game on who is responsible for the decline in commercially-important fish stocks, with little oversight from the government to resolve what seems to be an overfishing problem.

The fishermen explained that the different species which they target are undergoing different levels of pressure, which is not the same across all the species, but there is a definite problem related to increased fishing effort especially on demersal species. They have explained that the problem also results from leisure fishing conducted with harpoons, and sometimes aqualungs even though this is not permitted by law. Fishers also highlight that the increase in the fishing effort on mackerel, to be used as fish feed for tuna pens, has affected the catches for the lampara fishery. Apart from the competition from different segments, the fishery is also experiencing increased fishing effort from specific parts of the artisanal segment. In the past 10 years or so, fishers explain that the fishing activity for trammel and gillnets has increased throughout the year as a result of declined opportunities in the tuna fishing sector (Bluefin tuna recovery plan). Fishermen explain that the fishing activity during what was before the bluefin tuna season (open for all), has now transferred to other fisheries which are not equally monitored including trammel netting and gillnetting. Official statistics show that between 2007 and 2012 the days at sea (fishing effort) on trammel nets has increased by 4500% while gillnets have increased by 870%. The issue of catch management of the coastal fisheries within the FMZ does not seem to be receiving specific attention within the national management portfolio as the supranational EU policy pertaining to coastal fisheries provides only for the management of the large-scale fishing sectors operating within Malta's fisheries management zone. In this regard, the information gap between what is officially recorded and managed in terms of resources, and what is

actually unfolding at sea in terms of fishing effort, remains a threat to marine governance of inshore waters (Said *et al.* 2018). The challenges vary from one fishing port to another, thus necessitating a more localized understanding through scientific studies together with fishers.

1.4.2 Ecosystem changes

The decline in fish stocks is also related to changes in the ecosystems, as witnessed by fishers, especially the elderly ones who have been fishing in the Maltese waters for over 60 years. Fishers mention the increase in marine pollution created by the various industries such as the Freeport, the operations of the power station, and the installation of sewage outflow and spoil dump systems, since these have, according to fishers, affected the productivity of fish stocks. A fisherman's wife argued that... "the power station killed the sea [ecosystems] due to the heating of the water [thermal pollution], and the infrastructure work and dredging in the development of the Freeport [which creates sedimentation processes and suspended matter in the water column] also negatively affected the fish stocks in this area [Marsaxlokk Fishing Village]" (Said et al 2017). Other impacts on the seafloor integrity includes dredging, dumping, agricultural runoff and pollution. This comes along the intensified change of the coastal landscape which is increasingly becoming developed. Fear ensues with the plans for land reclamation which if goes forward, is likely to impact the ecosystems of important fishing grounds in Malta's Eastern coast. Although problems related to climate change have not been highlighted by fishers, sightings of invasive species have been noted and registered (Image 8), however fishers are not aware of any particular problems ensued by the alien species. On a positive note, the entrance of the blue swimmer crab, a lessepien species, has become a new niche species, fetching good market prices, thus providing new income opportunities for fishers targeting these species. Also, given the fast-growing and invasive nature of the species, removing it in large amounts from the local ecosystem is also important to keep the necessary natural balance.



Image 8: A silver-cheeked toadfish caught by a Maltese fisher in 2018 (Source TVM News)

1.4.3 Increase in top predators in the Maltese waters

Other examples related to ecosystem changes that might not have been getting sufficient attention in studies pertaining to fisheries and marine management include the increase in top predators in the coastal waters, as well as the problems related to the increase in the number of dolphins which is leading to intensified problem of predation on key resources targeted by the small-scale fishing fleet. According to the fishers TEK and experience, the increase is somewhat happening in parallel to the increase of tuna pens within the Maltese waters as these are acting as important reefs that attract large predators including wild Bluefin tuna, dolphins as well as sharks. In some cases, this is also intensifying human-wildlife conflict with fishers facing decreasing income due to the competition they are facing in a changing sea. Top predators feed on small pelagics as well as meso-pelagic fisheries such as squids, with fishers reporting declining catches in these fisheries. Moreover, dolphins have been noted to cause damage on trammel nets (holes) (image 9), and long-lines (eating off the bait), which increase the expenses for fishers and reduce their fishing capacity.



Image 9: Trammel nets with holes waiting to be mended by the fisher.

1.5 - Safeguarding the future of small-scale fisheries: Recommendations

1.5.1 Holistic Management: Main lines of action

The small-scale fisheries would benefit from more focused management that makes them more sustainable in the future. This however requires a broad lens that takes into account the cumulative fishing effort from small-scale, recreational and industrial fisheries contesting the same fisheries. Without this holistic approach, there would be the risk of not addressing the real fishing effort realities and the management can be erroneous.

The collection of data from the different fishing segments, already conducted through the EU data collection framework can be used to inform the fisheries management, as is currently conducted for other large-scale fisheries including trawling and purse seining, in line with the Mediterranean Regulation (see MSDEC, 2013b). The management needs to factor in more than mere bio-economic knowledge about fisheries but should endeavour to understand the social and cultural importance of fisheries and ascertain that the measures are endorsed by the fishing community at large. Moreover, it is recommended that an overhaul in the neo-liberal ideology is necessary for the artisanal small-scale communities to re-institute their image within a pro-efficient climate.

Plausible short-term mitigations would include policy restrictions on the transferability of capacity between the artisanal and large-scale industrial fleets in a way that controls the neoliberal expansion of large-scale operations to engender the prolongation of the small-scale fleets. This will also give a breathing space to the younger generations who find it difficult to access the fishery due to the price tags of fishing licenses and vessels. Such capacity measures will allow the regeneration of the fleet, which is currently facing a greying population. It is crucial to provide sufficient space to the newer generations to form part of the fishing industry. Plans to safeguard the future of small-scale fisheries is important for both fishing but also for the communities and the positive externalities they provide for the local economies. These include the supply of local and fresh fish to authentic fish markets and traditional Maltese restaurants; the reproduction of the social fabric that solidifies community networks and stability; and the creation of an emblematic cultural representation of fishing sought by tourists, especially in the main fishing villages of Marsaxlokk and Mgarr (Gozo) where local craftsmanship of vessel-and-gear making is still vibrant.



Image 10: Trammel netters showing their catch

1.5.2 Local co-management with fishers

The implementation of local co-management with fishers can be beneficial to implement localized strategies that could alleviate the profile of small-scale fishers through ideas that are crafted by fishers together with scientists and policy-makers. This would not only provide specific TEK input but also engender the necessary acceptability by the fishing sector for the implemented schemes. Fishers can, for example, pool in their indigenous, practical, and ecological knowledge to support grass-root development of robust and localised frameworks along with NGOs and other local entities. FLAGs can be used to provide the platform for partnership projects at both regional and national levels, and can empower fishers to participate within fisheries management, including in the implementation of marine protected areas and NATURA 2000 sites which are presently being implemented by the government (MEPA 2010).

Fishers can then potentially explicate their needs through the development of marine and fisheries conservation strategies, and become stewards of the marine environment on which their livelihoods depend. Given the current realities that the MPAs are perceived by fishers as a new encroachment over 42% of the fishing grounds since there is currently little or no attempt to effectively uptake the fishermen's knowledge and accommodate their interests through the MPA negotiation processes, the conservation measures need to be planned with and for fishers. In this sense, it is recommended that greater efforts are undertaken to improve and foster the participation of fishermen in the decision-making process, particularly those belonging to the small-scale fishing segments and that fishers pool in their efforts to self-organize and strengthen their common voice. Co-management can also ease the current problems related to institutional complexity where fishers constantly witness the coming about of new policies from different governmental bodies in the country but with lack of coordination and understanding of the cumulative impacts that the different policies are having on the sustainability of the sector.

New avenues which could lead to this include the implementation of floating laboratories where fishers become part of the data collection process to provide knowledge about fish stocks. The initiative has been implemented in

Sicily in 2019, and has been well-received and successful in the study of cetacean depredation on small-scale fisheries (Figure below). Moreover, by being engaged in the process (and not alienated by it) control and enforcement can be truly used to regulate measures which are agreed by the fishers themselves.

This could also be developed through initiatives for self-governance, including the implementation of closed areas and seasons as has been implemented in the past with the seasonal fishing pattern, shared and practiced by the various fishing communities across the island.

1.5.3 At the Sector Level

Small-scale fishers in Malta need to be better represented and empowered. Fishers explain how decisions are not always made for the benefit of society at large, mostly because the current governance system is orchestrated by the powerful few fishers within the co-operatives who determine most paths of decision-making at the national level. A representative body, that breaks away from current co-operative structures could result in more representativeness and counter the inequalities that have fragmented the sector over the past many years. This neo-endogenous formation requires the mobilization of small-scale fisher agency, and could be implemented in various parts of the island in a way that it encompasses more fishers and the realities which they encounter at a socio-spatial level. To get it started, fishers might benefit from the assistance of non-governmental organizations such as 'Friends of the Earth' and 'Fish For Tomorrow', which are two national bodies that both call for the protection of sustainable fishing livelihoods. At the regional level, fishers can benefit from the support of organizations such as the 'Low Impact Fishers of Europe' organization and the 'Too Big To Ignore' since these bodies both have significant power vis-a-vis small-scale fisher concerns. With such support, fishers can become empowered, realize their potential, and gradually re-establish themselves within the fishing sector. Together through co-management and opportunities-seeking initiatives, fishers can be provided with the capacities to develop new markets and alternative economies which can heighten their resilience.

1.5.4 A Social Science agenda for Fisheries of small-island states

Many of the problems and challenges encountered by the fishing community, including the declining stocks and sustainability crisis, have resulted from policies that were particularly aligned to the conservation and economic paradigms with little recognition to the social situation and the impacts ensued from new policies. The impact on the Maltese fishing communities has been quite high also given that their island-based nature, their vulnerability is quite high. With the UN Sustainable Development Goals (SDGs) paving the research and policy trajectories for the next decade and beyond, a discussion on the sustainability of small-scale fisheries is timely, also to propel a conversation about the integrated role of social and natural science research needed to achieve these ambitious goals. The discussion about the upcoming Common Fisheries Policy reform should include consideration about small-scale fisheries in the exploration of options and opportunities, which might lead to both achieving SSF sustainability and the SDGs in the EU. The call for an integrated approach in the implementation of the SDGs and the SSF Guidelines is applicable to all countries, especially those where the values and the importance of SSF are ignored, and where the current policy directions have the tendency to further marginalize them.

In line with the scope of the SSF Guidelines, fishers can benefit from enriched stability through the provision of tenure rights and the formation of fisheries local action groups (FLAGs). This way, small-scale fishers, who represent the relics of sustainable fishing in Malta, can become empowered and proactively get involved in designing a long-term vision that restores the image of the small-scale fisheries sector in the neoliberal era. Although often considered as a (fish)ery problem, the sustainability of small-scale fisheries is much more than that, as it is interconnected to various systems including the community, the markets, the political economy, and other structures which although not always visible, have a determinant role in the viability equation of small-scale fisheries. For this reason, a nuanced and principled governance approach—away from the one-size-fits-all technical fixes conventionally used in fisheries management—is necessary to attain not only sustainability of small-scale fisheries but also the viability of fishing communities, their economies, and their socio-cultural contributions.



CHAPTER 02

Pantelleria Island, Italy

MEDTEK: TRADITIONAL ECOLOGICAL
KNOWLEDGE OF MEDITERRANEAN
SMALL-SCALE FISHING COMMUNITIES.

Preliminary Findings in Cabo de Gata (Spain), Malta
and Pantelleria island (Italy) sites

2.1 - Abstract

This chapter highlights the challenges and complexities in the protection and promotion of Traditional Ecological Knowledge (TEK) in a Mediterranean island located in the Strait of Sicily, the island of Pantelleria. We analyzed the perception of the fishing community through the specific approach of TEK models. Data were collected through a semi-structured and open questionnaire method and focus group discussions in the villages of the island. The study revealed that, unfortunately, the current trend of drivers such as climate change, policy and rules implementation, threats from invasive/alien species, rural exodus and lack of generational renewal, alongside many conflicts within inside the fishing sector, are negatively impacting traditional practices.

The fishing area, the activities and synergies within the traditional fishing sector, altering the TEK model, modify it without improving the well-being of the fishers as well as the marine environment. Starting from the initiatives and proposals implemented by the fishing community of Pantelleria, this work identifies potential strategies aimed at minimizing the loss of ecological and cultural biodiversity of the fishing community stemming from a tradition dating back to thousands of years. The result of the study also helps policy makers and officials of the Mediterranean fisheries department of the region of Sicily in managing economic policy instruments by incorporating TEK in a sustainable way.

2.2 - Description of the Area

The island of Pantelleria is located in the Strait of Sicily, precisely 70 km from the African coast and 85 km from Sicily (image 10). It is characterized by an area of about 85 km² and a maximum height of 836 m designated in the high ground of the Montagna Grande. The latter represents the emerged part of a volcanic body that rises about 2000 m above an oceanic crust about 20 km thick.

The Municipality of Pantelleria (TP), according to ISTAT data updated on 01/01/2010, is characterized by a number of inhabitants equal to 7,403 and a density, expressed in number of inhabitants per Km², of 89. It is also characterized by a surface of 83.03 Km², by an altitude of 5 m asl and by the following geographic coordinates expressed in latitude North 36 ° 49 '44.40 "and East longitude 11 ° 56' 35.88".



Image 11: a) Aerial image of Pantelleria Island. Source Rai.

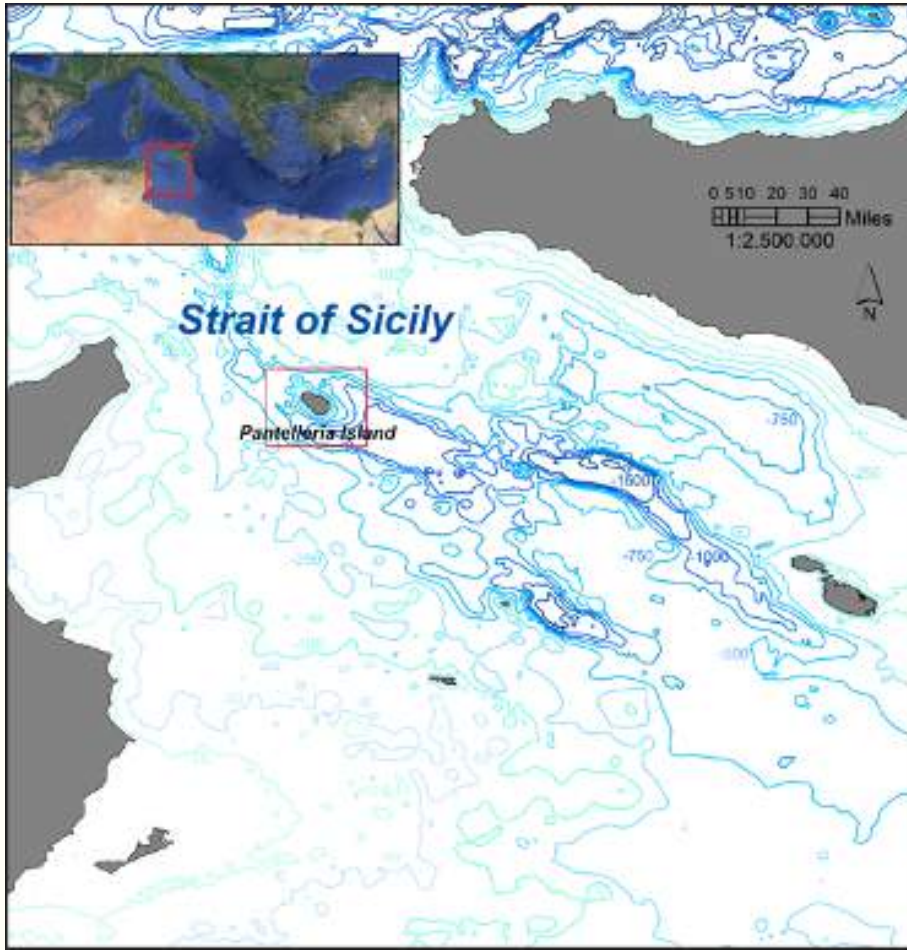


Image 12: Location of Island of Pantelleria in the Strait of Sicily. Elaborated with ArcGis.

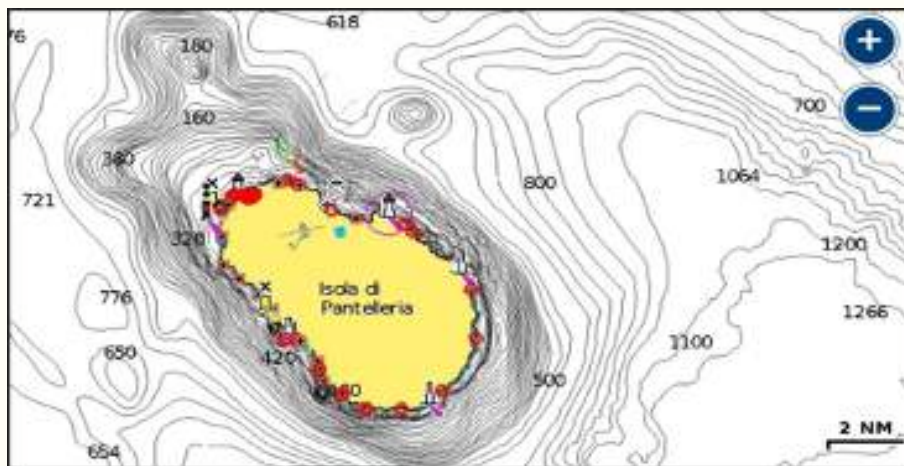


Image 13: Island of Pantelleria with evidence of bathymetry. Source Navionics 2020 map

When talking to fishers a rich description of the orography, sea-bottoms, and species encountered is provided and which is described as follows in this section:

The island, of volcanic origin, is characterized by the presence of many emerged cones and an undefined number of submerged craters. Its coasts are high and jagged, surrounded by a narrow platform consisting of boulders of considerable size, sometimes visible thanks to the outcropping upper part. From the biogeographical point of view, Pantelleria falls within the western territory of the northern area of the African continent.

To the north of the island is the Bue Marino shoal, about a mile from the main port of the rocky island. The greatest depth in this place is 29 meters.

Furthermore, near the port of Pantelleria, the seabed slowly declines, leaving behind furrows, falls and splits. This panorama can be seen by visiting the area that goes from Kharuscia (north-east side) to Punta Fram (north-west side). Continuing from Punta Fram (north-west), up to Punta Tre Pietre (west), we find an area with a bottom that ends in a chair, whose water depth is about 70 meters. In this area the fishers point out "one can find groupers, amberjacks, snappers and in general sedentary fish species: octopus, bream, mullet, thrush, parrot, some corvina".

To the south-west, in front of the port of Scauri, the seabed becomes sandy and is about 15 meters deep, the same seabed as far as Punta Nikà, in front of which rises a shoal, where seabed drops to 14 meters and they are all located the species mentioned above.

To the south, between the area from the Balata dei Turchi and Punta li Marsi. The seabed reaches about 35 meters with the presence of granite masses. In these areas amberjacks, snappers, groupers and breams are concentrated.

Going south-east from the port of Martingana to the Faraglione behind the island, the seabed alternates rocky and sandy areas (25-30m deep) and there is little fish.

Continuing the tour, the rocky seabed rises with outcropping rocks that alternate with shoals. Small fish are encountered in these areas. The seabed rises rocky in the so-called *secchitella dell'arco* which is located in front of the *arco del elena c*, a place rich in sea breams, snappers and amberjacks.

The Faraglione di punta Tracino separates Cala Levante from Cala Tramontana here the seabed drops rapidly to more than 70 meters here too the quantities of fish have decreased in these areas.

Followed by Punta Rubasacchi and Punta Garage and Gadir, there is a small marina and the thermal waters. From Cala Gadir to Cala Cinque Denti, the seabed drops steeply and there are important currents; from Cala Cinque Denti to Punta Kharuscia there is a flat seabed alternating with areas of Posidonia and in front of the coast of Khattibuale is another shoal.

In the north-east of the island, at about 500 meters from the coast, there is the Shoal of Campobello, an area often exposed to the mistral and sirocco winds. Here the seabed exceeds 40 meters and is frequently interested by strong currents. The shoal has its top at 12 meters and rocky walls rich in typical Mediterranean flora and fauna.



Image 14: Nautical map with in evidence the Campobello shoal.
Source Navionics - Boating HD

This area has been identified by the Association of Fishers of Pantelleria as a possible nursery area to protect the surrounding environment and lends itself to being subject to restrictions not only for its importance in abundance of species but also for the geographical position that it would favour control activities.

Thanks to its geographical position, Pantelleria Island in the Strait of Sicily clearly constitutes one of the most important sites in the Mediterranean context, a privileged observation base to follow the distribution and seasonal evolution of most of the masses of water circulating in the Mediterranean basin.

The territory examined is characterized by the presence of numerous habitats appreciated by various fish species of commercial interest, but also protected species. Near the rocky walls and the shallows, which are areas affected by currents, it is possible to find the presence of benthic organisms, such as gorgonians, sponges and bryozoans, which offer nourishment to numerous fish species.

2.3 - Anthropic activities and fisheries tradition

The adverse weather and sea conditions during most of the year make fishing activities impractical, therefore those are concentrated in the late spring and summer period. During that same period, there is an important tourist flow which lead to an increase in fish capture activities by recreational fishers. However, according to what emerged from the territorial survey, conflicts due linked to the presence of recreational and illegal fishing activities emerges throughout the year, in particular in the spring-summer months.

In this regard, it should be noted that recreational and illegal fishing has a significant impact on the overexploitation of fish resources also because it often conveys the catch in informal sales circuits, altering the market and commercial dynamics to the detriment of the artisanal fishing sector which suffers the negative impact of this lack of control in the territory.

2.3.1 Port system

The island of Pantelleria has a port consisting in two basins with a depth up to 6 m and an average of 2 m. Commercial operations are carried out here, as well as recreational and small-scale fishing boats are moored in this port.

The old port, located in the area in front of the town, is bordered by the Molo a Levante and the Molo Nasi. Internally, there are three docks: Dogana, Castello, and Borgo Italia. It has 50 berths, the docks measure 1,120 m and of these, 285 are operational.

The new port instead, located in front of Punta Croce, is delimited by the Nasi pier and the Cidonio pier. In the latter case, the dock has a length of 900 m for most of the operations, with 80 berths available.

In the SE part of the island, on the other hand, there is the port of Scauri characterized by 4 stretches of quay that stretch for 75 m.

2.4 - Fisheries in Pantelleria

The Island of Pantelleria belongs to the Geographical Sub-Area (GSA) number 13 (Gulf of Hammamet) as defined by the General Fisheries Commission for the Mediterranean (GFCM), located in the middle of the Strait of Sicily. For its special conditions, the area in question is highly appreciated and it is specially of interest for bottom trawling and purse seine of different fleets of the Mediterranean Sea from Sicily but also Sardinia, and other countries like Malta and Tunisia.

Those who come from Sicily belong to the bigger fleets of Trapani, Marsala, and Mazara del Vallo. The main species targeted are: pink shrimp (*Parapenaeus longirostris*), hake (*Merluccius merluccius*), red mullet (*Mullus barbatus* and *Mullus surmuletus*), red shrimp (*Aristaeomorpha foliacea*), Norway lobster (*Nephrops norvegicus*) for the bottom trawlers and small pelagic species for purse seiners. These boats however, have specific limitations around the island of Pantelleria that need to keep a specific distance from the coast and depth.

On the other hand, the local fleet from Pantelleria have been carrying out small-scale fishing for generations fish all around the island. They are mainly active in the spring and summer period. On average, there is used around 100 fishing days per year, while the rest of the year small scale fishers alternate their fishing activity with other activities, normally agriculture.



Image 15: A small-scale fishing vessel operating in Pantelleria waters.



Image 16: Setting nets in Pantelleria waters.

2.5 - Description of existing fishing activities

2.5.1 Fishing fleet

There are 17 registered vessels in the NN.MM.GG Registers of the Pantelleria Maritime District Office and 17 operators (table 1). Small-scale fishing (LFT <12 m) affects 88% of the boats, while the rest correspond to bigger boats. However, the bottom trawler seems not to be operational anymore for some time now. 100% of the fleet is made up of boats with GT below 11, while 82% have an engine power of less than 20 kW.

The 17 vessels referred to above are characterized by an average length of 5.75 m of LOA, with average tonnage and engine power values respectively equal to 1.2 t (GT) and 7.1 kW (table 4 and 5).

Registration Number	Name of vessel	Main fishing gear	Subsidiary fishing gear 1	LOA	Tonnage GT	Power of main engine	Year of construction
03TP00229	SILVANA	LLS	GNS	3.97	1.00	0.00	01/01/1971
03TP00267	GIOVANNA	GNS	NO	5.47	1.00	2.00	01/01/1973
03TP00268	SPARVIERO	LLS	GNS	5.05	1.00	0.00	01/01/1984
03TP00269	MARIA PIA	LLS	GNS	4.95	1.00	0.00	01/01/1986
03TP00270	ELENA	LLS	GNS	6.75	1.00	16.20	01/01/1986
03TP00273	FORTUNA	LLS	GNS	4.70	1.00	6.50	01/01/1988
03TP00279	AZZURRA	LLS	GNS	4.50	1.00	0.00	01/01/1989
03TP00284	NUOVA FORTUNA	LLS	GNS	4.10	1.00	5.50	01/01/1990
03TP00292	CATERINA	LLS	GNS	5.80	1.00	12.50	01/01/1989
03TP00293	CALIFORNIA I	OTB	LLS	13.10	11.00	96.00	01/01/1985
03TP00295	S. ANTONIO	LLS	GNS	7.85	2.00	20.59	01/01/1968
03TP00297	LUCIA	GNS	NO	7.31	2.00	14.70	01/01/1965
03TP00298	F.MARTINI	LLS	GNS	5.60	1.00	15.44	01/01/1981
03TP00299	GIUSEPPE PADRE	LLS	GNS	12.77	9.00	88.26	01/01/1978
03TP00302	FOLLIA	LLS	GNS	9.95	2.00	0.00	01/01/1981
03TP00303	BAMBOLA	LLS	GNS	5.07	1.00	0.00	–
03TP00304	PINA	LLS	GNS	5.14	1.00	13.00	01/01/1971

Table 4: Characteristics of the fishing vessels composing the Pantelleria fleet (year 2020). Source: European Fisheries Register.

Comando periferico	Vessels	≤12 m LFT		≤14 m LFT	≤11 GT		≤20 kW	
		N	%	N	N	%	N	%
Marine District Office of Pantelleria	17	15	88	2	17	100	14	82

Table 5: Fishing vessels registered in the registers of the Peripheral Commands of the C.P. and their characteristics (year 2020). Source: European Fisheries Register.

The Island of Pantelleria is special as far as its fishing tradition is concerned, since most of the professional fishers are also engaged in activities other than fishing, such as agriculture (specially harvesting the caper) or the restructuring of the typical construction of Pantelleria called “*dammusi*”. The reasons behind this part-time dedication could be to ensure adequate profitability in the framework of the economic crisis that grips the caper market, the seasonality of the construction works and the marine weather conditions that allow only a few days of fishing in autumn and winter.

In the reference area, fishing is mainly practiced with passive gears, mainly trammel net, with “*ricciolare*” and other gillnets depending on the nature of the seabed. All boats in the area have a license to fish with gillnets. Licenses for the use of longlines are also widely used, while the possession of licenses for lines and harpoons is less popular. There is one single boat officially registered within Pantelleria that is a bottom-trawler, however this boat is no longer operational.

Itime District Office of Pantelleria	Vessels		Driftnets and Gillnets		Longlines		Trawlers	
	N		N	%	N	%	N	%
	17		16	50	15	46.8	1	3.1

Table 6: Fishing vessels registered in the registers of the Peripheral Commands of the C.P. competent authorities and main licenses held (year 2020). Source: European Fisheries Register.

The adverse weather and sea conditions mean that fishing activities are carried out exclusively in the period from April to September. The fish species most fished and considered target species as regards artisanal fishing are the following: the boghe (bogus, *Boops boops*), the menole (*Spicara maena*), the triglie di scoglio (red mullet, *Mullus surmuletus*) and the scorfani (rockfish, *Scorpaena spp.*). Other species, quite important in terms of quantities, are: gallinella (moorhen, *Chelidonichthys lucernus*), murena (moray eel, *Muraena elena*), the occhiata (saddled seabream, *Oblada melanura*), the dentice (red snapper, *Dentex dentex*), sargo (sea bream, *Diplodus sargus*), and the pagello fragolino (common pandora, *Pagellus erythrinus*). Furthermore, the area is rich in small pelagics such as the suro (Atlantic horse mackerel, *Trachurus trachurus*) and the ricciola (amberjack, *Seriola dumerili*).



Image 17: Small-scale fishing vessels in the harbor of Pantelleria.

2.5.2 Fishing gears

The fishing activity of the fleet operating along Pantelleria's coasts is majoritarian of small-scale nature. This fleet is a polyvalent fleet using different gears along the year depending on the season. Also, the morphology of the seabed and to the climatic conditions of the various areas are other factors that dictates the type of gear most suitable to be used. These aspects, combined with the diversity of the fishery resources available in the examined fishing areas, determines the prevalence of the use of such fishing gears as trammels, gillnets, longlines and pots. Seeing them in detail:

- **Gillnets:** nets composed of vertical panels of netting that hang from a line with regularly spaced cork lines. They are left at sea in a fixed position, in Pantelleria normally settled "a mezzaqua", capturing the target species that by moving into it remain trapped (Image 18). They are passive gears, and could be made of different mesh size alternated during the fishing months to capture different species. In pantelleria they normally target "*elena pesce di passaggio*" or small pelagic fish such as menola (blotched picarel, *Spicara maena*), Ritunno o ele (*Spicara smaris*), sgombro (mackerel, *Scomber scombrus*), etc. As fishers mention they capture what normally used to be transformed and conserved dried (known as *pesce asciuto*).

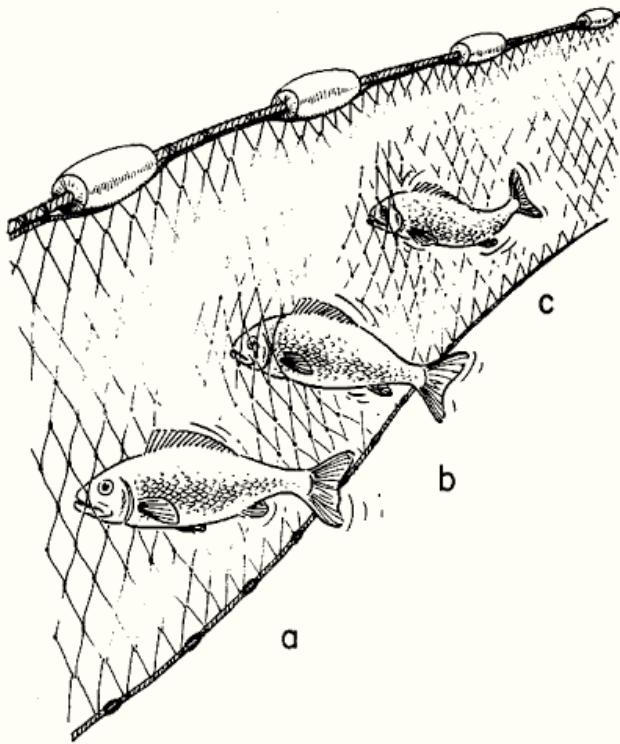


Image 18: Fish capture by gillnetting. Source FAO.

- **Trammel nets:** similar to a gill net but composed by three layers of netting, where the two outer layers have large mesh, and central smaller one is sandwiched between them. The inner layer of the small mesh netting creates a slack netting where the fish swim into and then get tangled in the netting between the two outer layers. Depending on the size of the internal net, they target elenac species such as Triglia (red mullet, *Mullus surmuletus*), pesci pappagallo (parrot fish, *Scarinae spp*), scorfano (red scorpionfish, *Scorpaena scrofa*), lucerne (elenac stargazer, *Uranoscopus scaber*), tracina draco (greater weever, *Trachinus draco*), Murena (Mediterranean moray, *Muraena elena*), etc (Image 19).

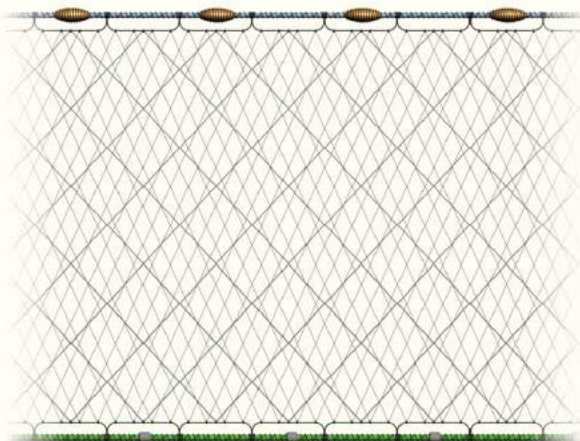


Image 19: Structure of a trammel. Source SeaFish.

• **Longlines known as *Palangari* or *conzi*:** they consist of a mother line, called beam and oriented horizontally, to which the armrests and lines ending with numerous hundreds of hooks and baits are tied at a regular distance. Longlines can be placed at the surface or at the bottom along the water column, with lines set by means of an anchor. Depending on the size of the hook fishers target species such as, dentice (Common dentex, *Dentex dentex*), sarago (sea breams, *Diplodus annularis* e *Diplodus sargus*), Pragma (red porgy, *Pagrus pagrus*), etc. (Image 20; Image 21).



Image 20: A tank containing a longline before the fishing set

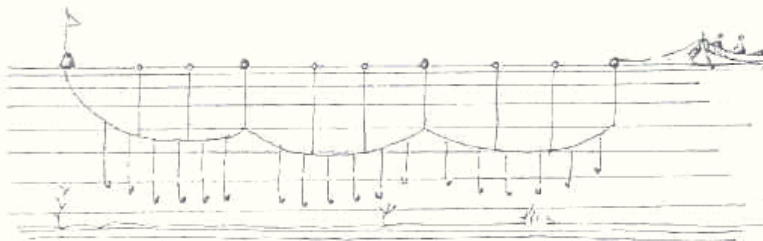


Image 21: Explanation of how a longline is deployed at sea.

- **Nasse or traps or pots:** gears built-in wood or bamboo, in such manner that its structure diverts the fish into an enclosure so arranged that egress is more difficult than ingress entrance itself, becoming a non-return device, where the fish enter voluntarily and cannot escape. They are can be baited or not. The traps are used to catch fish, molluscs, and crustaceans (Image 22).



Image 22: Different size of artisanal pots.

In the following table the fishers detailed the different métiers used in Pantelleria, identifying the gear used with its characteristics, seasonality, main target species and correspondent sea bottoms (Table 7)

	Fishing gear	Seasonality	Use of art	Bait	Target species	Bottom type and depths
Nets	“Rete lisce per minnole” (Guillnet)	All year long	1 transparent nylon single net. Commercial number (that indicates the mesh size of the net) is 13. It is set at sunset and lifted at sunrise, with the gear being arranged a “mezzaqua” (midwater)	No bait	“Per piccoli pesce di pasagio” like: Menole (<i>Spicara maena</i>), sgombro (<i>Scomber scombrus</i>), suro (<i>Trachurus trachurus</i>), etc	Mid-water
	Rete lisce per ritunni” (Guillnet)	All year long	1 transparent nylon single net. Commercial number (that indicates the mesh size of the net) is 15-16. It is set at sunset and lifted at sunrise, with the gear being arranged a “mezzaqua” (midwater)	No bait	Ritunno/ zero (<i>Spicara smaris</i>)	Mid-water
	Tremaglio per la triglia (Red mullet trammel net)	April -sept	Three-layer nylon netting. Commercial number (that indicates the mesh size of the internal net) is 10. It is set at sunset and lifted after two or three hours	No bait	Triglia (<i>Mullus surmuletus</i>), pesci pappagallo (<i>Scarinae spp</i>), tracina draco (<i>Trachinus draco</i>), scorfano (<i>Scorpaena scrofa</i>), sogiola (<i>Solea solea</i>)	where the rock ends and the sand begin (average of 12-15 m)
	Tremaglio “per tutto” (Trammel net)	January-April	Three-layer nylon netting. Commercial number (that indicates the mesh size of the internal net) is 8-9. It is set at sunset and lifted after around 6 hours.	No bait	Murena (<i>Muraena Helena</i>), scorfani (<i>Scorpaena elongate</i>), orate (<i>Sparus aurata</i>), lucerne (<i>Uranoscopus scaber</i>), Mormora (<i>Lithognathus mormyrus</i>), tracina draco (<i>Trachinus draco</i>), suro (<i>Trachurus trachurus</i>), sarago (<i>Diplodus annularis e Diplodus sargus</i>)	Located on mixed bottoms with rocks, with mud, etc.
	Lobster trammel net	All year round	Three-layer nylon netting. Commercial number (that indicates the mesh size of the internal net) is 6. It is set at sunset on rocky bottoms and left for 1 or 2 days	No bait	Aragosta (<i>Palinurus elephas</i>), astice (<i>Homarus Gammarus</i>), pagello fragolino (<i>Pagellus erythrinus</i>), Gallinella (<i>Chelidonichthys lucerne</i>), scorfano	Rocky bottoms from 40 to 80 m deep, (depending also on the type of boat that can

					(<i>Scorpaena elongate</i>), <i>cernia bruna</i> (<i>Epinephelus marginatus</i>)	manage the currents in deeper waters)
Hooks	Palangaro	All year round	Cord or mother thread from which depart perpendicularly and at regular intervals threads of lesser diameter (bracelets) with hooks tied at their ends. They are set so that the hooks are close to the target species: <ul style="list-style-type: none"> - Hooks with commercial number 7-8 for dentici e murene - Hooks with commercial number 11 per i praghi - Hooks with commercial number 12-13 per i saraghi 	Sardine/squid	orate (<i>Sparus aurata</i>), dentici (<i>Dentex dentex</i>), sarago (<i>Diplodus annularis</i> e <i>Diplodus sargus</i>), cernia bruna (<i>Epinephelus marginatus</i>), Praghi (<i>Pagrus pagrus</i>), scorfani (<i>Scorpaena elongate</i>), murena (<i>Muraena helena</i>), grongo (<i>Conger conger</i>), orate (<i>Sparus aurata</i>), spigola (<i>Dicentratus labrax</i>)	Located on mixed bottoms with rocks, with mud, from about 10m depth to more deep waters
	Lenza (Handline)	Aug-Oct	Rigging consisting of a rope about 200 m long and 5 mm in diameter, to the end of which is attached another slightly thinner rope about 50 m long. At the other end, a nylon line 1.8 mm in diameter and 20 m long is attached with a tied hook at its end, with a plumb line	sardine/octopus	Tunids, riciole (<i>Seriola dumerili</i>), dentici (<i>Dentex dentex</i>), etc.	In the water column
Traps	Nase per aragosta (traps for lobster)	Jan-Mar + Jun-Aug + Nov-Dec	Cylindrical-conical. Pots are attached to a leaded mother. They are kept at bay 24 hours a day and are only lifted to replenish bait and collect the catch.	Sardine	Aragosta (lobster, <i>Palinurus elephas</i>)	Rocky bottoms of more than 20m
	Nase per i gamberi (traps for shrimp)	Nov-Dec	Same trap as before but with smaller mesh size.	Bogue/ Atlantic horse mackerel, Mackerel	Gamberi (shrimp, <i>Aristeus antennatus</i>)	Rocky bottoms of more than 20m
	Nase per i monacedde	June-sep.	Same type of trap as before but much bigger size	-	Monacedde o castagnole (<i>Chromis chromis</i>)	Very shallow waters

Table 7: Main small-scale fishing “metiers” in Pantelleria island: corresponding fishing gears, target species, practices and grounds. Source: Collected from Fishers 2020.

2.6 - A complex institutional framework: from COGEPA to FLAGS, from the interventions of the Fisheries Department to local initiatives

Today the Strait of Sicily represents the main hotspot of Mediterranean biodiversity, characterized by high levels of biological diversity and at the same time threatened by the loss of habitats and species. In this stretch of sea between Sicily, Malta and Tunisia there are, among others, almost all pelagic and benthic marine protected species of the Mediterranean.

This area is currently considered the most important fishing area for large and medium pelagics such as bluefin tuna, swordfish, amberjack, and demersal species such as hake, pink shrimp, Norway lobster, lobster, red snapper, sea bream, grouper. There are also large stocks of small pelagics, such as those of anchovies, mackerel and sardines, which have allowed the development of an important canning industry in the area (ISPRA, 2015).

The island of Pantelleria is located in the center of the area and this is also noted for the important presence of initiatives aimed at protecting the environment and cultural biodiversity. The considerable environmental importance of the territory in question has led to the establishment of natural protected areas belonging to the Park of Pantelleria established in 2016, two SIC zones (1: Coastal area, Cliffs and *Bagno dell'acqua* and 2: *Montagna grande* and *Monte Gibeles*). The founding elements of the Habitats Directive highlight the need to define specific Conservation Measures to which each Natura 2000 Site must be subjected in order to guarantee the maintenance of the habitats and / or species of community interest in a "satisfactory state of conservation", reference to which that SCI and / or SPA data was identified.

It is in this framework that a number of initiatives stemming from political reflection at national and European level are developed at different levels, showing the growing need to realize efficient management plans for the sustainable development in each area of reference. In this context, different institutional strategies were added with voluntary initiatives by coastal communities, in order to better manage fishery resources. In particular, a first co-management initiative that the Sicilian Region has implemented and which

involved the fleet of the Island of Pantelleria is represented by the so-called “*Consorzio di Gestione della Pesca Artigianale*” (CoGePA) that is based on European regulations, whose main objectives are:

- 1) promoting the modernization of the fisheries sector at local level and safeguarding employment and income levels;
- 2) managing fisheries activities responsibly and in cooperation, for a sustainable use of fishery resources;
- 3) carrying out actions for the mitigation and conservation of resources and for the limitation of negative socio-economic impacts;
- 4) the preservation of local traditional fishing techniques. Among the measures limits on catches, the number and type of fishing permits, and adopt technical measures were defined.

Image 2 shows the Local Management Plans (LMPs) activated to December 2015 in Sicily:

- 1) Pelagie islands;
- 2) Mazzara del Vallo;
- 3) East Palermo and Gulf of Termini Imerese;
- 4) West Palermo and Ustica island;
- 5) Castellammare del Golfo, Marsala and Egadi islands;
- 6) Pantelleria island;
- 7) Portopalo di Capo Passero and Siracusa;
- 8) Augusta;
- 9) Eolie Island;
- 10) Capo Milazzo – Capo Calavà.

Their assignment is to regulate fishing activities in areas with homogeneous administrative, physiographic and ecological characteristics, through self-management of local fishing enterprises, both singles and associated. An essential role is played by the cultural and traditional heritage of Sicilian fishers, and by the scientific knowledge of the experts designated to define the technical aspects of the plans.

In summary, the goal is to strengthen fisheries management with the creation of a supply chain organization aimed at improving working conditions, hygiene, workers' health and product quality. An ambitious and complex framework of measures for the Local Management Plan (PGL) of fishing activities elaborated by the Co.Ge.PA of Trapani, which has as general objectives:

1. contribute to the sustainable use of fish resources through responsible management of fishing activities in the territorial waters of the Sicilian Region;
2. implement fisheries sustainability in derogation through a rational management of the sea that includes mitigation and safeguard actions;
3. contribute to the conservation of traditional / historical local fisheries;
4. to contribute to the sustainable maintenance of fishing activities in relation to marine ecosystems;
5. intervene, if necessary, in direct civil protection actions and activities and / or alongside competent authorities.

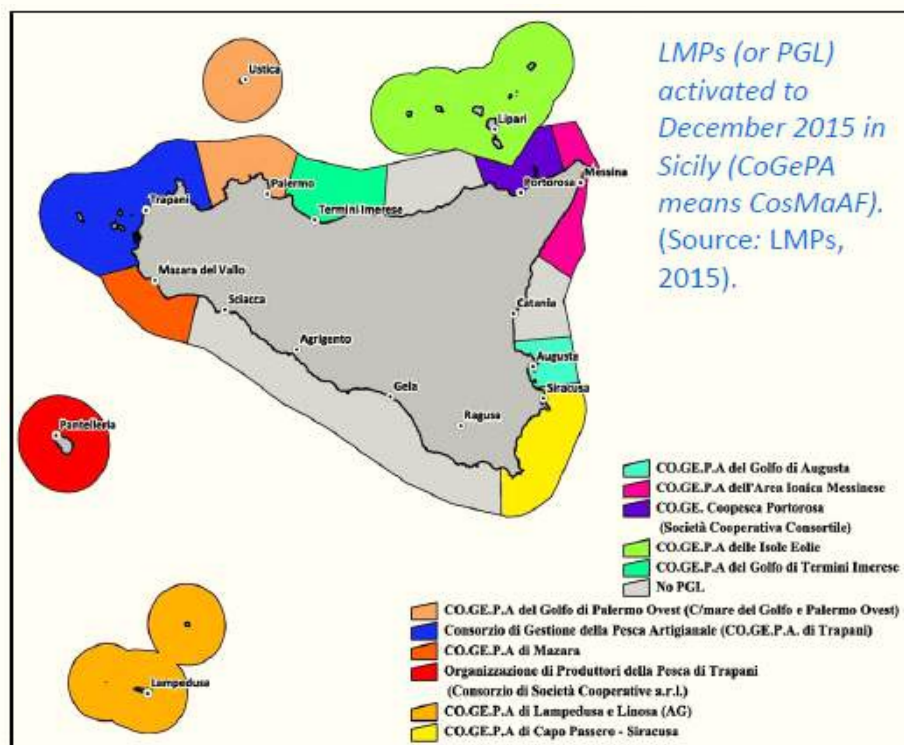


Image 23: LMPs (or PGL) activated to December 2015 in Sicily (CoGePA). (Source LMPs, 2015).

CoGePA is associated with the initiatives of the GAC / FLAG Islands of Sicily which also includes the island of Pantelleria. Governance is articulated and concentrated in general and specific objectives aimed at local development based on innovation and environmental quality. Unfortunately, as underlined by the fishers of Pantelleria who were interviewed, after a first cycle of interventions, the process has slowed down sharply.

The governance of the various initiatives has foreseen and foresees the direct involvement of national and above all regional institutions by virtue of the special statute which delegates special autonomy to the Sicily Region in relation to fishing activities.

In this sense, the Mediterranean Fisheries Regional Department, in addition to coordinating European policies through the EMFF calls for proposals, has carried out an important legislative initiative on a theoretical level, the Law of 20 June 2019, n. 9 on the “Rules for the protection of marine culture and identities and for the promotion of the economy of the sea. Management of Mediterranean fishing in Sicily” which regulates the various activities related to the economy of the sea and the related industries that revolve around it with the aim of modernizing, innovating and enhancing the activities of fish entrepreneurs, promoting fishing tourism, fishing and direct sales. A regulatory framework that should encourage the processes launched by local communities and in particular by fishers.

It is in this context, as we will see below, that a crucial role was played by the Pantelleria fishers’ association which, in part autonomously, in part using the financial instruments of the EMFF and the initiatives shared with the COGEPa and the GACs and subsequent FLAGs, have developed initiatives in synergy and with strategic objectives specific to economic, environmental and social sustainability (Image 24).



Image 24: GAC funds for artisanal fishing on the island of Pantelleria.

In particular, in order to improve landing conditions, with special attention to the sale of fish and fishing tourism services, and to improve the quality of facilities and services on land with a direct impact on the management costs of the fishing activity, two landing points have been financed and implemented, one at the port of Pantelleria and the other at the port of Scauri (Image 25).

However, the various initiatives planned have had a slow and uneven development. For example, despite its approval, an important initiative born with the aim of equipping the local fleet with suitable equipment for the conservation of the fish product in order to complete the supply chain and encourage direct sales, has seen its administrative bureaucratic path starting in 2014 but has not yet been released.



Image 25: Landing point of the catch at the Port of Pantelleria.



Image 26: Area designated as location for fish processing.

The already funded intervention involved the redevelopment of an area owned by the municipality in the port area to be used as a warehouse for the storage of the fish product and for minimal transformation. In particular, it would be a matter of renovating and adapting the municipal slaughterhouse systems made available. The installation of cold rooms, ice machines and storage rooms has been also planned, and the supply of equipment for the minimum processing of the catch (packaging, evisceration of the catch) (Image 26).

The complexity of the institutional context and the initiatives undertaken, including with a participatory approach, is amplified by the relevance that the issues of environmental sustainability as well as economic and social sustainability typical of the island of Pantelleria. Among the most important initiatives is the debate on environmental protection and the creation of a Marine Protected Areas. A long path in this case as well, where different approaches, conflicts between opposed stakeholders, generated a stop to all potential initiatives, that have taken place over time and that have never reached the degree of consensus necessary to their realization (Box 1).

Box 1- Notes on the creation of an MPA on the island of Pantelleria

For about 20 years there has been intense discussion about the interest in Pantelleria to create a Marine Protected Area. Multiple initiatives stemming from environmental sensitivity and interest in safeguarding the environment and the natural heritage have been carried out over the years. In particular, we recall the initiative of the “Pro Parco Marino di Pantelleria Committee” established in 1999 which summarizes on its website the main reasons for the creation of a Pantelleria MP which we report below:

- “- create a reception area for the Monk Seal (endangered species, of which some specimens on several occasions in recent years have been spotted along the coast of the island);
- preserve and study the exceptional biodiversity of the coastal seabed of Pantelleria, favored by the strategic position of the island situated as it is in the center of the Sicilian Channel, in the full flow of the dominant Mediterranean currents;

- start observations and surveys on this seabed in order to obtain completely non-existent basic data, data of fundamental importance for a correct evaluation of the current and future conditions of the Mediterranean;

- protect the underwater archaeological heritage of enormous value that is still hidden on the coastal bottoms of Pantelleria, to achieve its "in situ" enhancement with the collaboration of the Superintendency for Cultural and Environmental Heritage of Trapani, which has already been carrying out such activity for some time".

Alternate events have seen like the presentation of a proposal supported by WWF and several associations, such initiatives have not benefitted from concrete follow-up. But surely made use of the support and vision of the Pantelleria fishers's Association who have imagined a precise path aimed at putting into practice the creation of a study area for the creation of a no-take zone seems at the moment more concrete

2.7 - The voice of fisherman of Pantelleria from problems to innovative solutions

"Mio padre diceva sempre devi occuparti delle cose, non devi preoccuparti."

"My father used to say that you should take care of things, not worry about it."

Anonymous, 2020

Fishers have a concrete knowledge and experience that is fundamental for a sustainable management of fisheries particularly in the case of small-scale fisheries. "Pantelleria Fishers's Association" was founded in 2010 and gathers about 80% of the Pantelleria fishers and yet counts 12 members. In 2012 this small association decided together to drastically limit the length of the nets and increase the opening size of

the mesh with the hope of giving to their sea the opportunity and time to regenerate. They reduced from the 5000 meters of nets allowed by the European legislation to 1500 meters.

They also managed to oblige anyone who came to fish in their waters to respect such as limitation which allowed them to reduce by 60% the fishing effort in their area, an important result in terms of ocean conservation. Despite the constant decline of stocks in recent years, the fishers hope that their “good practice” slowed down this trend (Image 27). These initiatives have also the aim to reduce the fishing effort, considering that derived from sport and recreational fishing, and especially very intensive in the summer season.



Image 27: Pantelleria fishers reduce their nets to protect the sea bottom of the Island.

In the following video (<https://vimeo.com/290229007>) the small-scale fishers of Pantelleria explain the challenges they face and what solutions they tried to ensure the survival of the sector and the profession in the island.

In line with the Mediterranean general trend of decreasing stocks, Pantelleria fishers witnessed a dramatic fall of catches recorded in the last decade, in parallel with a general reduction in the size of fish, as well as a change in the variety of fished species: There is a relevant presence of alien flora and fauna: Parrotfish (*Sparisoma cretense*), Barracuda (*Sphyraena viridensis*), algae of the genus *Caulerpa*, Medusa bag (xx), Runner crab (*Percnon gibbesi*); while the usual local species seem to have disappeared: ope (*Boops boops*),

menole (*Spicara maena*), mormore (*Lithognathus mormyrus*), oysters, sea urchins; or severely reduced: bream and lobsters.

The fishers tell the story of fishing as an integral part of their lives. The challenges of fishing are the main challenges they face. "I started fishing when I was a child, I can say that I've been fishing forever, everything was different, me, my father and the sea, now there is little fish and especially too many rules to respect that are very complicated and make everything more difficult. I think I can say that since I started fishing there has been a sharp reduction in the fishing stock, of at least 50%".

"Pantelleria is a volcanic island, a cone that rises from 800 meters deep in the middle of the Sicilian Channel. The sea is immediately very deep and this makes the fishing areas around the island very limited from a few hundred meters to even less and when we see the trawl boats arriving from Sicily, we know that they will go to the coast and will fish illegally". "The legislation obliges the trawl to respect at least 0.7 miles from the coast but around the island it is not possible, in fact more and more often trawlers and purse seiners arrive very close to the coast. Trawls destroy the seabed and above all the *Posidonia* seabeds, instrumental to the life of many species, a balance is altered and our species disappear". This is why local fishers desire to establish a self-regulation capable to assure the conservation of the bottoms around the island.

"Trying to create harmony and cooperation between fishers, there is a lack of consensus. With the association, we have been trying for a long time to try to improve things. But everything is difficult and the institutions either do not help us or deadlines are very long. So it's the same thing. If we don't cooperate we lose everyone and we can't reach the goal of getting better, we lose the sea and our community. But it's difficult, very difficult. Thank God we carry out other activities that help us to live properly, fishing remains above all a passion and this is why we continue".

The members of the association were initially suspicious of "the 2012 co-management plan," but then it turned out to be an important initiative. For the first time, working together was also useful to obtaining regional calls for proposals on European funds". Now it seems that the funding is gone and that we have to invent other initiatives".

The idea of the commons is not new to the fishers. "Fishing should be properly managed! In the sense that it should be

managed in a common way. We should have tuna quotas for example, this could help us to get a better income. For example, the longline within three miles could be allowed to us small fishers to thrive. We have different types of seabed with areas near the coast that are shallow, which could be used as nurseries. For this reason, the association has been trying for some years to close this area to try to increase the catch in terms of numbers and size. A kind of natural reservoir, but more research is necessary for this”.

“As far as tuna quotas are concerned, I think that a single, collective tuna quota should be given to Pantelleria for the whole island and the catch should only be consumed in Pantelleria for the local populations to avoid speculation. The tuna is there and uncontrolled recreational fishers catch it”.

As the number one competitor, the fishers are pointing to recreational fishing, often illegal. “Recreational fishing is the first threat and problem of our sea, we have only 100 days of fishing and they are concentrated in the spring, summer and early autumn months, and the number of recreational fishers who sell fish illegally to restaurants as well as to the inhabitants is growing enormously. Recreational fishers can fish a lot or even a little, but many recreational fishers fish a lot. In addition, they are using different fishing techniques”.

“Due to lack of controls, we have abusive trawling they sell a lot of fish illegally and do not pay taxes. from Mazzara, Marsala and Trapani but also from Sardinia. Fishing mainly in sandy bottoms close to rocky landslides: 12 - 15 meters; for example in Sauchi, Campobello, behind the island, in areas that are difficult to control. For trawling, it would be necessary to put the anti-trawl boulders in the seabed below the coast”.

“We feel as slaves of the fishmongers, seeing the selling prices tripled makes us feel very bad”.

“There's some competition on the sale. They do not respect the rules of recreational fishing, they compete in the market at a competitive price and they ruin us and the market itself”.

“I think that having a market run by us small fishers would reduce the illegalities represented by recreational fishing in particular. It could also be a valid reference on the traceability of the catch and food safety”. Yet another problem is regarding the amounts available and amounts fished.

“What's happening? The sea is sick, society is sick. Here at Pantelleria in reality there are 12 boats 6/8 of 5 meters, 1 of 4 meters, 2 of 8 meters and one of about 10 meters. The shake

is mainly used and in order to improve the sustainability of fishing, attempts have been made to reduce the size of the nets and to enlarge the mesh up to 7. They do not fish more than three miles away but generally between 300 m and a maximum of 1000 m from the coast. The bottom plunges immediately to 120 meters and sinks again after 90, 100 meters from the coast”.

“On the quantity fished, we must remember that like the farmer, the fisher is also a bit of a liar, he never tells the truth. This is an ancient history, as ancient as human history. The fisher works when everyone is asleep and a world apart. If he fishes a lot and the other fisher fishes less, he knows the price of his fish will be higher. But for a long time in Pantelleria we have understood that if we do not cooperate, we will no longer be able to do fishing and this job will become a pastime no longer a source of income”. The community of fishers of Pantelleria, organized in an association from more than 10 years, know that cooperation is a way of maximizing long-term community benefits to deal with the threats of fisheries mismanagement. The approach of the Association of fisheries is based on essentially on the balances of the aims for human and ecological well-being.

“The Pantelleria fishermen have been working together for about 15 years, identifying concrete actions to coexist constructively through their association. They represent a unicum.”

“It must be said that the fishing effort at Pantelleria is not large scale, there only few boats with all together about 6000 meters of net (let us remember that the fishers's association has planned and implemented the reduction of the nets to 1500 meters)”.

The dysbalanced biodiversity of the sea itself is posing a problem, as there are alien species as well as predators.

“The low quantities of fish are also endangered by the presence of dolphins who sometimes approach the fishing gears and make the fish escape, or even eat the catches trapped in the nets causing their break of many holes of different sizes that don't permit to reuse the gears for a good capture. Thus, the damage is done not only to the catch but also to the nets which need several days of work to be repaired”.

"A big problem is the illegal fish, there are no adequate controls on the quantity fished, the way it is fished and, above all, the fact that it is marketed. Surely there are local pantries that do boating and that escape the control and sell a few kilos of fish, to these are added the tourists who are passionate about fishing and all these people concentrated in a small period of time in the same place, without looking at the size of the catch, without respecting the rules".

"One problem are the alien species: parrot fish which is not very appreciated by the market".

"The problems are not only the alien species like barracuda and blue crab that are eating (they are voracious) also the small pelagics, but especially the lack of respect of the rules".

"In addition to barracudas also tuna eat a lot of fish and now there are many tuna".

"We should diversify the catch: we used to use "conzi" or "palangari" or longline for bream, a tool suitable for selective fishing, now we have moved towards the trammel nets".

Among other challenges there is a lack of concrete institutional support.

"The association has worked over the years for a common project. Among several directions, there was one related to the market. We tried to shorten the supply chain through the GAC / FLAG, a point of sale at the slaughterhouse. We tried to make a warehouse and two landing points. The institutions seemed to support us with public funds but the waiting times without news are very long once we think we are almost there but then everything dissolves. The project wanted to make sure that the direct sale of not only fresh fish but also processed fish and the so-called poor catch was realized. All in order to improve the living conditions of the fishers and their families and the income of the fishers".

"The fishers suffer the price at the market. We should try to start the direct fishing project and avoid suffering the price of the traders".

"We decided to make our fishing more sustainable by reducing the length of the gears, and finally we decided to carry out a study to see if closing a fishing area in a shoal could improve the amount of catch. Unfortunately, our efforts have clashed with bureaucratic slowness and perhaps the lack of interest is causing our association to become more fragile because there are no concrete answers".

The envisaged solutions are to raise awareness and increase

solidarity.

"I have to say that repression doesn't work. I don't think it's necessary to make records and pay fines; we have to do surveillance and explain what can and cannot be done. Especially for who come from outside, everyone calls themselves environmentalists, but rarely is there an awareness of what can be done to respect everyone. We have to train people who come to Pantelleria and the locals who live next to the sea, we have to increase people's awareness because the sea belongs to everyone. I don't think we need to close the fishery but make everyone enjoy it in a conscious way."

Following the interviews reported above, the following social constraints that characterize the sector emerged:

1. Lack of trust in institutions: The companies, despite having formed an association of fishers and having implemented concrete initiatives with a view to improving their living conditions while respecting the principles of environmental sustainability, have encountered over the years a series of administrative constraints. In the last period, this translates into the difficulty in reaching a common goal for which to collaborate, with consequent difficulties in maintaining the network that can connect the various companies, and with little possibility of innovation and progress for them. The effect of socio-economic constraints is accentuated by additional administrative constraints, such as difficulty in accessing funds and bureaucratic slowness

2. Lack of infrastructure and services: The field survey revealed significant structural deficiencies that make efficient marketing of fish difficult. Minimal amenities such as ice machines or retail banquets are still lacking.

3. Lack and ineffectiveness of the controls of the competent authorities: for this reason, among the operators, there is the idea that carrying out fishing activities is penalizing in these conditions and that their work is not respected by the institutions;

4. Poor profitability: most fishing operators are unwilling to invest because they do not believe they can obtain adequate income increases.

5. Excessive costs to adapt the vessel: the idea of adapting your vessels for the specific use you have chosen, can generate many perplexities, there are several costs necessary to adapt

the boat to current regulations. As a result, most fishers prefer to invest in the routine maintenance of their fishing vessels.

The constraints to which the fishing community of Pantelleria is subjected that emerged from the interviews result from the perception of local fishers and can also be divided into two strongly interconnected areas (Image 28).

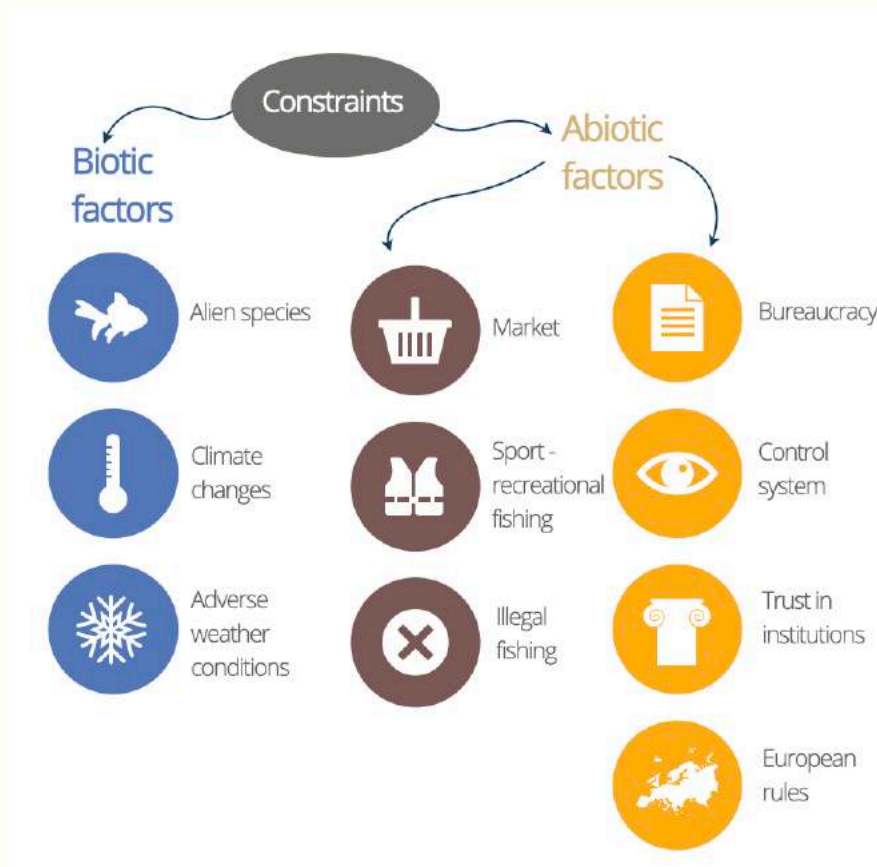


Image 28: Diagram of the constraints affecting the fishing community of Pantelleria.

2.8 - Perspectives: a strong consensus for two crucial objectives

The clarity and awareness of Pantelleria's fishers are not only in the words expressed by the members of the Fishers' Association, but in their actions.

The Association's intent is broad and concrete and looks at the entire supply chain from the sea to the table. "We sowed and together we wanted to create a festival of our catch, in Scauri, fish from net to plate, fished with our boats to protect our traditions". It was a first initiative linked to the valorization of fish products but above all aimed at raising the awareness of local communities but also of visitors with respect to traditional fishing carried out in a sustainable way that looks to the enhancement and marketing of uncommon species of fish (Image 29).

Furthermore, the detailed plans for the protection of fish stocks (creation of a "no take zone") and the measures adopted (reduction of the length of their nets) are the hallmark of the ability to know how to identify solutions to respond to complex problems such as those that the fishers of Pantelleria face daily.

"Unfortunately, the weight of the risks and of the subsistence weighting upon the fishers' activity and above all the feeling of a complex long and self-managed journey remain strong". Times and lack of concrete support from Institution could weaken the will of the members of the Association. At the same time, the emergence of one's own will and the prospect of implementing a co-management plan both in terms of ecosystem and biological diversity, and in terms of fleet structuring and fishing culture, represents an important tool capable of guiding small-scale fishing in Pantelleria towards sustainable development, a tradition which is at the same time innovative in the perspective of sustainability.

The main needs and objectives of local fishers is to recover fish stocks through the management of fishing effort. To this end, two strictly interconnected macro-areas have been identified:

- Environmental: Rationalize the exploitation of resources, and decrease the effort in order to reduce the impact of legal, but above all illegal, fishing activities on the island. Reduction of fishing activity expressed in terms of fishing effort and creation of a nursery, to allow the reconstruction of the habitats necessary to restore the stocks.
- Economic: Improvement of the economic conditions of the workers in the sector in order to increase revenues also by reducing the costs of fishing activities, improving the supply chain, services and infrastructures (direct sale of fresh and processed products) by promoting diversification in particular of ittiturismo involving wives and families.



Image 29: Initiative of Pantelleria's fishers for the valorization of the catch.

CHAPTER 03

Cabo de Gata, Spain

MEDTEK: TRADITIONAL ECOLOGICAL
KNOWLEDGE OF MEDITERRANEAN
SMALL-SCALE FISHING COMMUNITIES.

Preliminary Findings in Cabo de Gata (Spain), Malta
and Pantelleria island (Italy) sites



3.1 - Introduction

Traditional Ecological Knowledge (ETK), also known as traditional environmental knowledge, indigenous knowledge, local ecological knowledge or popular knowledge is defined as “a cumulative body of knowledge, practices and beliefs that evolve through adaptive processes and is transmitted through cultural forms from one generation to another about the relationships between living beings, including humans, and between living beings and their environment” (F. Berkes, et al, 2000).

Small-scale fishing is an ancestral craft, normally learned within the family and whose knowledge is passed on through experience, within the sector itself.

Although this knowledge of fishers and their communities has traditionally been in high demand from science, politics and society in general, it has never been rigorously recorded and therefore does not have the status of “science” but of “popular knowledge”.

One of the main values of ETK is applicability; by its own development (based on experience) ETK has adapted to the local situation and evolves in a comprehensive way, taking into account all aspects of the ecosystem and the sector itself. However, its high level of specialization in the local sphere has made it difficult to manage, despite the fact that it is recognized as being of great importance not only in the environmental sphere but especially in the cultural and social spheres.

Since the 1980s, a significant number of authors have recognised the ETK's contribution to science, biodiversity conservation and natural resource management. This recognition has led to many ETK-based projects for the management of natural resources: soil conservation, forest management, etc.

A clear example of the change in the perception of ETK has been provided by forest fire management: initially the prohibition of traditional uses in the mountains has degenerated into episodes of increasingly violent and shocking fires. As a consequence, and in view of the enormous social and economic cost of prevention plans, a return to traditional uses is being considered in order to minimise the impact and number of fires. The most valued characteristic of ETK

is its practical use, which gives it extraordinary value in any management field.

In fishing there is also documentation regarding the ETK and its applicability (Bergmann, H. et al., 2004; S. Mackinson, 2001). However, in our experience, in the marine environment there are scarce examples of ETK being taken into account in the management of marine areas or many examples of collaboration between science and local knowledge of fishermen. Here we should highlight the case of the “Os Miñarzos” Marine Reserve in Galicia (Atlantic). This was created at the request of local associations and the fishermen participated from the beginning in the design and planning of the reserve. A detailed methodology was used to capture their traditional ecological knowledge, with the support of social scientists and biologists.

For the Alboran Sea, as in the rest of the Mediterranean, specific official or scientific information on small-scale fisheries is very poor. As in many other sea areas, fisheries management is informed by single-species analysis, which is not suitable for artisanal fisheries. ETK can bring a wealth of knowledge to the management of fisheries, providing a great opportunity for the development of more effective management systems.

On the other hand, we must also reflect on the difficult situation of some traditional fishing communities; the loss of workers and the lack of generational renewal is putting this ethnographic heritage at risk.

Low Impact Fishers of Europe (LIFE) is committed to addressing this situation.

The information gathered in this report has been provided by the small-scale fishers of the Alboran Sea, specifically from the area of Cabo de Gata (province of Almería, in Spain) in the area of influence of the Cabo de Gata -Níjar Marine Reserve of Fishing Interest.

3.2 - Fishing activity in the area described: fishing grounds, species and legacy

3.2.1 Fisheries in the Alboran Sea

The Alboran Sea is an area where the waters of the Atlantic Ocean (colder and less salty) meet those of the Mediterranean (warmer and saltier). Its biological, hydrological and oceanographic characteristics make this area one of the most productive and biologically rich, as well as the most emblematic of the Mediterranean, due to its socio-cultural characteristics.

The Alboran Sea, on its northern coast, corresponds to the Andalusian Spanish coast and extends from the Strait of Gibraltar to Cabo de Gata, in the province of Almeria, along just over 250km of coast.



Image 30: Location of the Alboran Sea and predominant sea currents

As in the rest of the Mediterranean, fishing in this area has been carried out since the existence of man. Numerous signs found at the “Los Millares” archaeological site in Almería (pre-historic settlement from the bronze age 3200-2200 BC) show that fishing in the area is as old as human settlement, both for food and for ornamental purposes (especially mollusk shells).

Due to the wide biological diversity of the Alboran Sea, fishing has been preserved from ancient times to the present day as one of the main economic activities. Today there are 11 ports where fish is landed, and the fishing activities in each one of them is highly diversified, with variations from a locality to another one.



Image 31: Characterisation of the fishing fleet in the North Alboran Sea. Source: Report from the Andalusian Regional Government's Fisheries Department 2019 "The Andalusian fishing fleet".

As can be seen in Image 31, of the total of 620 professional fishing boats in the Alboran Sea, almost 70% are small-scale. These boats have an average length of less than 9 metres and an average tonnage of less than 4 GT. They are by far the most numerous (420 boats), the smallest and almost the oldest (only surpassed in a few years by bottom longliners). In terms of the contribution to the gross value of catches, small-scale fishing gears come in third place, after trawling and purse seining (Image 32).

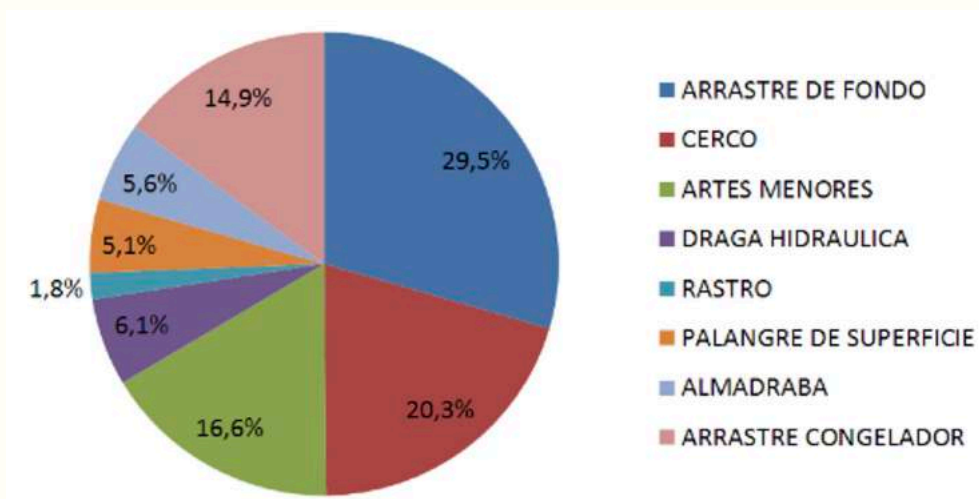


Image 32: Contribution to Gross Value by type of fishing activity in Andalusia. Source: Statistical operation "Value Added and Fishing in Andalusia". Statistical and Cartographic Plan for Andalusia 2013-2017

The current small-scale fishing fleet is dedicated to the exploitation of species very close to the coast, using a wide variety of gears, adapted to the particularities of each area. They are very small fishing units, boats of less than 12m, with small crews (three members on average) and generally belonging to the same family.

Small-scale fishing has undergone very little change and has developed in the same way over time, preserving the knowledge that is passed on from generation to generation. The main changes have been in the materials used, seeking the greatest resistance and lowest maintenance costs, both in the boats and in the gear. However, the fishing gear has been designed to adapt to the particularities of the target species and the habitat in which it is intended to be caught (currents, sea-bottoms, type of substrate, etc.).

This ancestral way of fishing has all the potential to be respectful of the ecosystem. In this regard, we find a space within the Alboran Sea, in the eastern end of it, where initially only small-scale fishing existed as a marine activity, which is what we know today as the Cabo de Gata Marine Reserve of Fishing Interest. This space, thanks to its biological values and exceptional state of conservation over time, has been granted different protection regimes. In 1987 it was declared a Natural Park, and since then other descriptors have been added such as Biosphere Reserve, Marine Reserve of Fishing Interest (since 1995) and ZEPIM area (Specially Protected Area of Mediterranean Importance) for the conservation of the preferential habitats (in this case the seagrass beds) classified under the European Union’s Habitats Directive.

3.2.2 Fisheries in the Cabo de Gata Marine Reserve of Fishing Interest

The study area covered by this report is the area under the influence of the Cabo de Gata Marine Reserve, located in the province of Almería (Spain), on the northern coast of the Alboran Sea.



Image 33: Map of the Cabo de Gata Níjar Marine Reserve Source: Ministry of Fishing (in yellow - limit of the marine reserve, 1 mile; red - integral protection areas of exterior waters; green - maximum protection area of the Cabo de Gata-Níjar Natural Park) blue - waters of the Cabo de Gata Níjar Natural Park)

The area of influence of the Marine Reserve includes the municipalities of Almería, Níjar and Carboneras, with fishers scattered along a total of 68 km of coast, located in 2 ports (Almería and Carboneras) and in 5 fishing villages scattered along the coast where the boats are kept on the beaches: Cabo de Gata, San José, Isleta del Moro, Agua Amarga. The Reserve extends over a total of 4653ha along to the coast line, bounded by Carboneras to the north and Cabo de Gata to the south, and between the land line and the 50 metres depth contour (corresponding to the distance of only one mile from the coast)

It is in this area that we can identify properly the ETK, as the fishing communities that continue to fish in these waters do not have port infrastructures or services and it is the fishermen themselves who adapt their boats to these very special conditions, even manufacture their gears, adapting it to the type of bottom where they will be used.



Image 34: Traditional latine rig.

The traditional boats were known as Vela Latina (image 34), made of wood and without an engine and have been evolving by incorporating internal combustion engines and changing wood for fibreglass, although always with the application of “carenotes” or planks on the sides of the keel of the boats, so that it stays straight when it is sailed on the beach, due to the lack of a port. Over time some technology has been added to the boats, improving safety on board and communication and the performance of the work, such as the incorporation of winches, GPS and sounders, but without changing the technique of the work system.

The role of women in fishing in general and within these communities has been very important, although always far from the boat. They have been supporters of the family and in charge of selling fish on the street. Since the practice of peddling was banned in the late 1970s, women have taken over the bureaucratic tasks of the boat in some cases. In both cases they increase the benefit of the fishing activity for the family and the fishermen themselves recognize that without the involvement of their women (wives, mothers and daughters) they would not have been able to carry out the fishing activity.

Until the Marine Reserve of Fishing Interest was declared, the fishers themselves had a certain margin of self-management of the fishing grounds, adapting their catches to the situation of the species, alternating gears to vary the target species and not overfishing any of them, and avoiding damage to the sea-bed. After the declaration of the Marine Reserve, the management of the area become more centralized by the central government (Ministry of Fisheries of Spain), establishing detailed regulations, in terms of distance from the coast, daily fishing hours, days of work, species and gear.

Within the Cabo de Gata Marine Reserve of Fishing Interest, there is now a census (which has been reviewed approximately every three years, although there is no established review period) where the boats authorised to fish in its waters are listed, currently consisting of 32 boats. These boats must fulfil a series of requirements such as having a base port within the marine reserve, regularity and being on the “artes menores” register (which is one of the ways in which the fishing regulations in Spain legally define small-scale fishing boats). Since the last update of the census, purse seine fishing is also allowed, and 1 such boat is included in the list of vessels authorized to fish within the Reserve. Fishers who have the right of access to this fishing ground are not involved in its management. All this experience and knowledge that the fishers have, would provide an enormous resource for the management of the marine area, if incorporated.

3.2.3 Fishing fleet, fishing practices and fishing grounds

In the Cabo de Gata Marine Reserve of Fishing Interest, only purse seining and small-scale fishing is allowed. A total of only 32 boats from the registered fleet of Carboneras and Almería may fish (from the ports with the same name and the beaches of Cabo de Gata, San José, Isleta del Moro, Agua Amarga). However, in the areas adjacent to the reserve, it is estimated that a total of 132 vessels, corresponding to the fleet of Carboneras and Almería, could come to fish. These vessels are mainly small-scale fishing boats (53 boats), but there are other more industrialised fishing methods being used such as bottom trawling (30 boats), purse seining (15 boats), bottom longlining (2 boats) or surface longlining (32 boats). Sporadically, small-scale fishing boats, trawlers and seiners from more distant ports, such as Roquetas or Málaga, can also approach.

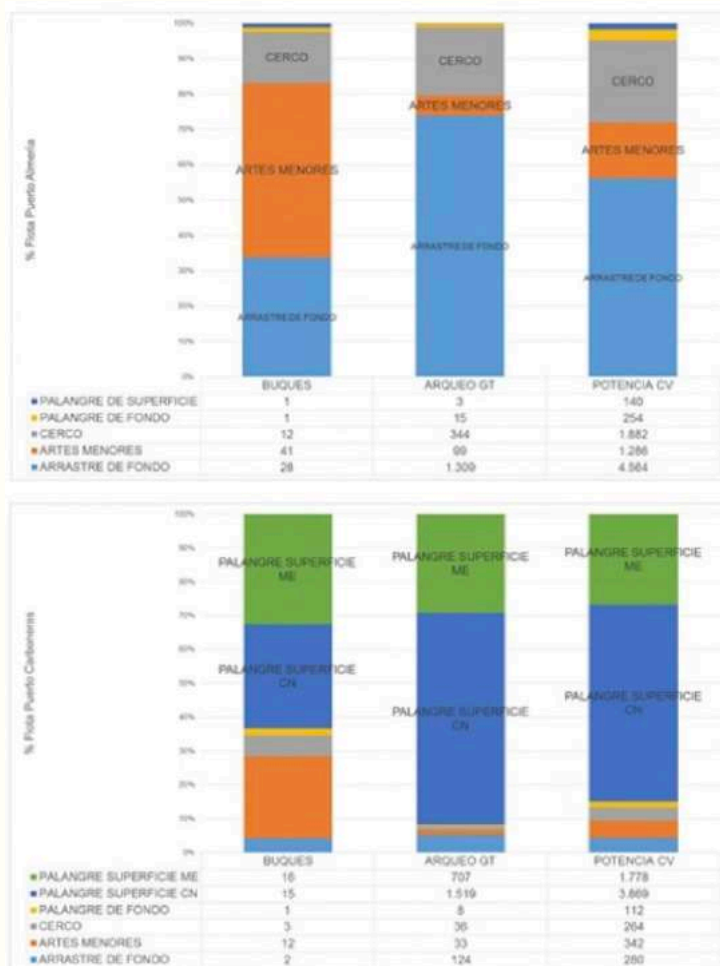


Image 35: Fleets of Carboneras and Almería by fishing methods (includes the fleet in the fishing ports, but also the fleet directly on the beaches). Source: GALP coastal development of Almería.

The lack of infrastructure in the coastal area of the Reserve means that small-scale vessels are less than 9m long, with tonnage ratings of less than 3GTs, and all of them are small scale fishing boats. The maximum number of crew members on the boats is of three, although the majority go with two local crew members.

The usual practice of small-scale fishing is done during the day, always returning to port; with a fixed time of departure and return to port, in a day that cannot exceed 16 hours and at a distance from the coast rarely exceeding three miles. They are obliged to have a weekly rest of at least 48 hours on the weekend.

The boats work all year round, and this is the main economic activity of the families involved, although in the summer they can combine it with other economic activities, mainly in the hospitality and commerce sectors. Depending on the time of the year and the conditions of the environment, the different small-scale fishing gears that fishers have access to are those listed in the following calendar for the use of small-scale fishing gears (Table 8).

Meses	ARTES DE RED							PALANGRE	ANZUELOS		TRAMPA			Rastro*
	ENMALLE				TRASMALLO				Lienza	Potera	Nasas	Moruna	Quisquilla	
	Pijotera	Solta	Volera	Melvera	Salmonete	Jibiera	Arte recio	Palangrillo	Lienza	Potera	Nasas	Moruna	Quisquilla	Rastro*
Enero	Orange	Yellow				Light Blue	Light Red	Blue		Brown	Yellow			
Febrero	Orange	Yellow				Light Blue	Light Red	Blue		Brown	Yellow			
Marzo	Orange	Yellow				Light Blue	Light Red	Blue	Grey	Brown	Yellow			Light Orange
Abril	Orange			Grey	Brown	Light Blue	Light Red	Blue	Grey	Brown				Light Orange
Mayo	Orange		Light Blue	Grey	Brown		Light Red	Blue	Grey			Orange		Light Orange
Junio	Orange		Light Blue		Brown		Light Red	Blue			Yellow	Orange		Light Orange
Julio	Orange				Brown		Light Red	Blue			Yellow	Orange		Light Orange
Agosto	Orange		Light Blue		Brown		Light Red	Blue	Grey		Yellow			
Septiembre	Orange		Light Blue	Grey	Brown		Light Red	Blue		Brown				
Octubre	Orange	Yellow		Grey			Light Red	Blue	Grey	Brown				
Noviembre	Orange	Yellow		Grey			Light Red	Blue		Brown	Yellow		Light Blue	
Diciembre	Orange	Yellow					Light Red	Blue		Brown	Yellow		Light Blue	Light Orange

Table 8: Calendar of use of artisanal fishing gear. Source: As. Pescartes.

The main target species with each type of gear are:

- **Net gears:**

1. *Pijotera*: Pajel o Breca (Common pandora, *Pagellus erythrinus*) and Pijota (Blue whiting, *Micromesistius poutassou*)
2. *Solta*: verrugato (*Umbrina cirrosa*), corvallete (Brown meagre, *Sciaena umbra*), herreras (sand steenbras, *Lithognathus mormyrus*), palometa (*Trachinotus ovatus*), espetón (*Sphyraena viridensis*), agujeta (garfish, *Belone belone*), salema (Salema porgy, *Sarpa salpa*), oblada (Saddled seabream, *Oblada melanura*), dorada (seabream, *Sparus aurata*), robalo o lubina (seabass, *Dicentrarchus labrax*), baila (Spotted seabass, *Dicentrarchus punctatus*), caballa (Atlantic mackerel, *Scomber scombrus*) and jurel (Atlantic horse mackerel, *Trachurus trachurus*)
3. *Volaera*: volaor (Mediterranean flyingfish, *Cheilopogon heterurus*)
4. *Melvera*: melva (*Auxi rochei rochet*), bonito (Atlantic bonito, *Sarda sarda*), albacora (False albacore, *Euthynnus alletteratus*) and llampuga (Mahi-mahi, *Coryphaena hippurus*).

- **Trammel nets:**

1. *For Red mullet*: salmonete (Red mullet, *Mullus surmuletus*), araña (greater weever, *Trachinus draco*), rascacio (black scorpionfish, *Scorpaena porcus*), tapaculos (*Citharus linguatula*), caballa (Mackerel, *Scomber scombrus*), jurel (Atlantic horse mackerel, *Trachurus trachurus*), lenguado (sole, *Solea solea*)
2. *Jibiera*: jibia (cuttlefish, *Sepia officinalis*), herreras (sand steenbras, *Lithognathus mormyrus*), lenguados (sole, *Solea solea*), arañas (greater weever, *Trachinus draco*), raya (*Raja sp.*), dorada (seabream, *Sparus aurata*), rodaballo (Turbot, *Psetta maxima*), jurel (Atlantic horse mackerel, *Trachurus trachurus*), pámpano (*Balistes capriscu*), tapaculo (*Citharus linguatula*), mojarras (Annular sea bream, *Diplodus annularis*), sargos (white seabream, *Diplodus sargus*)
3. *Arte Recio*: langosta (lobster, *Palinurus elephas*), bogavante (European lobster, *Homarus gammarus*), breca (Common pandora, *Pagellus erythrinus*), rubio (Tub gurnard, *Chelidonichthys lucerna*), raya (*Raja sp.*), gallineta (*Scorpaena elongata*), mero (Grouper, *Epinephelus marginatus*)

- **Hooks:**

1. *Palangrillo*: pargos (red porgy, *Pagrus pagrus*), gallinetas (*Scorpaena elongata*), morenas (Mediterranean moray, *Muraena helena*), dentón (Common dentex, *Dentex dentex*), zafio (European conger, *Conger conger*), raya (*Raja sp.*), borazo (*Diplodus cervinus*), mero (grouper, *Epinephelus marginatus*), abadejo (mottled grouper, *Mycteroperca rubra*), dorada (Seabream, *Sparus aurata*), róbalo or lubina (seabass, *Dicentratus labrax*), brótola (forkbeard, *Phycis phycis*), chucho (common stingray, *Dasyatis pastinaca*), rubio (Tub gurnard, *Chelidonichthys lucerna*), rodaballo (Turbot, *Psetta maxima*), cherna (white grouper, *Epinephelus aeneus*),
2. *Handline*: Bluefin Tuna (*Thunnus thynnus*)
3. *Potera*: squid (*Loligo vulgaris*)
4. *Volantín or chambel*: July-September: Galán (razorfish, *Xyrichtys novacula*) Rest of the year: (sea bream, *Pagellus acarne*) and breca (Common pandora, *Pagellus erythrinus*)

- **Traps**

5. *Nasa**: octopus, (*Octopus vulgaris*), morena (*Muraena helena*), zafio (*Conger conger*), besugo (*Pagellus acarne*), quisquilla (*Aristeus antennatus*)
6. *Moruna*: lecha (*Seriola dumerili*), bonito (Atlantic bonito, *Sarda sarda*), albacora (*Euthynnus allentteratus*)
7. *Quisquilla*: (shrimp, *Aristeus antennatus*)

- **Trolling gears**

8. *Dredges**: coquina (*Donax trunculus*), almeja (*Venus nux*)

The characteristics of each small-scale fishing métier used in the area of influence of Cabo de Gata Marine Reserve are summarized in the following table (table 9). Specially the table relates the different gears and its use with its main target species, as well as the type of bottom and depth ranges.

* The Andalusian Government has established a specific census for the “artes menores” that use these arts: pots and dredges

	Fishing gear	Seasonal ity	Use of art	Bait	Target species	Bottom type and depths
Nets	<i>Pijotera</i>	All year round	20-50 pieces of nylon netting with a 60 mm mesh size. It is set at sunset and lifted at sunrise, with the gear being arranged parallel to the coast	No bait	<i>Pagellus erythrinus</i> , <i>Micromesistius poutassou</i>	Sand and gravel beds up to 200 m
	<i>Solta</i>	October-March	gear of a single net of nylon netting of about 200m in length with increasing height from one end (the ground end at 1.5m) to the other (the bottom end up to 5m). It is put in at dawn or dusk (<i>prima</i> or <i>alba</i>) and is only in the water for about two hours	No bait	<i>Umbrina cirrosa</i> , <i>Sciaena umbra</i> , <i>Lithognathus mormyrus</i>), <i>Trachinotus ovatus</i> , <i>Sphyræna viridensis</i> , <i>Belone belone</i> , <i>Sarpa salpa</i> , <i>Oblada melanura</i> , <i>Sparus aurata</i> , <i>Dicentrarchus labrax</i> , <i>Dicentrarchus punctatus</i> , <i>Scomber scombrus</i> and <i>Trachurus trachurus</i>	Close to the coast at the mouth of the wadis
	<i>Volaera</i>	May-June + August-September	Nylon netting between 900 and 1000m in length with a mesh size of 40mm. It is laid on the surface for two hours	No bait	<i>Cheilopogon heterurus</i>	On the surface
	<i>Melvera</i>	Apr-May + Sept-Nov.	Gear similar to the <i>volaera</i> but with a lighter mesh (70-80 mm) and longer length (1000-3000m). It is set for approximately two hours and in favour of the current	No bait	<i>Auxi rochei rochet</i> , <i>Sarda sarda</i> , <i>Euthynnus alletteratus</i> , <i>Coryphaena hippurus</i>	On the surface
	Red mullet trammel net	April - sept	Three-layer nylon netting with 250-400 mm mesh size in the external layers and 45-55 mm in the central one, which is put in at sunset and lifted after two or three hours	No bait	<i>Mullus surmuletus</i> , <i>Trachinus draco</i> , <i>Scorpaena porcus</i> , <i>Citharus linguatula</i> , <i>Scomber scombrus</i> , <i>Trachurus trachurus</i> , <i>Solea solea</i>	Rock bottoms, between bathymetries up to 40 m
	Cuttlefish trammel net	January-April	Three net with 380-500 mm mesh spacing in the external layers and 80 mm in the central one. Fishers deploy 30-50 pieces of net. It is set in the bay and is removed at dawn, when it is in water for about 6 hours.	No bait	<i>Sepia officinalis</i> , <i>Lithognathus mormyrus</i> , <i>Solea solea</i> , <i>Trachinus draco</i> , <i>Raja sp.</i> , <i>Sparus aurata</i> , <i>Psetta maxima</i> , <i>Trachurus trachurus</i> , <i>Balistes capriscu</i> , <i>Citharus linguatula</i> , <i>Diplodus annularis</i> , <i>Diplodus sargus</i>	It is located on "clean" bottoms (sand) close to rocky bottoms at depths of up to 50 m
	Lobster trammel net*	All year round	Trammel with very strong wires and very clear meshes of light of 500-600 mm in the external layers and 100mm in	No bait	<i>Palinurus elephas</i> , <i>Homarus gammarus</i> , <i>Pagellus erythrinus</i> , <i>Chelidonichthys lucerne</i> , <i>Raja sp.</i> ,	Rocky bottoms from 50 to 350 m deep

			the internal one. It is set at sunset on rocky bottoms		<i>Scorpaena elongata</i> , <i>Epinephelus marginatus</i>	
Hooks	<i>Palangrillo</i>	All year round	Cord or mother thread from which depart perpendicularly and at regular intervals threads of lesser diameter (bracelets) with hooks tied at their ends. They are set so that the hooks are close to the target species	Squid/ sardine	<i>Pagrus pagrus</i> , <i>Scorpaena elongata</i> , <i>Muraena helena</i> , <i>Dentex dentex</i> , <i>Conger conger</i> , <i>Raja</i> sp., <i>Diplodus cervinus</i> , <i>Epinephelus marginatus</i> , <i>Mycteroperca rubra</i> , <i>Sparus aurata</i> , <i>Dicentratus labrax</i> , <i>Phycis phycis</i> , <i>Dasyatis pastinaca</i> , <i>Chelidonichthys lucerna</i> , <i>Psetta maxima</i> , <i>Epinephelus aeneus</i>	
	Handline	Tue-May + Aug-Oct	Rigging consisting of a rope about 200 m long and 5 mm in diameter, to the end of which is attached another slightly thinner rope about 50 m long. At the other end, a nylon line 1.8 mm in diameter and 20 m long is attached with a tied hook at its end, with a plumb line	Bean/ sardine/ octopus	Bluefin Tuna	In the water column in dry areas or areas where tuna is passing through
	<i>Potera</i>	Sept-April	Special hook made up of a lead fusiform body which has a crown of hooks at one end and is attached to a line on a reel at the other end. It is inserted at nightfall	No bait	Squid	In the water column near the bottom
	<i>Volantin</i>	All year long	Fishing line with a lead at the end and then two lines with a hook at the end each. At the other end of the line there is a string or thread from which it is operated. It is held with the hand to feel the pull of the catch	No bait	July – September: <i>Xyrichtys novacula</i> Rest of the year: <i>Pagellus acarne</i> and <i>Pagellus erythrinus</i>	Rocky or sandy bottoms at a depth of 10-15 m
Traps	<i>Nasa*</i>	Jan-Mar + Jun-Aug + Nov-Dec	Square cages whose structure is made up of iron rods that give shape to the rigid plastic mesh. Each boat is authorized to carry a maximum of 200 pots that are joined together	Sardine	<i>Octopus vulgaris</i> , <i>Muraena helena</i> , <i>Conger conger</i> , <i>Pagellus acarne</i> , <i>Aristeus antennatus</i>	Rocky bottoms of more than 40m

Table 9: Main small-scale fishing “metiers” in the area of influence around the Cabo de Gata Marine Reserve: corresponding fishing gears, target species, practices and grounds. Source: Collected from Fishers 2019

The choice of one gear or another depends on the conditions of the target species. The species that is at its best when mature (larger size) and outside the breeding season (no eggs) is always chosen, while gears that can be used throughout the year are used as a “wild card” when the more seasonal gears do not work. As the fishermen themselves say, “if I am in the red mullet season (April-October) but there are no red mullets, I use the arte recio, pijotera or palangrillo, depending on the conditions of the species or the environment”.

Migratory species (tuna, melva, Atlantic bonito, flyingfish, etc.) are given priority over local species to further diversify catches.

Of all the available fishing gear, the only ones that need bait are hand-lines, pots and longlines and they usually use low commercial value species as bait such as the lacha (*Sardinella aurita*) that they buy previously in the fish market.

However, although this alternation of gears has traditionally been used in this environment, since the declaration of the Marine Reserve all fishing gears within the Marine Reserve have been banned except for the jibiera (a kind of trammel net), which within the reserve focused the effort of the entire fleet on this species (cuttlefish). According to the sector, this practice led to a reduction in the stocks, an increase in fishing effort and a fall in prices. Many years later, the use of longlines was also authorized, but not the other gear traditionally used on these coasts. It is outside the Marine Reserve where they can continue using all the gears they have.

In addition, small-scale fishers have now lost access to traditionally caught species such as bluefin tuna, which used to be an important source of income for them, because quotas are unfairly distributed among different fleet segments. Another fishery that has been lost in some areas has been the clam and coquina fishery, which the sector claims it was caused by a regulation that was not adapted to the local reality and by the alteration of habitats in shellfish areas.

As far as the fishing grounds of the Cabo de Gata Marine Reserve are concerned, it should be noted that fishers have used the waters of the entire coast, choosing the appropriate sea bottom for the species of interest (shallow sand for molluscs, rock for longlines and arte recio, open water, deep rocks for pots, etc.). Along the 68 km of coastline, we find bottoms with different characteristics (phanerogamy seabeds, sand, mud, rocks, maërl, etc.) and with a very varied bathymetry (plain areas or underwater canyons).

According to the sector, the zoning of the Cabo de Gata Marine Reserve has limited and fragmented the traditional fishing grounds, forcing boats to concentrate on specific points, conditioned by the availability of space and the prevailing weather. On the other hand, the most

desirable areas for fishing were the tips or overhangs which are currently declared integral marine reserves which have been left out of the fishing activity and which, according to the fishing sector “do not fulfil their function of generating fish stocks because they are not breeding areas, but rather a refuge for fish”.

Within the Marine Reserve of Fishing Interest only trammel nets and longlines are allowed, while inland waters trammel nets and pots are allowed. However, as it is limited to the edges of the marine reserve, for practical purposes fishermen are not setting their pots even though they are permitted to, and they have to go outside the Reserve and look for other areas at greater depths.

3.3- Challenges at Sea and on Land

3.3.1 Conflicts with other marine uses

The Alboran Sea coast has developed enormously since the middle of the last century. The coastal strip has been massively urbanized, with few exceptions, which has led to increased pressure on the coastal area of the Alboran Sea, both in terms of demand for resources and diversification of activities.

Small-scale fisheries have had to learn to integrate with other users, in areas where traditionally they were the only ones operating.

The most striking activity is undoubtedly tourism and uses of the sea linked to leisure, from recreational fishing, leisure sailing, water sports, etc. The average population is 14 inhabitants/km² but it always increases during holiday periods, sometimes even tripling. According to the some of testimonies of fishers, the lack of knowledge of artisanal fishing has led to confrontations between fishermen and other users of the sea (diving centers, jet skis, and even bathers).

A problem pointed out as very important by the small-scale fishing sector participating in the report is that due to the constant increase of recreational fishing boats, which compete with small-scale fishing for space and resources and which, in addition, due to their high number of boats, serious damage is being done to the Posidonia beds. Fishers have also reported many cases where the passage of recreational boats has caused the breakage of fishing gear. In the case of the Marine Reserve, although there is no census of recreational boats, there is a very significant increase in them during the summer season. In addition to the 250 moorings in the port of San José, the only port within the reserve, there are hundreds of boats that anchor in the waters of the park, as well as the numerous sports anchorages that are installed in the summer season to provide service to visitors. Recreational fishing is a recurrent activity among the nautical sector, but the effort and real impact that this activity may be having on the area is unknown, as no quantitative studies or monitoring efforts have been carried out to date that the fishers know about. In fact, the sector is of the opinion that the regulation affecting this sector is insufficient and when it does exist it is barely controlled. In this sense, they highlight the importance of poaching which is carried out under the cover of tourist activities and that, although there seem not to exist quantitative studies on this subject, fishers' comment that recreational catches end up entering the local market, competing with professional fishermen.

Another aspect that fishers have to face with tourists is that they have to help them on many occasions, as they are unskilled people who can sometimes venture into marine areas that they do not know well enough. In this case, fishers come to the aid of boats that have broken down, surfers who cannot return, swimmers who are dragged along by the current, etc. Demonstrating once again how their expertise and knowledge of the environment are put at the service of society.

Also, areas reserved for aquaculture as well as outfall installations often come into conflict with small-scale fishing activity, firstly during the installation of the infrastructure (due to the impact of the work itself) and then during its operation. In the specific case of the Marine Reserve, the installation of the outflow of the Rambla Morales desalination plant generated a lot of turbidity and the failure to fix the pipes to the

bottom caused the pipes to come up in areas where fishing boats were in transit. Once the pipes and the diffusers were in place, nets caught in them and broke up because the choice of location did not take into account the fishing activity. Over time, fishers have learned to avoid fishing on the diffusers, also because they claim that "fishing in that location has decreased since then", attributing the causes directly to the pollution emitted by the pipe.

Another important case in point was the installation of a gas pipeline that crosses the Alboran Sea from Algeria to Spain and which, according to the sector, had a great impact on the sea bottom.

Another peculiarity of the marine reserve is that, as it does not have port facilities, the traditional way of keeping the boats in this space is anchored in the sea or beached on the shore, which is highly impacted in the summer tourism season due to the beaconing of the bathing areas and nautical channels, which are installed in certain places invading the anchoring areas and blocking the beaching areas.

3.3.2 Conflicts within the fisheries sector

The main competition from small-scale fishermen within the professional sector is undoubtedly the bottom trawl for the power, size and fishing system it uses. Trawling very often fails to meet the obligation to fish at depths of more than 50m outside the reserve, in addition to the direct and irreparable impact on the seabed where the sector says the fish stock is regenerating. On the other hand, the characteristics of the trawling make it impossible for the vessel to manoeuvre when trawling and this means that, if a gear is in its trajectory, it also drags it, causing losses to the fisher and social conflict.

"We've also had episodes of poaching," say the fishers, as when they lift their gear, they find that the catch has been stolen from the net. The fisher's comment that these actions are normally carried out by divers who take advantage of the time the gear is left unguarded to steal the catches, and they do not deny that this poaching could be from within the sector. Another form of poaching within the sector is that which occurs when professional fishing gear is used from recreational boats, despite being prohibited – a kind of cheating that avoids all the requirements professional fishing.

Finally, in recent years there has been an increasingly fierce competition among small-scale vessels for the amount of gear used (especially trammel nets). Fishers somehow are trying to compensate for the reduction in catches (which is becoming increasingly important) by increasing the number of pieces of gear and therefore their length, making it difficult for them to live together at sea. Although this is common in several gears, one particularly damaging case is that of octopus fishing with traps. The regulations established a limit of 200 pots per boat, but the reality is that the boats are able to set more than six hundred pots, impacting on the resource as well as taking up much more space and displacing their companions who in turn need much more space to set their gear as well. It is a perverse practice that means that only some can finally use the pots (those larger boats - and those with more space to store them on board - that come from areas closer to the marine reserve).

This also has an effect on the management of the resource as they falsely declare the catches as coming from two hundred pots, which gives a false image of the effort and the state of the octopus population, which is obviously much lower. The fishermen of the Marine Reserve are calling for more realistic control of fishing gear because, in their words, "the sea is full of pots that do not allow the octopus to grow". Access to this fishery is based on a specific census carried out by the Andalusian Regional Government, which includes small-scale fishing boats that can demonstrate octopus' sales at the markets. At the time "selling a boat with this license has been very lucrative", says the sector. Other specific censuses carried out by the Andalusian Government have been the dredges, for the capture of the clam and coquina.

3.4- Fishers' perceptions of ecosystem changes and threats

3.4.1 The fish stock is decreasing

The fishermen consulted generally report a decline in the volume of catches for almost all species and a change in the location of the catches: "we need to go further, deeper, with more nets to fish as we did twenty years ago". The causes lie in the industrialization of fishing and its impact, which has led to increased competition (and has even led the small-scale sector itself to increase its own effort), habitat alteration and inefficient management "from a distance, without listening to our proposals".

It is particularly striking that, 25 years after the declaration of the Marine Reserve of Fishing Interest, there is no increase in the available stock and therefore no increase in the sustainability of existing vessels. Both catches and vessels have decreased in spite of the integral reserves, surveillance and centralised management of the marine reserve. This is endorsed by scientific papers that state that limited coordination between national and regional government, and weak management at both levels, has made achievement of strategic conservation objectives significantly more challenging. They conclude that greater coordination between national and regional government is required, along with interven-

tions to introduce more participative and knowledge incentives to generate a greater sense of stewardship among all stakeholders (Hogg et al., 2017)

Fishers are in favor of maintaining the protection status of the Marine Reserve, but believe that changes are needed in its management, starting with zoning, since, according to the industry, the areas of maximum protection are not nursery areas, one of the factors to which they attribute the lack of effectiveness of the reserve. Another factor they attribute it to is the lack of fisheries diversification. When the only gear allowed has become the jibiera, all boats have been forced to fish on the same species all year round. This, they believe, led to a drastic reduction in the stock of this species and an increase in the length and depth of the gear (more than twice the initial length) in order to compensate for the decline in fishing. Many years later, longlining was also authorized within the marine reserve, but there is still insufficient diversification opportunities to have a balanced fishing effort within the Marine Reserve, according to the fishing sector. A new zoning plan and technical measures to allow for greater diversification, agreed by fishermen together with scientists and the competent administrations, would be a great opportunity to seek success in the long-awaited reserve effect.

One of the concerns that was brought to our attention is the issue of minimum sizes, which are sometimes established with criteria that are not very close to reality and end up having consequences for other elements of the food chain. For example: the increase in the minimum size of horse mackerel caused, according to the sector, a decrease in the quantity of squid. According to the fishermen, the horse mackerel (in an already adult size) needs a lot of time to grow 0.5cm more than it was established, and during that time it would devour many more squid which, according to their knowledge, is their favorite food. On the other hand, some fishermen recognize that a minimum size for cuttlefish should be established.

The location of certain reefs in a specific point of the coast altered the sediment contributions of the area and that made, according to the sector, the mullets leave an area where they had always been due to the dynamics of the bottom sediments and the food that reached them.

3.4.2 Changes in the ecosystem

As we have indicated before, fishers are certain that climate change and pollution have also influenced the decline of species and change in marine ecosystems. They note that currents have changed their dynamics in intensity, temperature and extent; water takes a long time to cool down after summer, winter is almost non-existent and the wind regime is also altered.

The fishermen say: "In this area of the Mediterranean, where the rains are torrential, the mouths of the wadis, after the rains, were a preferred fishing area, because the nutrient supply from the run-off water attracted a lot of fish. In addition, the turbidity of this water made it easier to catch fish. But at the same time, they observe: "For some time now, when the rains are less and less numerous, we have seen fish fleeing from the mouths of the rivers, probably due to the large number of pollutants of a terrestrial origin that the water carries with it".



Image 36: Image of the Blue Crab, an invasive species that appears in the nets

"The areas of influence of the effluent pipes from the desalination plants have also caused the displacement of species, as well as the out flow of the cooling water from some industries that may be deteriorating the marine phanerogams on which it flows," they say.

The increase in maritime traffic (very numerous in this area of entry and exit of the Mediterranean) has caused the introduction of many species that in some cases have become invasive, displacing others typical of these areas. The blue crab (image 36) appears very frequently in the nets of local fishers, although not as much so far as in other areas of the Mediterranean.

The most recent case is that of the algae *Rugulopteryx okamurae* which has invaded the coasts of Cadiz and has begun to enter the Mediterranean, with such invasive development that in some areas it is not possible to continue fishing. In the case of the Marine Reserve, at the time of this study, it is not yet so extremely affected and the quantities of algae that have appeared are small, but the sector is concerned because in other areas of the Andalusian coast fishers have suffered greatly from this phenomenon, being unable to fish for a long time.

They also often indicate that “mucus clouds” appear in the water (called “mafa” by fishermen) that clog the net, preventing it from catching fish, and causing work to stop on days when the “mafa” is present. It seems to them that these could be anomalous developments in the plankton that appear as a result of the increase in water temperature.

Furthermore, the fishermen point out, “all the constructions on the coast have modified the marine balance in some way, altering the coastal dynamics of currents and sedimentation. Although such construction may be carried out at a specific point along the coast, they may affect other remote areas”.

3.4.3 Interaction with cetacean species

We don't want to leave out a very important problem on an economic level such as interactions with dolphins. The sector states that there has been an increase in the number of specimens being sighted in recent years, as well as a change in hunting strategies for these individuals, which has led to an increase in the case of interaction with their activities, causing economic losses to fishers. One of the reasons given by fishers is that the increase in tuna populations has led these two groups to compete for the same resource, which has led to cetaceans acquiring new opportunistic feeding strategies and seeing fishing gear as an easy and available food.



Image 37: Fishing gear broken by interaction with bottlenose dolphins.

3.5 - Safeguard the future of small-scale fisheries: Industry recommendations

The fishers of the Cabo de Gata Marine Reserve have joined together in a small-scale fishing association, Pescartes, through which they are trying to preserve their traditional way of life and its viability.

The main objective of the association is to serve as an interlocutor with the competent administrations in matters of management of the Marine Reserve of Fishing Interest since, according to the administration itself, this was the main obstacle to reaching agreements. However, this objective has not been achieved because the administration continues to insist on having as interlocutor the national federations which, according to the local fishing sector, are too far away from the fishing communities.

Despite this difficulty, the Pescartes association carries out many initiatives to improve the working conditions of its fishermen and the environment: awareness campaigns, training agreements, cooperation with the administration, cooperation with universities, etc. In recent years, its main work has been focused on achieving environmental sustainability, as well as social and economic development in the sector, promoting changes in the management of the marine reserve, enhancing the value of small-scale fishing products, while at the same time studying new formulas for the marketing of its fishing products, among other issues.

3.5.1 Holistic management: main lines of action

In Spain there is a very abundant body of legislation for the regulation of the different fisheries, including the Artes menores or smaller scale passive gear fisheries. This body of legislation is based on very limited studies of local realities, which is why they are constantly being modified and are not as effective as the sector needs for sustainable and adaptive management.

It should also be noted that the administration has little impact on the management of small-scale fisheries, as the mainly economic models of fisheries management have focused more on other sectors. Fisheries management models need to include factors related to environmental, economic, social and heritage sustainability. This more general approach would be more rigorous and more appropriate for the management of small-scale fisheries.



Image 38: Small-scale fisher deploying their nets.

It is true that the EU is taking steps in this direction, as well as at the Mediterranean basin level with the approval in 2018 of the Regional Action Plan for Small-scale Fisheries, but the inertia of the system and the conflicting interests of other fishing sectors are not facilitating the transition. A firm commitment is needed from national and regional administrations to properly manage fisheries and this sector, as well as a firm commitment from the EU to ensure that Member States move from fine words to real changes in favor of small-scale fisheries.

For the management of small-scale fisheries, management plans should be managed from an ecosystemic rather than a single species perspective, because small-scale fishermen diversify their catches according to the availability of the species, trying to maintain a delicate balance and thus avoid overexploitation of any one species.

On the other hand, the social role of small-scale fishing, which is fundamental in protected areas, must also be taken into account, as its presence keeps stocks alive throughout the year, counteracting the seasonality of tourism.



Image 39: Small-scale fishing boat from Cabo de Gata.

It would also be of great importance to make the marketing systems more flexible so that fishermen can manage their catches, always subject to the necessary control by the administration, since we must not forget that they are accessing a natural resource. This would require specific training for the artisanal fishing sector (accounting training, marketing channels, sales management, associations, valorisation of their catches, etc).

Another much-needed measure is the search for generational renewal, new generations need to take an interest in fishing as a job opportunity. To do so, they should be able to access it and get to know it, because a lot of experience is needed to run a fishing boat. This experience is transmitted by word of mouth and it is important that the conditions for the first access to a fishing boat are made more flexible. In the same case, although for other reasons, the women's role into fishing activities should be visible and recognized.

3.5.2 Local co-management with fishermen

Co-management is a great opportunity to improve the management of small-scale fisheries, especially in marine protected areas. This tool would make it possible to establish rules based on the traditional ecological knowledge of fishers, on the advice of scientists, the obligations of the administration and the interests of society. Organizing decision-making using this model would enrich the processes and ensure that the fishermen concerned would comply with these decisions without bias because they would be co-responsible for them.

The experience that the fishermen of the Cabo de Gata-Níjar Marine Reserve have passed on to us is that in the 25 years of existence of this MPA, neither of the two of the main objectives of these areas have been achieved: to increase the fish stock through the reserve effect and to maintain the traditional way of life.

It would have a very positive effect for the fisheries sector for it to make an effort to participate in these co-management forums, to strengthen its representation and to commit itself to the management of the space. The administration should also stop fearing this form of governance which would certainly be an improvement on the current one, given the experience in other spaces where co-management is done with the fishermen (in Galicia, Catalonia or even other areas of Andalusia).



Image 40: Small-scale fishers catch of the day.

3.5.3 At the sector level

The small-scale fishing sector must make an effort to take its place among the representative organisations of the fishing sector. Being the crew of their own boats does not leave them much time for meetings or for other organisations, but they must understand that their participation in decision-making is very necessary.

The small organisations that have been created have had many difficulties due to the hierarchical dynamics of the representative bodies, which give power and responsibility to the leaders of other fishing sectors whose interests are often in conflict with those of the artisanal fisheries. An obvious example of the consequences of this dynamic in Spain is the distribution of tuna, where small-scale fishing was deprived of access rights.

They should also take advantage of training opportunities. A positive strategy can be to carry out social activities that restore their prestige and help them to create links with other sectors in their environment (fairs, open days, etc.). Opening up to society can only bring them good experiences and learning.



Image 41: Small scale fisher from Cabo de Gata preparing the fishing traps.

CHAPTER 04

A Regional Portrait: MEDTEK in Science and Policy

MEDTEK: TRADITIONAL ECOLOGICAL
KNOWLEDGE OF MEDITERRANEAN
SMALL-SCALE FISHING COMMUNITIES.

Preliminary Findings in Cabo de Gata (Spain), Malta
and Pantelleria island (Italy) sites



MedTEK indicates that although having different ecological baselines, cultures, economies, and political frameworks, small-scale fisheries around the Mediterranean have similar characteristics. Fisheries sustain their livelihoods, enables them to survive and form part of their communities' legacies. The building blocks of these communities have been founded by the ancestors of these societies, the traditions and knowledge of whom are still lived and practised through new generations. The extent to which such transfer of knowledge and traditions are strengthened is however questioned given the ongoing challenges facing small-scale fisheries, necessitating their protection across the Mediterranean coastline. Without disqualifying the need for scientific quality data and investigation, the report states that a thrust towards improving knowledge about small-scale fisheries, as well as collecting fundamental knowledge from them forms an intrinsic part of safeguarding these elements.

In all three case studies, it came out clear that fishers hold knowledge about the ecological systems, are well-versed about the natural fluctuations of fishing seasons, engage in polyvalent activities to follow the natural cycles of fish stocks, and diversify their catches to preserve the ecosystems. All this knowledge is fundamental to inform fisheries conservation, especially now that the Mediterranean countries have vouched their commitment towards the sustainable development towards small-scale fisheries through the Medfish4ever roadmap (European Commission, 2017), and the regional plan of action for small-scale fisheries (RPOA 2018-2028). In supporting these regional commitments, our focus in MedTEK has been streamlined to providing insights about why these should be collected for science and policy, what different types of fishers' knowledge could be gathered, and detailing how these could be collected and applied.

4.1 - Why collect small-scale fishers' knowledge for science and policy?

The three case studies indicate how fishers, as 'citizens of the sea' who are constantly out at sea, exposed to the environmental variations and witnessing changes as they happen, can bring substantial knowledge to the fisheries interface at particular spatial scales. Fishers experience patterns in the sea, changes in the environment, currents and fish migration, thus holding a bag of local and temporal knowledge which is not always available through scientific data gathering. In Malta we saw how fishers have been noting the effects of change in the fisheries due to increased bluefin tuna in their waters, which is allegedly preying on small pelagics and cephalopods, potentially striking ecosystem imbalance in the Maltese waters. On the other hand, in Pantelleria, fishers have highlighted the need to protect an area and the surrounding environment which they consider as a key nursery area in Pantelleria, called the "Campobello shoal"; while in Spain small-scale fishers clearly explain how the impossibility to diversify their fisheries within the Marine Reserve has focused the effort of the entire fleet on the only allowed fishery, leading to a reduction of their stock.

Through the studies, fishers have provided ecological data that could be deployed by scientists to further investigate and detect changes in species distribution, such as in the case of new and invasive species that were uncommon and became recurrent in fisheries, the blue swimmer crab a case in point for the Mediterranean. Fishers' accumulated knowledge can also be used to calibrate and improvise the detail pertaining to localized scenarios, the knowledge of which cannot be deciphered from large-scale regional stock assessments. Ecosystem-based approach to understanding the fisheries can also be enhanced by TEK, as fishers have been able to interpret changes as they result from systemic fluctuations, such as the presence of eutrophication processes. These exemplify opportunistic ways in which fishers' knowledge and activities can be tapped to provide data which is not readily available through other scientific rigorous systems.

Efforts should thus be in place to collect this knowledge both in its raw format, or through knowledge co-production which engages the role of fishers in providing data through collaborative practices with the aim of mobilizing certain knowledge types that are still not known or recorded (Wilson et al., 2003). Various scholars have highlighted the potential of collecting traditional or indigenous knowledge in the study of marine climate variability and the impacts of climate change on fisheries, for example (Drew, 2005; Krupnik and Ray, 2007).

4.2 - What types of knowledge could inform science and policy?

In the Mediterranean, data about fisheries has been predominantly focused on the large-scale fisheries, with little focus on small-scale fisheries. It should also be noted that the administrations have little experience in managing artisanal fisheries, and in this regard, knowledge to inform fishery management models needs to be wide enough to encompass different datasets. These need to include factors related to environmental, economic, social and heritage sustainability, the information about which should be collected directly within the fishing communities. This context-oriented approach would be more rigorous and appropriate for small-scale fisheries management, however, requires more intensive attention at the finer scale.

Fishers knowledge in this sense is a worthwhile investment towards the production of knowledge as some events, such as ecological blooms or invasive species sightings, could be too localized, unpredictable or too specific to be detected through the usual scientific monitoring procedures (Morais et al., 2019, Hargrove et al., 2015). Also, fishers' ability to recognize local scale shifts in fisheries migration is all important detail that can be brought to the forefront to inform about particular overexploited species. This is especially relevant in the case of elder fishers who hold long-term knowledge and fish stories that are not yet written. The table below indicates the various types of knowledge as collected in the three case studies, and how they can contribute to the building of knowledge systems from an ecological, economic and social perspectives.

Type of Knowledge	MedTEK contribution
Ecological	
Fish species	The small-scale fishing métiers and fisheries targeted and their exploited status
Fishing grounds	The whereabouts of spawning, nursery and feeding grounds (to complete in future editions)
Fishing seasons	The seasonal adaptations and polyvalence activities
Impact of fishing gear	Fishers perceptions of intensive fishing activities and gear use
Cetacean depredation	Sightings of cetacean depredation on fisheries
Bycatch	Knowledge of bycatch of mammals and seabirds
Alien species	Sightings of alien species, and invasive blooms
Economic	
Market fluctuations	Impact of market supply-demand and consumer patterns
Role of middlemen	The fixing of prices at the detriment of fishing sector
Local markets	Lack of awareness about local species and competition with imported products
Marketing initiatives	The importance of facilities and synergies at the community level to improve sustainable production and consumption
Social	
Community Practices	Traditions about small-scale fisheries
Marine-use conflicts	Fishers spatial competition with other marine uses including aquaculture, tourism, shipping
Fisher-to-Fisher conflict	Conflicts between different gears and with recreational fishers
Local and traditional recipes	The community practices in terms of local gastronomy and the link with the culinary realm through tourism
Cultural heritage	The traditions and legacies lived and transferred from one generation to the other.

4.3 - How to collect and transfer fishers' knowledge?

Fishers themselves can participate in knowledge co-production by deploying their knowledge about small-scale fisheries patterns as they experience them on the local scale, and also through direct data collection using their vessels as ad-hoc floating laboratory systems. This is a novel approach of democratising science to conceptually bring fishers in the ring of research as informers of traditional knowledge, by equipping them with the necessary resources to become proactive data collectors. Such collaborative practices can be built into state-of-the-art models that could be implemented to improve the gathering of data through science-fisher synergies.

This could either be integrated in the data collection framework (DC-MAP) of the countries, such as incorporated it in the methodology, or aligned to onboard observations to the collection of TEK. In a similar vein of the MAVA project, the use of floating laboratories, for example, has fostered partnerships between scientists and fishers to collect information on dolphin depredation. These various data sources could help scientists establish a rigorous methodology that brings together knowledge types which could suit to inform the sustainability through more localized management systems of small-scale fisheries within the Mediterranean. Identifying data sources, also through fishers' gatekeepers is an important mode of accessing information that might not be readily available through official data collection systems.

Such gatekeepers could also help in identifying prospective interviewees for data collection purposes, especially in case of marginalized communities who are not visible and can be better traced through community links. This would be a way of eliciting and transferring 'invisible' knowledges of fishers to inform fisheries scientists and policy-makers. Transfer of knowledge could also be fostered through initiatives of younger generations learning from the older fisher generations. This could open-up opportunities for the younger generation within the community and can also attract newcomers from outside the community that have the willpower to engage in a fisheries start-up enterprise. This not only provides a vehicle to maintain the existence of TEK, but also provide the bedrock for the renewal of the sector.

However, LIFE states that the most practical way to use Traditional Ecological Knowledge is when a co-management scheme is settled to manage a particular fishery or fishing area. Actually, in many fisheries' co-management schemes ETK can act as a baseline data to measure changes and from which to partially base some management proposals. Moreover, exploring ways for fishers to produce their own knowledge base is essential intrinsic to any co-management process, as fishers can become empowered as with owners of data, better-oriented to discuss the problems and identify opportunities for the management of their activities (Jentoft & Mikalsen, 2014).

Conclusions



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The aim of MedTEK report is to highlight the urgent need to value, recognise, use and encourage the transfer and preservation of the knowledge held by local fishing communities. The production of localized data about fisheries requires that efforts are pooled towards enhancing and widening our knowledge approach to gather various knowledge types about the peculiarities that environmental change is bringing to different ocean frontiers. Although the knowledge of fishermen and their communities has traditionally been highly demanded from science, politics and society in general, it has never been rigorously recorded and therefore does not have the rank of “science” but rather of “popular knowledge”. In this report, MedTEK can be used to provide a baseline on such information, and to make a case of why such knowledge is equally important. However, LIFE considers this report as an ongoing process and more findings and concrete knowledge will be gathered in the following years and in further sites. MedTEK has shown that a widened approach that bridges the engagement of knowledges to go beyond the epistemic forms of knowledge production to include other sources including local and traditional types is fundamental. TEK needs to gain a more official position in decision-making and it is considered that through the establishment of co-management schemes this could be achieved. It needs to be both recognized and mobilized to inform science, and policy. It cannot remain simply an additional type of data that is collected as part of a process, but should be collected in such a way that endows it with the necessary credibility. The starting point is the involvement of fishers in enhancing and applying this knowledge, and the political commitment to foster a baseline for TEK to be officially collected. A vehicle towards this goal could be achieved within the ambit of UN Sustainable development Goal 17 which calls for Partnership for Goals, a baseline that also indicates the need to foster science-local knowledge partnerships to strengthen the world’s role in ensuring sustainable conservation of our resources.

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