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ADRINET

HANDBOOK

on joint management of pollution-related related risks

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HANDBOOK ON JOINT MANAGEMENT OF POLLUTION-RELATED RELATED RISKS

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Responsible

Prof. Giuseppina Tantillo, ADRINET Scientific Coordinator

Participants

PP1 Università degli Studi di Bari Aldo Moro:
Prof. Giuseppina Tantillo

PP4 Univerzitet Crne Gore:
Research Associate Aleksandra Huter

PP5 Universiteti Bujqesor i Tiranes:
Assoc.Prof Fatmira Shehu

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PREFACE

This Handbook aims to provide a *vademecum* for the correct application of best fishing practices to respect the marine environment considering also the impact of the anthropogenic contamination of the fishing area of the Castro Bay, located in the North- Western Ionian Sea (GSA19) on the border of the Southern Adriatic Sea (GSA18), of the Vlora bay (GSA18) and of the Boka Kotorska Bay (GSA 18).

ADRINET collected and analyzed the data relating to the current situation of the marine ecosystem, connected to the issues of greatest impact, such as fishing techniques and pollution, for the assessment and management of risks related to the maintenance of the "fragile" equilibrium of marine ecosystems.

The objective is to offer an expanded awareness of the studies on knowledge exchange in the Mediterranean area relative to the development of sustainable fishing practices.

The ADRINET Project has achieved the objectives set with the technical-scientific competence of the participating Partners and experts and with the necessary and essential involvement of fishing communities. The dissemination of the results obtained are of political-administrative, scientific and technical interest.

Acknowledgements

The ADRINET's Partnership wish to extend their gratitude to all those who contributed in one way or another to the development and production of this Handbook, with particular reference to fishermen who were involved in the training activities.

We would like to acknowledge: COISPA Tecnologia & Ricerca – a cooperative of researchers and technicians which carries out applied research to the study of living marine resources, marine environments, fisheries, aquaculture and production of eco-system services; ARPA Puglia for their support and feedback.

CONTENTS

1. INTRODUCTION

Since the early nineties, following the Rio de Janeiro Conference[1], the perception the excessive overexploitation of resources and the need to preserve fish stocks for the future generations have been increasingly spreading globally.

At the EU level, however, it was necessary to wait until the early 2000s for achieve a review of the Common Fisheries Policy (CFP). With the Council Regulation (EC) 2371/2002 significant changes have been made related to Stock Recovery Plans and Management Plans.

The objective of the CFP is to lay down rules to ensure that fishing and aquaculture are sustainable in ecological, economic and social terms, and that they represent a source of healthy food for EU citizens.

There are many elements in the new CFP that benefit small-scale fishermen using gear low impact. The reform of the CFP also included decent living conditions for small-scale fishermen among its objectives and promotion of coastal fishing activities, and calls on the Member States to give preferential access to local artisanal fishermen working in the area within 12 miles.

Even more important is Article 17, which requires Member States to use transparent criteria and objective, including those of an environmental, social and economic nature, in the assignment of rights to fishing, and to provide incentives to vessels using selective gear and techniques with low impact on the environment, for example by committing to reduce fuel consumption and damage to habitat.

The Marine Strategy Framework Directive, adopted on 17 June 2008, is a European Directive that aims to achieve good environmental status in the marine waters of the Member States by 2020 considering the marine environment a precious heritage to be protected, safeguarded and, where possible and necessary, restored.

The four regions identified by this Directive are: the Baltic Sea, the North-East Atlantic Ocean, the Mediterranean Sea and the Black Sea. The Mediterranean Sea, in turn, is divided into four sub-regions: Western Mediter-

ranean Sea, Adriatic Sea, Ionian Sea and Central Mediterranean Sea, and Aegean and Levantine Seas.

The Marine Strategy Framework Directive constitutes the pillar of the current maritime policy of the EU and is therefore designed to integrate all sectoral policies affecting the marine environment in terms of impacts that affect the quality of marine waters.

The Marine Strategy Framework Directive requires each Member State to implement a strategy to achieve good environmental status, for each region or sub-region.

2. MARINE FISHERY

2.1. Italy – Castro Bay

The North West of the Ionian Sea (GSA 19) in which the fishing area of the Project Partner Municipality of Castro (PP2) is located, is characterized by a varied bathymetry which is reflected in an exceptional presence of different fish species, some of which are of specific interest for fishing sector due to their high nutritional and commercial value.

The most used fishing gear in the considered fishing area are gillnets and trawl nets, as well as purse seines near the coast.

However, in the Southern Adriatic Sea and in the Ionian Sea it is trawling, mostly carried out by small to medium-sized fishing vessels, that provides the greatest amount of catch, accounting for 36% of the total volume of the global capture and contributes substantially to the national fish trade.

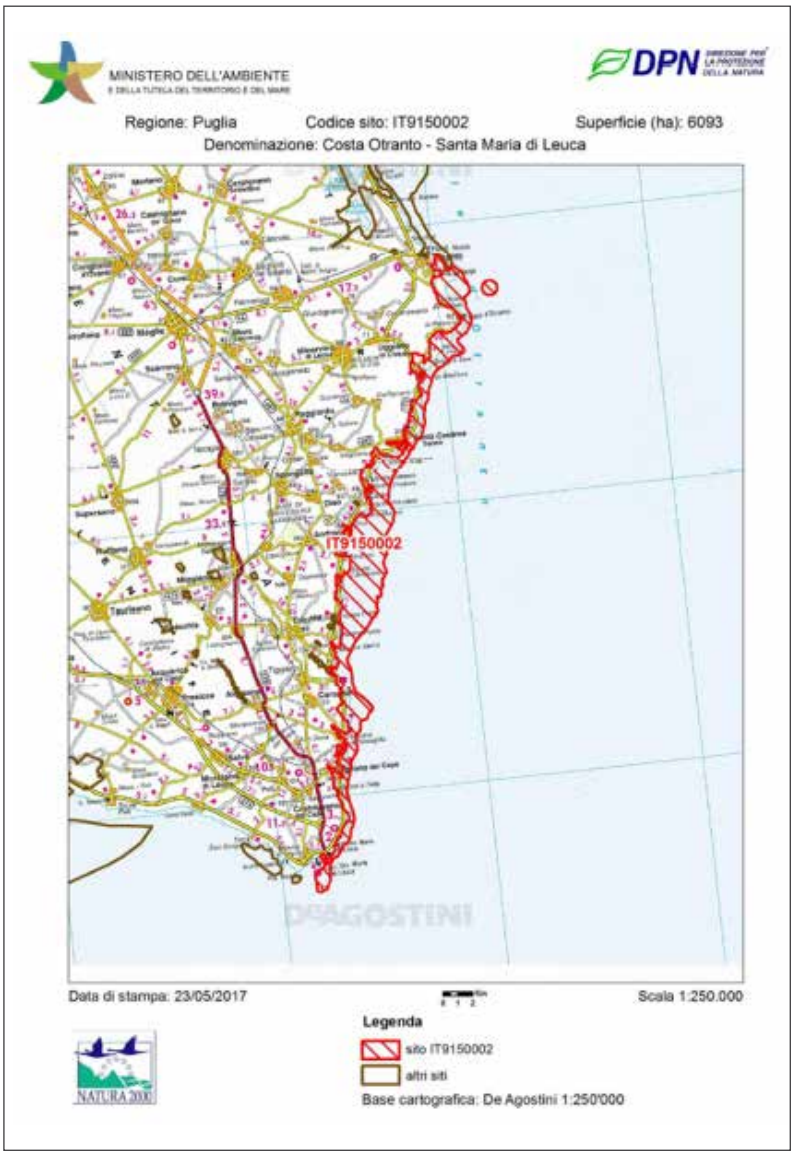


Figure 1.
Natura 2000 SCI IT9150002
Source: *COISPA Tecnologia & Ricerca*

In the last century, the pressure of anthropic activities present on the Ionian coasts have led to rapid and drastic changes in biodiversity, the causes of which are attributable to a multiplicity of known factors (overfishing, urban and industrial growth, pollution, alteration of hydrological regimes , etc.) and, more recently, also due to the phenomenon of invasions of alien species, a phenomenon that has assumed great importance, so much so that this part of the Mediterranean Sea, together with the Adriatic Sea is now considered the sea most influenced by the entry of non-native species

The anthropogenic concentration of the coasts of the Municipality of Castro at certain times of the year and the excessive exploitation of fish resources exert considerable pressure on the marine ecosystem with consequent loss of biodiversity, destruction of the habitat for various fish species of commercial interest, situations that compromise the enormous socio-economic potential of this fishing zone.

The economic profitability of the fishing communities and some fish farms present in the coastal area of interest strictly depend on the environmental status of this marine area and it is therefore essential to know and use tools for the prevention and conservation of the present fish stocks. The commitment to the protection of marine ecosystems and the global fight against water pollution are not exclusive aspects for research activities; in fact, preserving biodiversity allows the sustainable development of human activities related to the use of marine resources.

The key word is, therefore, “balance” between man and the environment, for the growth of territories and sustainable work; to achieve these objectives it is essential to allow the leading role of all the social and economic actors concerned (fishermen, entrepreneurs, Authorities), in addition to the work of researchers belonging to multidisciplinary scientific sectors.

Among the threats to the marine ecosystem of the Mediterranean Sea, and Ionian Sea in particular, in addition to fishing efforts and the presence of environmental contaminants, the problem of plastic material discarded or dispersed in the sea is of great relevance, a problem that still complains about the lack of certain and reliable scientific data, even if by now microplastics represent an important contaminant for determining the sanitary quality of the water and fish.

Scientific data relating to the presence of plastic material in this fishing area are sporadic and limited; the ADRINET project has launched a specific study in this context, both with preventive actions related to the technology of microchips (RFID and GPS systems) installed on fishing gear to banish the so-called 'ghost fishing' (abandoned, lost or discarded fishing gear), considered among the most dangerous of the marine ecosystem, and with corrective actions that must effectively address the economic and environmental problems of plastic waste brought ashore by fishing vessels.

All the coast from Otranto to Santa Maria di Leuca forms part of the Natura 2000 – Site of Community Interest (SCI) network under code number IT9150002 (see Figure 1).

It is a site of outstanding natural beauty made of calcareous rocky shores overlooking the sea. The peculiar south-eastern exposure confers the site particular warm-humid microclimatic conditions. The marine area has hard seabed substrate with high level of diversity and submerged – and partially submerged – sea caves are widely distributed (e.g. the Zinzulusa Cave).

The presence of endemic and trans-Adriatic species makes the site highly important, as well. The coastal substrate is made of bio-concretions by encrusting algae, Coralligenous and a significant red coral (*Corallium rubrum*) facies. For the Natura 2000 network, the Coralligenous is part of the Habitat type 1170 "Reefs"; such a category – which consists of a great variety of natural biogenic habitats with different levels of ecological relevance – is extremely challenging to be managed. The population includes – among shellfish – protected species (i.e. date shell – *Litophaga lithophaga*). The Coralligenous communities represent the second most important "hot spot" of Mediterranean biodiversity just after Posidonia oceanica beds. Studies have been done in the recent years highlighting the presence in the concerned area of Coralligenous bio-concretions at a depth of between 10 m. and 100-150 m.; the Coralligenous wall may cover a range between 20-25 cm. in the shallow waters down to 2 m. in the deeper water. Such populations play a key role as nursery and spawning area for a relevant number of demersal species, many of them having an extremely high commercial importance.

According to recent studies[2] in the mid-19th century, good amounts of red coral were fished from Spartivento Cape to Colonne Cape[3]; important banks were also exploited off Roccella Ionica and Soverato villages, as well as off Rizzuto and Colonne Capes[4]. Other banks were exploited at 4 NM off St. Pietro and St. Paolo Islands4 (Taranto) all the way to Santa Maria di Leuca (Ristola Point, 90 m depth).

Today, in the Ionian sea, small red coral banks are reported at 60-75 m. depth at Santa Caterina, 7 NM off West Gallipoli, at Santa Maria di Leuca, 3 NM off the coast, and at Campomarino, 5 NM off coast, towards East. Other banks are reported close to Porto Cesareo[5]. No information are available with reference to recent legal fishing activities in the concerned area although size and density of red coral ancient colonies provide the evidence of a progressive exploitation which asks for a urgent need of management and protection measures.

2.1.1 The legal framework

In accordance with Council Regulation (EC) No 1967/2006 Of 21 December 2006 in Italy it is forbidden to trawl at less than 3 nautical miles (nm) from the coast or inside the 50m isobath when this distance is reached at a smaller distance from the shore. Moreover, in the Ionian Sea a closure of 30 days in september have been enforced in 2020 for the Italian trawl fleet.

2.2. Albania – Vlora Bay

2.2.1. The lega framework

The legislative framework for the fisheries and aquaculture sector includes several laws and by-laws. Albania is in the process of becoming an EU Candidate Country and, in this regard, is also in the process of aligning its legislation with the EU's acquis communautaire. Several by-laws have been approved that transpose some of the principles of the Common Fishery Policy into Albanian legislation. The legislation also contains the main principles of FAO's Code of Conduct for Responsible Fisheries, and establishment of the Fishery Management Organisation for marine and inland waters has begun.

Law "On Fisheries" (No. 64/2012 dated 31.05.2012), regulates all fishery activities and their management and aims at ensuring the protection of the marine life and internal waters through promoting sustainable development in the maritime space and the internal waters. This law does not regulate matters related to food safety and fishery products, consumer protection and fish diseases which are regulated by separate laws.

Law no. 8905 on the Protection of the Marine Environment from Pollution and Damage (dated 06.06.2002, as amended by the Law "On Some Additions and Amendments to Law No. 8906, dated 06.06.2002" (9868/04.02.2008). the marine environment of the Republic of Albania from pollution and damage, through their prevention and avoidance, caused by human activities at sea and coastal zone. Other important instruments In addition to the aforementioned law, (Management Protected Area-s) Law "On Environmental Protection" (No. 10.431, dated 09.06.2011) and Law "On Environmental Impact Assessment" (No. 10.440, dated 07.07.2011), are also important for MPAs.

2.2.2. Marine fishing fleet

In 2019, there are 651 entities licensed to exercise fishing activity (Table 1). The fleet operates almost entirely in the Geographic Sub-Zone (GSZ) 18 (South Adriatic). There are 19 entities licensed more

Description	2014	2015	2016	2017	2018	2019
Distribution of Vessels by Vessel Type						
Trawlers	166	156	156	157	170	180
Seiners	4	3	3	5	4	9
Purse seiners	9	8	8	8	7	3
Dredgers	0	5	5	5	5	5
Gill netters	389	367	368	360	424	434
Multipurpose vessels	13	25	25	24	22	20
TOTAL	**581**	**564**	**565**	**559**	**632**	**651**

Table 1:
Marine Fleet by vessel types, 2014 – 2019
Source: *MARDWA*

2.2.3. Marine fishing fleet by ports

In 2019, the port with the largest number of licensed vessels is the port of Durres, with 37.33% of the total fleet. The **port of Vlora** has 30.41% of the total fleet number, followed by the port of Saranda with 15.82%. The fishing port with the lowest percentage of licensed fishing entities is that of Himara with 2.30%. The following tables show the Albanian navy from ports and fishing catches by water categories in Albania, respectively for the years 2014-2019

Description	2014	2015	2016	2017	2018	2019
Distribution of Vessels by Vessels by Port						
Durrës	219	209	209	204	233	243
Vlora	210	183	184	181	198	198
Saranda	91	86	86	84	99	103
Shëngjini	52	65	65	73	78	79
Himara	4	11	11	10	12	15
Lushnja -Fier	5	10	10	7	12	13
TOTAL	**581**	**564**	**565**	**559**	**632**	**651**

Table 2.
Marine fleet by ports, 2014 – 2019
Source: *MARDWA*

Year		2015	2016	2017	2018	2019
Aquatic categories						
I	Total fishing (1+2+3+4)	7.875	7.884	8.289	8.629	8.707
1	Marine	5.052	4.646	4.609	5.537	5.499
2	Coastal line	614	952	1.074	315	342
3	Coastal lagoons	550	598	599	350	94
4	Inland waters	1.659	1.688	2.007	2.427	2.772
II	Acquaculture	3.000	3.200	4.000	5.138	5.229
III	*Mitylus galloprovicialis*	295	1.450	430	1.108	1.075
TOTAL (I+II+III)		**11.170**	**12.534**	**12.719**	**14.875**	**15.011**

Table 3.
Fishing catches by water categories in Albania
Source:
Fishery INSTAT 2019

2.3. Montenegro – Boka Kotorska Bay

Marine fishery in Montenegro is governed by the Law on Marine Fishery and Mariculture (Official gazette 56/2009, 47/2015) and related Rulebooks. All professional fishermen have to be registered as businessmen in the Central Register of the Business Court of Montenegro.

Overall, the fisheries sector in Montenegro is small, without the industrial fisheries, and is carried out along the coast and in the Skadar Lake (freshwater fisheries).

In 2019, the Montenegrin fleet consisted of **224** active vessels, while the total number of vessels issued with licences in 2019 was 244, with only 13 vessels longer than 15 meters (source of data, MARD – Directorate for fisheries). Data gathered within the MAREA-SEDAF project indicate that Montenegrin fleet in all its segments is on the average older than 30 years, while in some segments, the average age even reaches 45 years. The majority of the Montenegrin current fleet, around 80%, consists of small fishing vessels, less than 12 m LoA, which use a variety of coastal, non-trawling gears (beach or boat seines, gill nets, trammel nets, longlines, traps, hooks and lines) (Figure 2), that belongs to the segment of small-scale fisheries[6].

Based on the data collected from logbooks and catch reports majority of Montenegrin catches comes from the segment of small-scale fisheries. The trend of Montenegrin catches in the last decade shows a slight increase, and in 2018 a total of 1147 tons of marine fish and other organisms were landed (932 tons in 2017, 875 tons in 2016). In any case, the total catch made by Montenegro is only a small percentage of the catches made in the Adriatic and the Mediterranean[6]

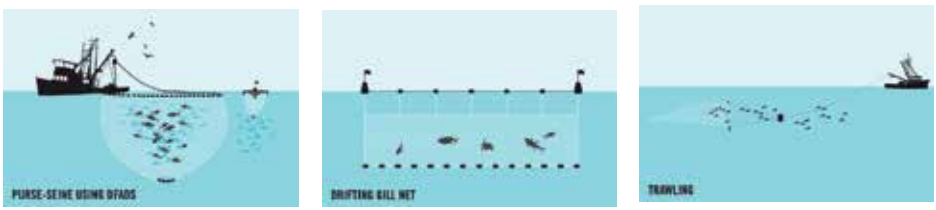


Figure 2.
Fishing gears

The main species in catches of the Montenegrin fishing fleet, in terms of quantities and economic value, are sardine, anchovy, hake, red mullet, deep water rose shrimp and tuna. Sardine and anchovy catches originate mostly from the beach seine and small purse seine catches inside and at the entrance to the Boka Kotorska Bay, since the industrial fishing on those species is still undeveloped in Montenegro. Purse seine vessels operating in the area of the open sea of Montenegro have several obstacles limiting their activity. There is a lack of trained fishermen for this fishing operations, high water transparency and strong currents in the South Adriatic makes it difficult to deploy the net and bring the school of fish to the surface, vessels are old and have a limited number of fishing days, lack of organized purchase of fish and absence of fish processing industry forces the fisherman to sell the fish at local markets in small quantities, uneven distribution of market demand for fresh fish products during the year, are just some of the reasons for the small activity of purse seine fishing fleet in Montenegro. On the other hand, hake and red mullet come from all the segments of the fishing fleet, but mostly from demersal trawl fishery. Regarding red mullet, 85% of catches originate from demersal trawl fishery, while for hake approximately 70% (source of data MARD – Directorate for fishery). Deep water rose shrimp is the species that is caught only with demersal trawl nets. Tuna fishing in Montenegro is conducted partly by purse seine fishery and partly through big game fishery[6].

The small vessels have limited autonomy. Many will fish part-time and effort may be opportunistic according to weather, demand and alternative work options. Depending on their size, target fishery and length of trip, small boats will be manned by one or two people. The average crew is 1.5. However, for the majority, this would not be full-time employment.

Small boats fish within 20 nm of the coast and most inside 5 nm on day trips. Fishing days are slightly higher than for the bigger fleet, but the fishing hours are likely to be less. Static gear such as gill nets is set and left with the fishermen returning to check for the catch. Activity is restricted by the weather and the market. For the entire fishing fleet monthly days-at-sea are lowest from October to March and higher in the remaining months with a peak in June and July; reflecting both weather and market demand.

Currently, Montenegrin fishermen are organized in 7 associations, some of them include representatives of large-scale and small-scale commercial fishing, while some of them are only for small-scale fishing. In recent years, they have become two national associations[6].

3. STATO ATTUALE DEL SETTORE DELLA PESCA I

3.1. Italy – Baia di Castro

The fishing concerned area is located on the border of the Southern Adriatic Sea (GSA18) and the North-Western Ionian Sea (GSA19) (see Figure 3[7]).

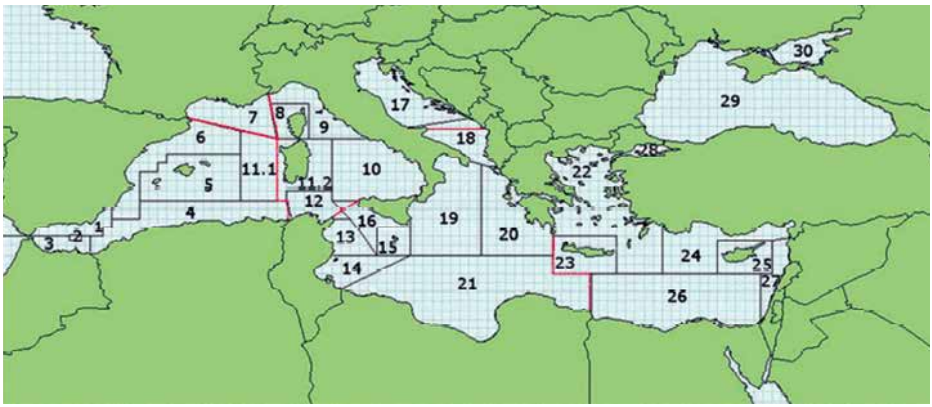


Figure 3.
General Fisheries Commission for the Mediterranean (GFCM) – Geographical subareas (GSAs)
Source: Food and Agriculture Organization of the United Nations website

The geographical concerned macro-area area covers a surface of about 16.500 km^2 – between Cape Otranto (Lecce) and Cape Passero (Siracusa)[8] – is 10-800 m. deep and has a coast line of about 1.000 km along the Apulia, Lucania, Calabria and Sicily regions, where eight maritime compartments are located. Sea fishing occurs from coastal waters to about 800 m. and different fishing techniques are used. The fleet composition by fishing technique and vessel size class (Length overall – LOA) is reported in the table below (see Table 4).

Fishing techniques	LOA	Number of vessels	Tonnage (GT)	Engine power (kW)	Average LOA	Average age of vessels
Demersal trawlers (DTS)	VL 12-18	199	3228	27604	14	24
	VL 18-24	26	1739	7101	22	28
Longliners (LLS)	VL 12-18	51	838	8662	14	25
	VL 18-24	27	1979	9692	22	24
Polyvalent passive gears (PG)	VL 00-06	352	352	1875	5	36
	VL 06-12	735	1823	25536	8	31
	VL 12-18	83	1320	11633	14	22
Purse seiners (PS)	VL 12-18	18	429	2687	16	29
	VL 24-40	3	537	1837	35	21
	VL 40-XX	1	264	705	42	14
TOTALE	**GSA19**	**1495**	**12509**	**97332**	**9**	**30**

Table 4
Fleet composition by fishing techniques and vessel size class (LOA) in GSA19
Source: Italian DCF National Programme (December 2016)

Different fishing techniques are used: small scale fishing, which utilizes mostly trammel nets, longlines and traps, is widespread in the whole area (see Figure 4). Trawlers represent about 15% in number, 40% in gross tonnage and 36% in engine power. Recreational fishing also occurs mostly in coastal waters.

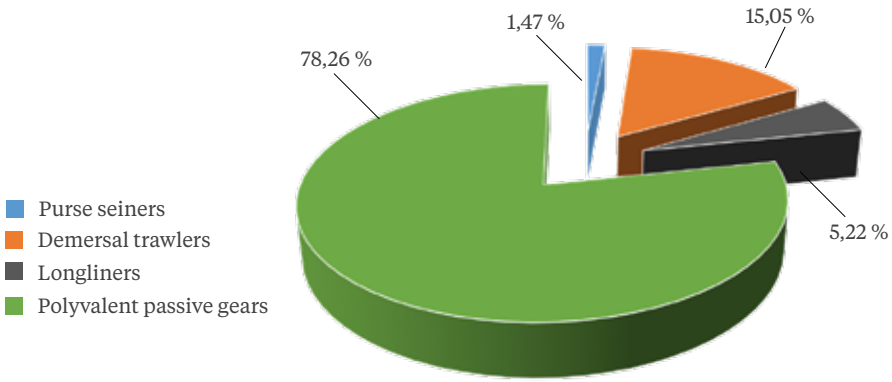


Figure 4
Vessels per fishing techniques (main gear) in GSA19
Source: Italian DCF National Programme

However, in all Ionian fisheries fishing boats registered as polyvalent fishing vessels often change type of fishing according to the season and sea-weather conditions as well as to the changing availability of resources and market demand.

Trawling is carried out during daily trips, from Monday to Friday, at different depths, generally from 200 to about 800 m; fishing is not allowed at night or weekends. The mean annual catch of trawling is due to the three main fisheries of the North-West Ionian Sea (Crotone, Taranto and Gallipoli) representing about 3% of the whole Italian production[9].

The most important resources in the GSA19 are represented by the red mullet (*Mullus barbatus*) on the continental shelf, hake (*Merluccius merluccius*), deep-water rose shrimp (*Parapenaeus longirostris*) and Norway lobster (*Nephrops norvegicus*) on a wide bathymetric range and by the deep-water shrimps (*Aristeus antennatus* and *Aristaeomorpha foliacea*) on the slope. Table 5 shows the data landing of these species.

Species	Total landing (in Kilos)
Engraulis encrasicolus	1.094.922
Merluccius merluccius	706.868
Aristaeomorpha foliacea	690.495
Parapenaeus longirostris	647.408
Sardina pilchardus	512.274
Octopus vulgaris	347.141
Boops boops	308.008
Mullus Barbatus	277.858
Lophius Budegassa	178.888
Illex coindetii	176.487
Aristeutis antennatus	103.020
Naphrops norvegicus	87.110
Eledone cirrhosa	49.352
Pagellus Erythrinus	45.547
Lophius piscatorius	33.437
Diplodus annularis	21.960
Helicolenus dactylopterus	13.731
Plesionika spp	13.154
Micrimesistius poutassou	9.337
Phycis blennoides	1.126

Table 5
Total landing in GSA19
Source: *ITAFISHSTAT (2016)*

Anchovy *(Engraulis encrasicolus)* is the most fished species, followed by hake (*Merluccius merluccius)* and giant red shrimp *(Aristaeomorpha foliacea)* (see Figure 5).

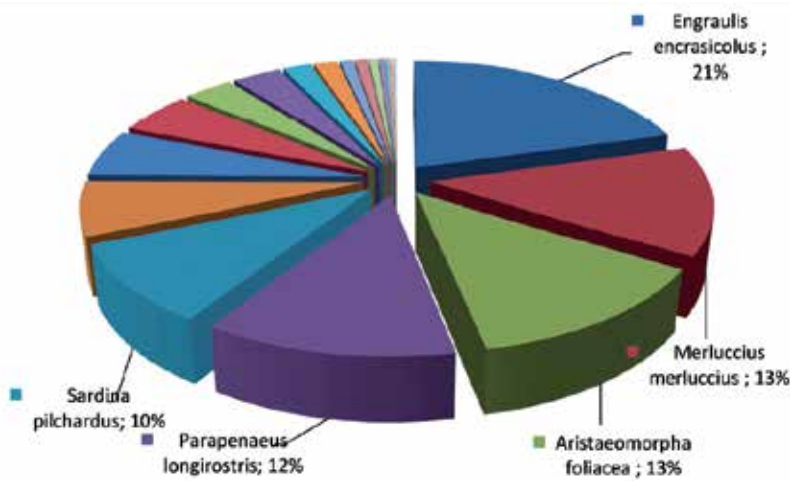


Figure 5 Most fished species in GSA19
Source: ITAFISHSTAT (2016)

Other important commercial species in the GSA19 are the octopus (*Octopus vulgaris*), the cuttlefish (*Sepia officinalis*) and common pandora (*Pagellus erythrinus*) on the shelf, the horned octopus (*Eledone cirrhosa*), the squids (*Illex coindetii* and *Todaropsis eblanae*), the blue whiting (*Micromesistius poutassau*), the anglers *(Lophius piscatorius and Lophius budegassa*) on a wide bathymetric range, the greater forkbeard (Phycis blennoides), the rockfish (*Helicolenus dactylopterus*) and the shrimps *Plesionika heterocarpus* and *Plesionika martia* on the slope.

For some of the above mentioned species, stocks are overfished[10]; this is the case of the hake (*Merluccius merluccius*) which is considered as one of the most important commercial species in the area. Furthermore, many other species are generally caught and totally discarded due to their lack of economic value.

3.1.1. The Fishery District of Castro

According to the European Fleet Register (update 2018) the whole number of the vessels operating in Castro is 25 (see Table 6)

N	Main gear	Second gear	LOA	Tonnage (GT)	Engine power (kW)	Entry service year
1	LLS	GNS	5,29	1	13,2	1973
2	GNS	LHP	6,06	1	19	1978
3	LLS	GNS	6,43	1	13,25	1981
4	PS	LLS	6,16	1	15	1981
5	LLS	GNS	5,81	1	19,1	1982
6	PS	LLS	6,2	1	15,4	1984
7	LLS	GNS	6,99	1	59	1985
8	LLS	GNS	7,9	2	33,08	1985
9	LLS	GNS	6,05	1	17,6	1986
10	LLS	GNS	6,7	2	24	1986
11	GNS	n.a.	4,6	1	14,4	1987
12	LLS	GNS	6,37	2	53	1988
13	GNS	n.a.	5,8	1	17,5	1994
14	GND	GNS	5,78	1	18	1994
15	PS	LLS	4,69	1	0	1972
16	GNS	n.a.	4,92	1	0	1987
17	LLS	GNS	6,22	1	18	1998
18	LLS	GNS	10,84	6	52	1998
19	LLS	GNS	5,5	1	0	2007
20	LLS	GNS	6,98	1	25	2008
21	LLS	GNS	5,96	1	18,4	2008
22	LLS	GNS	6,67	1	34,5	2009

N	Main gear	Second gear	LOA	Tonnage (GT)	Engine power (kW)	Entry service year
23	LLS	GNS	6,12	1	84,6	2011
24	LLS	GNS	6,12	1	18,38	2015
25	LLS	GNS	6,3	1	25	2017

Table 6
Number of vessels, GT and kW per metier in Castro
Source: *EU Fleet Register, update 2018*

The fleet is composed of small fishing boats (length overall of less than 12 m.) (see Figure 6) using mainly passive gears which are the most ancient type of fishing gears.

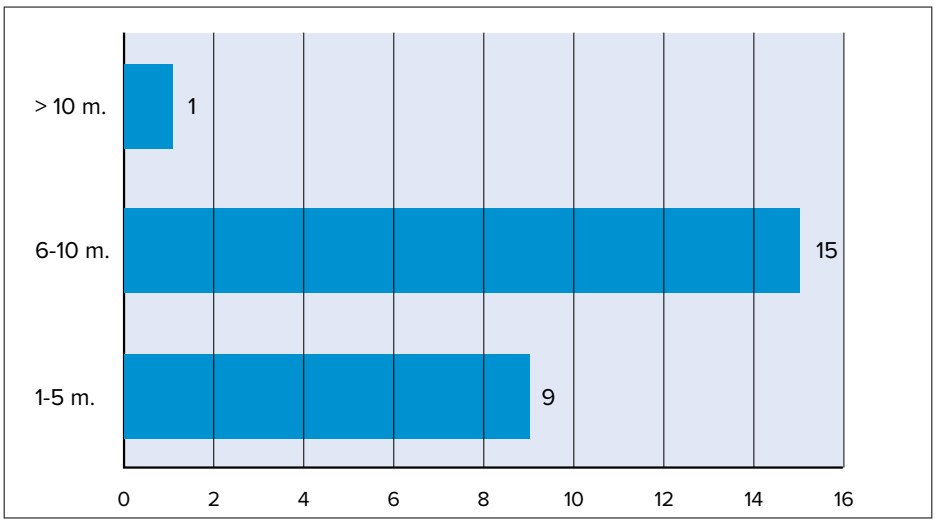


Figure 6
Number of vessels per LOA in Castro
Source: *EU Fleet Register, update 2018*

These gears are most suitable for small scale-fishing and are, therefore, often the gear types used in artisanal fisheries; this is the case in Castro where the small-scale fisheries using longlines (LLS) and gillnets (GNS) have the greatest number of vessels overall (see Figures 7 and 8). Very few vessels use the purse seine which belongs to the category of the "active gears"

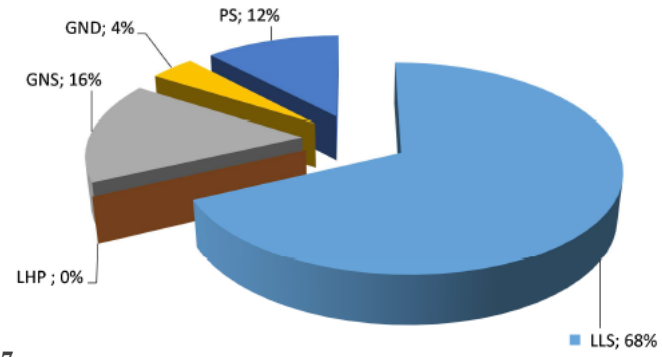


Figure 7
Vessels per fishing techniques (main gear) in Castro
Source: EU Fleet Register, update 2018

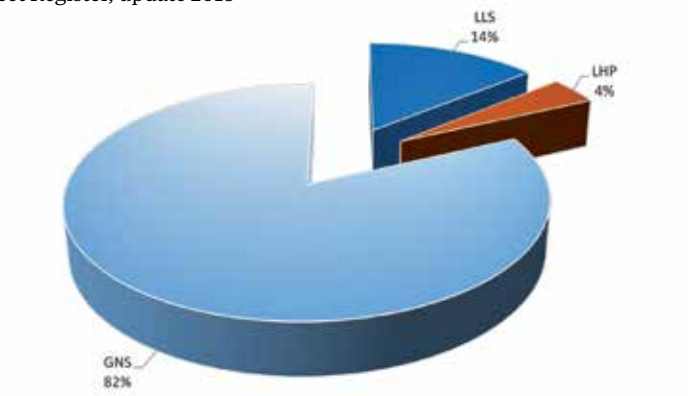


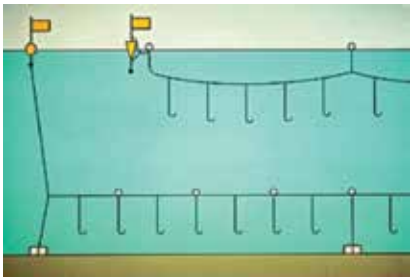
Figure 8
Vessels per fishing techniques (second gear) in Castro
Source: EU Fleet Register, update 2018

The main target species of the fleet operating in Castro are as follow:

- European hake (*Merluccius merluccius*);
- European anchovy (*Engraulis encrasicolus*);
- European Pilchard or Sardine (*Sardina pilchardus*);
- Mackerel (*Scomber scombrus*);
- Horse mackerel (*Trachurus sp.*);
- Bogue (*Boops boops*);
- Red mullet (*Mullus barbatus*);
- Annular sea bream (*Diplodus annularis*);
- Cuttlefish (*Sepia officinalis*);
- Octopus (*Octopus vulgaris*).

In the following sections a short description of the above mentioned gear types is given, including their catching principle, selectivity and properties related to ecosystem effects of fishing[11].

3.1.2 Set Longlines (Standard Abbreviation: LLS)



A set longline consists of a mainline and snoods with baited (occasionally unbaited) hooks at regular intervals and which is set, in general, on or near the bottom. The number of hooks, distance of snoods on the main line and length of the snoods depends on the target species, the handling capacity and technology used. Longlines can be set as bottom lines or, less commonly, in mid-water or even not far from the surface. Its length in coastal fisheries can go down to few hundred meters.

The fish are attracted by the natural or artificial bait (lures), hooked and held by the mouth until they are brought aboard the operating vessel which periodically hauls the gear.

Longliners, which account for almost 3% of the fleet of the GSA19, have fallen by almost 70% in terms of the number of vessels and more than 50% in

terms of GT and KW, in the period 2004-2015. Incidental catch of turtle, of certain species of sharks or other endangered species are possible negative impacts. Incidental catch of seabirds when setting and/or hauling the line are also possible. Technologies exist for avoiding the catch of seabirds while reducing the by-catch, in general, (turtle, sharks or other) is more difficult.

Despite the fact that longlines may attract and catch a large variety of fish species and sizes, this gear is considered to have medium to good species and size selective properties. The species selectivity of longlines can clearly be affected by the type of bait used, as different species have been shown to have different bait preferences. The size selective properties can partly be regulated by the hook and bait size as many studies have shown a correlation between the size of hook and bait and the size of the fish caught.

The longline attracts fish from several hundred meters away, and as large fish have a greater swimming and feeding range than smaller fish, this adds to the size selective properties of longlines. Little is known about the by-mortality of fish in longlines fishing, but fish that are lost during retrieval of longlines do often suffer mortality.

“Ghost” fishing may be regarded as a problem with longlining and this gear is not considered to cause significant adverse habitat effects when they are accidentally lost in the deep gorgonians communities. The energy efficiency of longlining is generally high, with typical energy coefficients from 0,1 to 0,3 (kilogram fuel per kilogram of landed catch), which is in the same range as that of gillnetting.

Longline caught fish are in general of high quality, but as is the case for gillnetting, long soak times may lead to reduced catch quality mainly due to bottom scavengers that may attack and eat parts of the hooked fish.

3.1.3. Set Gillnets anchored (Standard Abbreviation: GNS)

The gillnet is named after its catching principle, as fish are usually caught by "gilling" (i.e. the fish is caught in one of the meshes of the gillnet, normally by the gill region – between the head and the body). Thus, fish capture by gillnets is based on fish encountering the gear during feeding or migratory movements. As fish may avoid the gillnet if they notice the gear, catches are normally best at low light levels or in areas with turbid water.

In general gillnets are considered to be very size selective, with catches of fish sizes that correspond well to the chosen mesh size. However, due to entangling a small proportion of larger and smaller fish may be taken. The species selectivity of gillnets is not particularly

good and as different fish species grow to different sizes, there is always a possibility of catching juveniles of a large species when using small mesh gillnets for a smaller target species.

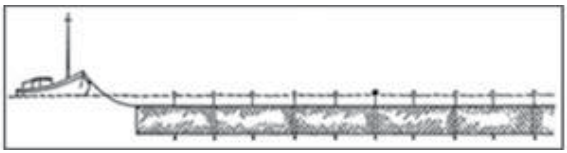
Another negative impact of gillnets is the by-catch of sea birds, marine mammals and turtles. Although little information exists on the real effect of such by-catches on the populations of these organisms, it has generated concerns, particularly for pelagic gillnet fishing.

Information on by-mortality of fish after escapement from gillnets is scarce. However, observations of fish with wounds from gillnet meshes are commonly made in catches by other gears, but the actual mortality rates from such injuries are not known.

Fixing the floats to the netting with biodegradable material could reduce the problem.

Gillnets are of special interest for artisanal fisheries because it is a low cost fishery. It is a gear with low energy consumption calculated on the relationship of fuel/fish. The catch quality of gillnet caught fish can be high; however, gillnets that are operated with soak times of several days tend to produce catches of inferior quality, as fish caught early in the fishing period may die and start to deteriorate long before the nets are retrieved.

3.1.4. Drift Gillnets (Standard Abbreviation: GND)



Drift gillnets consist of a string of gillnets kept more or less vertical by floats on the upper line (head-rope) and weights on the lower line (ground-rope) (sometimes the ground-rope is without weights), drifting with the current, in general near the surface or in mid-water.

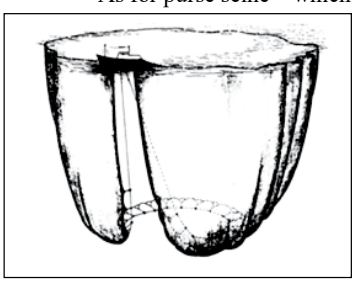
These nets drift freely with the current connected to the operating vessel. The method of capture is by gilling and driftnets are highly size selective on the targeted species.

The principal negative environmental impact produced by this type of nets is related to the by-catch of nontarget species like marine mammals, seabirds and to a minor extent turtles. In general gillnets are a fishing gears with a high degree of size selectivity for fish, efficiently regulated by the mesh-size.

It is also a gear with low energy consumption calculated on the relationship of fuel/fish. Various instruments are developed to reduce the negative impact of drift netting on the non-targeted biological resources.

3.1.5. Purse seines (Standard Abbreviation: PS)

As for purse seine – which is operated by 3 vessels – it is made of a long wall of netting framed with float line and lead-line (usually, of equal or longer length than the former) and having purse rings hanging from the lower edge of the gear, through which runs a purse line made from steel wire or rope which allow the pursing of the net. For most of the situation, it is the most efficient gear for catching large and small pelagic species that is shoaling.



Purse seining is a non-selective gear regarding fish size, as the mesh size is chosen to be so small that there should be no risk of mass meshing of fish, even by the smallest size groups of the target species. However, in cases where the fish size in the catch is too small, as estimated from samples taken from the seine, there is usually an opportunity to release the fish. The species selectivity is fairly high and both from the fishers experience and by use of modern sonar equipment it is not too difficult to identify the species before the seine is set. There is a certain risk of by-mortality in purse seining. Pelagic fishes are in general sensitive to contact with fishing gears which easily leads to loss of scales and resulting mortality. This can be related to the abovementioned release of unwanted species or sizes of fish, but the main cause of by-mortality in purse seining is the escapement of fish after net rupture due to large catches and/or bad weather. There is extremely low risk of ghost fishing with lost purse seines. The energy efficiency is high because of the relatively large catches that give a high catch-per-unit-effort in this fishery. Catch quality isnormally also high, particularly in modern purse seining, where the catch is pumped directly into refrigerated tanks on the fishing vessel.

Purse seining has generated some adverse publicity as a result of by-catches of dolphin in some tuna fisheries, but effective methods to avoid such capture have been developed.

3.2. Albania – Vlora Bay

3.2.1. The fishing Port of Vlora

(i.e., Triport) and the shelter port of Orikum (Fishing Center Orikum [FCO]/ Radhime). Triport where 30-40 commercial fishing boats anchor, located 5 km north of Vlore, is one of the most important fishing ports in Albania, with the second- largest fishing fleet (including industrial fishing vessels) in the country.

Marine fisheries are divided into professional industrial fisheries and professional artisanal fisheries (Figure 9). The difference between industrial and artisanal fisheries is based on the type of fishing gear used by license holders. All forms of trawling and purse seining, regardless of the technical characteristics of the nets that are used, are regarded as industrial fishing activities.

Figure 9
The locations of the two Fishing Ports of Vlora (Triport and Orikum)

3.2.2. Small - scale fisheries

Small-scale fisheries in Albania have developed remarkably since the 1990s as an alternative to unemployment and low income in coastal areas. The availability of SSF data is known to be crucial for devising proper management strategies (Guidetti et al. 2010; Di Franco et al. 2016).

Small-scale fisheries represents the unique sustainable fisheries activity in the Bay of Vlora, close to the office of Marine Protected Area (MPA) of Karaburun - Sazan. The Fishing Center Oriku (FCO) is located near the Info Point of the Regional Administrate of Protected Areas (RAPAV) in Vlore and the related fisheries activity represent the example of good collaboration

between the MPA managers and the fisherman (blueboost.adrioninterreg.eu.)

This fishing fleet segment represents the small boats with 5-40 HP that fish no more than 3 NM from the coast, with around 100-120 fishing days per year, with small incomes only for daily consume. The artisanal boats don't use a fishing harbor, so are not easy to be monitored. Mostly of them are not licensed, so they don't report their catches. It is rather familiar activity where women give a good contribution. This kind of fishing is rather marginalized, neglected but it is a big reality in Albanian fishery and Vlora also.

In the outside borders of MPA-s this kind of fishing should be more attractive for operators, so, became most imperative knowing that situation through evaluation of the number of boats, their production per fishing day, the legality of their activity by the purpose of differentiation from the legal operators. With the legal operators should be built a healthy partnership with MPA-s administrators.

3.2.3 The fishing methods used

In the area of Vlora are exercised a variety of fishing activities and forms, aquaculture as well. Fishing activities are equally with the same variegation in the area (Table 7).

In regards of the fishing trips and fishing routes we should stress that Vlora Bay is a Protected Area and according to its protection status and the Fishery Low Nr. 64 of date 31.05 2012 "On Fisheries", it is prohibited to apply Bottom Trawl Fishing on the Vlora Bay. In such condition we should say definitely that almost all fishing form applied in Vlora Bay is Artisanal Fisheries. This fishing form don't use fishing port facilities, they are based on capillary way along the sea coast. Some of the artisanal fishing boars we meet in the Treport Fishing Port.

Artisanal fishery covers all forms of fishing activity using fixed and selective gear such as hooks, fixed nets, trammel nets, and gill nets (https://www.eurofish.dk/member-countries/albania).

Artisanal fisheries have the roots of traditions since in ancient time and the coastal communities have inherited that skills generation to generation.

Here coexist the artisanal or traditional fishing, entertainment or leisure fishing, sport fishing with the industrial, (pelagic or bottom trawl). Marine aquaculture by intensive floating cage has not damaged this coexistence, at least, as long as there is not an uncontrolled expands of the aquaculture sites or unmonitored for the impact of irreversible environmental effects that can cause. It is a big number of Artisanal fishing, fishers and boats that are unlicensed, acting illegally fishing practices.

No	Boat	Administrator	Period licence	Fishing type
1	GABRIEL	Latif Azemi	2022	Trawler
2	ODISEA 1	Fjodor Bala	2021	Selective
3	MEHMETI	Qani Alushi	2019	SELECTIVE
4	GJYZELI	Jonita Alimuca	2022	TRAWLER
5	DIAMANTE	Engjellushe Dalipi	2021	SELECTIVE
6	DENIS	Llambi Nushil	2019	TRAWLER
7	XHOKLA	Maks Merko	2019	TRAWLER
8	KLODI 1	Klodian Isai	2019	TRAW+PELAG.
9	RICIOLA	Agron Nuredini	2020	TRAWLER
10	OQEANIA	Flamur Alimani	2021	TRAW+PELAGIC
11	MELISA	Zija Bejto	2019	TRAWLER
12	DE RADA	Mezan Jakupi	2020	TRAWLER
13	FABIANO	Dritan Kacaj	2021	TRAW.+PELAGIC
14	GERTA	Altin Nazdri	2021	TRAWLER
15	FIORE	Elham Zhegu	2020	TRAWLER
16	FORTUNELA	Isuf Nuredini	2018	TRAWLER
17	ANDI II	Ali Cakerri	2021	TRAWLER
18	PAVARSIA	Orgest Serjani	2019	TRAW.+PELAGIC
19	KELI	Enton Mishtaku	2021	SELECTIVE
20	SELMAN LEVANI	Astrit Levani	2019	TRAW.+PELAGIC

No	Boat	Administrator	Period licence	Fishing type
21	ROZETA	Besnik Pilinci	2021	SELECTIVE
22	AQCUARIO II	Skender Saliu	2019	TRAW.+PELAGIC
23	RICIOLA 1	Robert Nuredini	2020	TRAWLER
24	DEVI	Elham Malaj	2019	TRAWLER
25	MEDI	Pelagicumb Isai	2020	SELECTIVE
26	SULEJMAN HASANI 1	Gentian Xhema	2021	TRAWLER
27	ERIKLA	Llazar Nushi	2021	TRAWLER
28	LEDA	Fiqiri Refati	2019	SELECTIVE
29	IL-PU	Qemal Lato	2020	TRAWLER
30	POJANI	Agron Shermeti	2019	RRETHIME
31	RIGELS	Pelagicumb Lato	2020	TRAWLER
32	ELTJON	Flogert Arifi	2019	TRAWLER
33	LUCO-1	Flamur Isufi	2021	TRAWLER
34	PADAJ	Arben Nuredini	2020	SELECTIVE
35	BABALE	Mustaf Mustafa	2018	RRETHIME
36	AGIMI	Muhamet Feimi	2019	RRETHIME
37	BISTRICA	Sami Sulioti	2020	RRETHIME
38	ORGESTI	Ilirjan Haxhiu	2019	PELAGICAGJIKE
39	LA SPERANCA	Edmond Hyseni	2019	TRAW.+PELAGIC
40	KRISTO	Azem Lato	2018	TRAWLER

Table 7
Licensed fishing vessels in VLORA (2018)

3.3. Montenegro – Baia di Boka Kotorska

Boka Kotorska Bay is a relatively closed ecosystem, which is very sensitive and required special measures to maintain its environmental as well as development status. It is area of high interest for tourism development thus being under pronounced pressures by tourism and related urban development. It creates negative impact on marine ecosystem especially to fish stocks.

With a view to protecting the fish stocks and biocenoses in the Boka Kotorska Bay, the law prohibits use of certain types of fishing gear within the Bay, thereby the Bay was to a certain extent proclaimed **a fisheries restricted area**. In the area of the Bay fishing with the bottom trawls, pelagic trawls and encircling purse seine nets of large-scale fishery is prohibited (Official gazette 56/2009). Only the small commercial fishing gear may be used within the Bay, such as set nets, seine nets, longlines, traps spears and harpoons. Minimum mesh sizes are set for specific nets in order to prevent catch of juveniles, as well as the maximum length of the net that may be cast into the sea. Length of a single set net in the Bay may not exceed 160 m and a fisherman may have two or five nets, depending on whether he is engaged in small-scale or large-scale commercial fishing (Official gazette 8/2011) . For all these gear types, the law las down also the period in which their use is allowed or prohibited in order to protect the species in spawning period. Fishery resources management in Montenegro is based on the principles of sustainable fishery in order to prevent overfishing of certain species and hence distortion in the entire ecosystem community.

As a country in the process of accession to the European Union, Montenegro is bound to accept, incorporate into its legislation and implement all the regulations ang rules of the Common Fishery policy. Some types of fishing gear that have been in use in Montenegro for centuries, which are used mainly in the Boka Kotorska Bay, are not fully harmonized with the EU legislation. This particularly refers to the use of seine nets for pilchard and anchovy. This fishing gear has centuries long tradition in this area, a strong sociological and culturological significance for the population of the Boka Kotorska Bay. At the same time, fishing with seine nets has major significance for tourism as well, primarily because it provides fresh, healthy

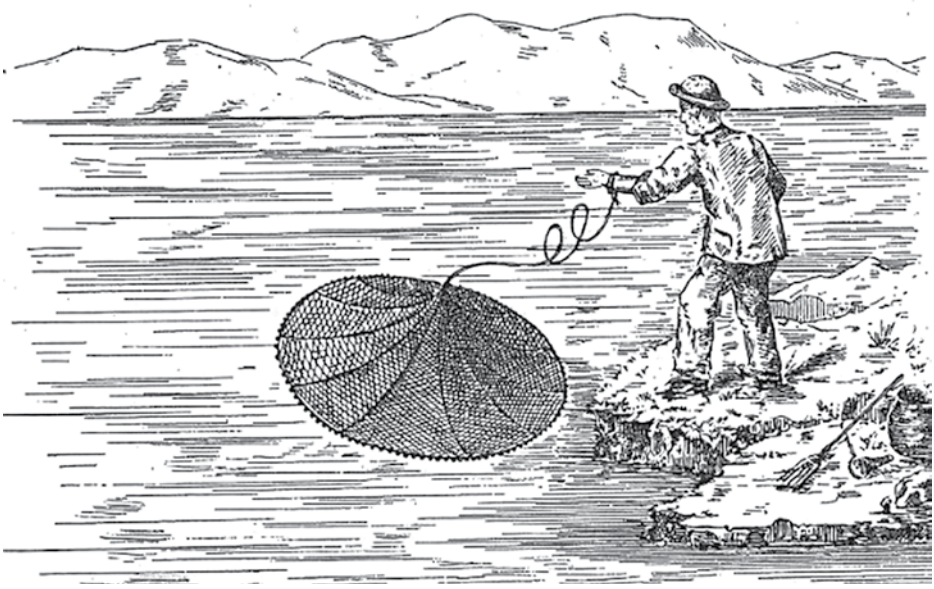


Figure 10
Fisherman throwing the net ričak

food from the sea, rich in Omega 3 fats acids, and it is at the same time a tourist attraction, since this fishing method, involving a large number of people, is quite attractive to tourists. Significance of fishing by seine nets is recognized by the Fishery Development Strategy of Montenegro (M.o.A.a.R. development 2015), which states that efforts would be made to preserve this traditional fishing manner on the principle of sustainable development through drawing up of a management plan for use of seine nets. The management plan will set the maximum number of seine nets to be used in the Bay and continuous supervision and control of the catch would be provided, as well as monitoring of other biocenoses as regards use of seine nets, particularly as regards biocenoses of marine flowering plants (*Posidonia oceanica*).

The number of fishermen using traditional fishing gears today has been decreasing. Intensive turism development and construction of tourist facilities on the coast has resulted in reduction in number of fisherman's posts, while cruising tourism development resulted in increase of noise and water turbidity, which affects fish stocks. Just around 20 fishermen in the entire Bay use seine nets, a few of them use *ričak* nets (Figure 10).

In order to enable use of this traditional fishing gears in the future it is necessary to ensure protection of fish stocks; otherwise, if there is no fish, there will be no fishermen and seine nets.

4. Impact of fisheries activities on marine ecosystem

4.1. Italy – Castro

Investigations on the occurrence of environmental contaminants in water, sediment and some fishery products of the Castro Bay carried out in the ADRINET project (i.e. ERMP) allow us to assert that there is no significant risk to the marine environment and suggest that consumption of these fish species can be safe for human health; on the other hand, they attest to the little pollution of the water, a situation probably linked to the absence of waste water from large industrial groups, the absence of large river mouths, but also the presence of marine currents. The Ionian Sea is the crossroads of waters connecting the Western and the Eastern Mediterranean basins with the Adriatic and the Aegean Seas. Its circulation is highly variable and characterized by two main states: a cyclonic or an anticyclonic circulation.

The greatest negative impact both for the environment and for the safety of fish products, on the contrary, seems to be the occurrence of microplastics in the fish viscera assessed by the ADRINET study.

However, on the basis of the data obtained from the investigations and from the scientific literature, it is not clear whether this contamination could be correlated to a risk for human health; the data obtained should be further investigated to check the type of the plastic fragment, the composition of the plastic and the presence of both chemical and microbiological adsorbed contaminants.

The discovery of plastic fragments in the viscera of the fish analysed confirms the serious risk to which the aquatic ecosystem is now exposed also considering the phenomena of bioaccumulation and biomagnification in the marine trophic chain.

A problem related to the presence of microplastics and nanoplastics in this marine area, is the presence of ALDFG (“Abandoned, Lost or otherwise Discarged Fishing Gear”).

The “Ghost fishing” represents serious damage to fishing and to the marine ecosystem.

To reduce this phenomenon it is necessary to implement appropriate training and close collaboration between fishermen who should make use of fishing gear that is always recoverable, through the use of appropriate technologies, and the involvement of institutions so that the recovery of lost nets, their disposal or possible reuse is organized and managed.

The fishing nets lowered along the coast, together with the bottom trawls, are among the tools that most often become Ghost fishing; both types of equipment present additional problems related to the protection of the marine ecosystem

For the nets lowered below the coast it is absolutely necessary to review what is indicated in the now dated main legislation governing Italian fisheries, Law 963/1965 and Decree of the President of the Italian Republic no. 1639/1968 regarding "Regulation for the execution of the law of 14 July 1965, no. 963, concerning the discipline of marine fishing", establishing a greater minimum distance from the coast of the gill nets, enlarging the size of the net mesh and limiting their length.

For bottom trawls, the most evident damage concerns the destruction of the seabed and Posidonia meadows, especially if practiced on shallow waters; it is a non-selective fishing technique, which involves bycatching; according to the FAO, every year in the world 7 million tons of unmarketable fish are thrown back into the sea.

All this entails a serious impoverishment of biodiversity and, moreover, this fishing practice goes against the European Directives that protect and preserve the conservation of the seabed. The 'good environmental status' discussed by the EU, in fact, concerns measures relating to the protection of biodiversity, the effective management of critical issues related to excessive fish exploitation, damage to the seabed, the presence of marine litter and contaminants.

The coastline of Apulian Region consists mainly of coralligenous, characterized by the presence of bioconstructions mainly made of encrusting red calcareous algae belonging to the genera *Lithophyllum, Mesophyllum* and *Peyssonnelia* and by benthic invertebrates with carbonate skeleton, such as annelids, anthozoan cnidarians, bryozoans and several specimens of Poriferi: the use of bottom trawls is a serious problem for the habitat.

The coralligenous of the Castro Bay considered by ADRINET mainly affects the infralittoral, where already at 10 m depth it can alternate with *Posidonia oceanica* or *Cymodocea nodosa* meadows.

The coralligenous is considered an important biodiversity hotspot, since thanks to its conformation, it hosts a rich associated fauna that exploits the coralligenous cavities as a habitat refuge from predation and as a place to reproduce.

Because of this important biodiversity to be preserved, we suggest creating a "Marine Park" in this area of the Apulian coast, where the deep coral already begins at 30-40 meters deep; marine parks are extremely precious environments that are increasingly of specific scientific and tourist interest; Guided tours also by marine biologist experts to the park and caves, already known and sought by tourist visiting the Apulia Region, can contribute to the creation of an economic return also for the fishing communities of Castro.

Our suggestion is closely linked to the "protection of the marine environment" topic that has been the focus of EU attention for a long time, given the fact that the programs of measures set up by the Member States under the "Marine Strategy Framework Directive" have not yet had any tangible results.

Therefore, further programs of measures are needed, which will have mainly to address economically advantageous aspects for fishing communities.

As regards the problem relating to the "fishing effort" and as highlighted in the meetings with the fishermen of Castro, it is very important to make closed fishing seasons divided into neighboring Marine Fisheries Department.

Currently the closed season is divided into very large macro-areas (Adriatic sea from Trieste to Ancona; Adriatic sea from San Benedetto del Tronto to Termoli, Adriatic sea from Manfredonia to Bari, Ionian sea and southern Tyrrhenian sea from Brindisi to Naples, Tyrrhenian sea from Gaeta to Civitavecchia, Tyrrhenian sea from Livorno to Imperia, Region of Sardinia, Region of Sicily) with very different fish species and various reproductive timing.

Therefore, in order to safeguard above all the reproduction of "native" fish species, it is advisable to restrict these fishing zones and implement the closure of fishing based on specific areas and the fish species that reproduce in certain periods.

4.2. Albania – Vlora Bay

Ghost nets according to fishermen's testimonies are fishing nets (nets, pur sein, hooks) that have not been thrown / abandoned by the fishermen with their conscience. They are stranded in stagnant objects such as boats stranded in the Vlora Bay, brought in by sea currents from fishing areas, fixed with anchors but pulled from there by large bottom fishing vessels that just launch depart from the fishing port and exit the bay with the launcher.

The trawls released during their voyage into the Gulf of Vlora to the depth of the bottom fishing (off the Gulf of Vlora) carry with them the nets that are badly damaged and dumped offshore by industrial fishing fishermen, often cutting them into pieces. small.

Another contingent are those stormwater fishing nets for stationary fishing. After being overthrown, they are displaced by the force of the hull and stuck in end objects like shipwrecks, in which case they are not tracked by their owners.

There was a very positive phenomenon in the group of fishermen in the row: there were artisanal fishing subjects that brought their nets out of the sea in the event of loss from bad weather or for other reasons but beyond their will. This category of fishermen, but also capable divers, also provided this service to third parties in the event of network bottlenecks. But only when stagnation occurred at depths up to 20 m. At depths of about 40 m it is impossible to pull them out with just a simple polar coating.

Another positive thing is that the nets were never discarded after damage, they were repaired until they were no longer valuable. Before each trash was thrown into the trash, the top rope (along with the tap) and bottom (along with the lead) were removed. Only unarmed nets containing a small amount are disposed of at the designated waste site.

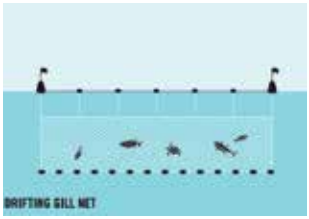
Fish depletion, assessments and related problems and impacts. Vlora bay has been from years under protection consideration from bottom trawl and pelagic fishing activities for the high environmental value that the area carries itself, but above all, for high positive effects on the maintenance and regeneration of the stock of some important marine reserve species in the area

Indeed, has not been fulfilled yet any real assessment of the fish reserve status on the area as well as fish stock or group stocks evaluation. On the other hand there is no assessment of fish production, yearly tendencies since no accurate statistical data's applied during last 25 years. To conclude on the tendency (decreasing or increasing) fish production must be implemented the accurate statistics over the years of all fishing impact on a stock or group of stocks, including the clear perception of the dimension of illegal, unreported and unregulated fishing activities in a selected area. If the legal aspects can be considered rather well we cannot say the same for their application in the field and moreover for inter-institutional cooperation.

Ilegal fishery activities occurring in the area Continuously has been reported for the illegal bottom trawl within the Gulf of Vlora. Moreover, the illegality of the fishery activities is not only within the bay but is extended outside the Gulf of Vlora, caused not only from the National operators but even from foreigner, mostly from Italian vessels. Some of them are evidenced, processed but never penalized. If we analyze the fishing fleet according the structure of them we can declare that only about 90% of professional fishing boats are licensed and registered in the National Fishing Fleet. When speaking for the artisanal fishery and Small Scale Fisheries less than 30-40% of them are licensed and or registered. So, the non licensed categories don't report and is out of monitoring for their activity and fish production. And the result comes directly in the fishing nets of the legal fishermen community which are landing fewer and fewer fish. The mostly illegal of activities identified in the area are fishing without license/Authorization, fishing in the prohibited areas, prohibited fishing gears and/or with smaller mesh size, by exterminator means, irregular fishing and with bad practices that results unfavorable for the fish reserve in area, that harm/mismanage the coastal lagoons with which the coast of Vlora is rich and the role of lagoons is irreplaceable to the fish resources.

***Fishing practice by diving equipped with compressor*,** has led not only damages the target fish but this kind of fishing is associated with the exploration and exploitation of corals, sponges, sea cucumbers, species prohibited by law and by which Vlora coast is rich. The coast of Vlora is rich on a variety of ecosystems which are not studied enough; such ecosystems appreciated for their combination of their impact on the maintenance and regeneration of fisheries resources. Empiricism and irresponsibility have accompanied economic activities in this area, which is so rich environmentally and of diverse

Gillnets are sets of panels of uniform mesh size, which form a large net-wall hanging vertically in the water. Suspended in the top- or mid-depths of the water (a drift gillnet), or anchored to the seafloor (bottom gillnet), gillnets trap fish by their gills. They are very effective – and particularly destructive.



Trawling involves dragging a large fishing net with heavy weights behind a boat, either mid-water or across the bottom. The net indiscriminately catches or crushes everything in its path. Consequently, by-catch is extremely high and nets are often lost due to snagging on the bottom.

Trawling is a common fishing technique. **It is forbidden to trawl within Vlora Bay.**

Purse seine is a long wall of netting deployed around a school of fish and pulled tight, thus enveloping the school of fish (and any other animals) in a purse-like structure.

Purse seines target pelagic fish of all sizes, including tuna, and are therefore frequently used in the western Indian Ocean, often in combination with FADs.

On the other **hand, pole and line**, are other traditional fishing technique associated with a low impact and **is sustainable fishing technique**.

4.2.1. Pollution risk assessment through the analytical results performed

The most delicate phenomena of marine coastal water pollution in past years in Vlora Bay were heavy metal pollution (mainly metallic mercury from past discharges of a soda plant near the city of Vlora) and organochlorine pesticides (OCs). Moreover, urban waste is dumped into the sea without any treatment. In Albania, OCs were mainly used as insecticides such as dichlorodiphenyltrichloroethane (DDT), hexachlorobenzene (HCB), and lindane before 1990. As a result of recent transformations in agriculture, pesticide use has generally declined after 1990. From year to year, the distribution of PCBs has changed in favor of less volatile technical mixtures (such as Aroclor 1260), indicating a ground-based contribution, probably due to the importation of contaminated transformer oils or their malfunctioning existing.

No data have been available on the levels of those pollutants in biota from the coastal areas of the Gulf of Vlora until 2010. Implementing decisions on actions to monitor and evaluate marine pollution, in coherence with all partners, the AUT carried out analytical testing for: heavy metals were measured in 86 cefalopodes samples (54 samples sepia.spp + 32 Loligo spp), polychlorinated biphenyls (PCBs) and organochlorine pesticides (56 samples), residues of antibiotics (68 samples) in fish were measured. PcBs and heavy metals were measured in 2 samples, and PCBs in 2 sediments samples. OCs pesticides and PCB were found to be below the detection limit, in fish, water and sediments. Overall, the results show an environmental quality of the Bay of Vlora, which similar to those a marine protected area. In fact, what is to be discussed is that in the past years Hg levels have been problematic as a result of the of past industrial activities (especially soda

plant discharges), those over the years, after its closure have improved significantly. Analyzes of antibiotic residues in fish also show satisfactory results

The results of analysis performed in samples fish, cefalopodes and water from Vlora Bay also support its suitability in environmental quality assessment of marine coastal areas.

There was small variability of different microplastics found in all species of fish, since we found only filaments and smaller fragments. We didn't expect to find so many filaments in fish gut, but this result is in correlation to high abundance of filaments in sea surface samples. There is also difference in number of filaments and fragments, which we can correlate to the specific fish feeding habits. Therefore, we found the most microparticles, mostly filaments, in Pagellus Erythrinus that feeds low in the food chain, It is omnivorous, but mainly feeds on smaller fish and benthic invertebrates either as direct primary consumers and detrivores, or at a secondary level feeding on small macro fauna, what means it eat on the shallow bottom floor and on the sea surface, preferably near waste waters and marinas. The least of microplastics we extracted from the gut of Solea solea specimen, which lives and feed mostly on the sea floor, were is not so much exposed to floating filament and fragments in the water column.

4.3. Montenegro – Boka Kotorska Bay

Impact of fishery on marine environment cannot be neglected in any part of the world, as well as in Boka Kotorska Bay. However, the Bay is already protected from use of fishing gears that has most negative effect on marine environment – bottom trawl nets. Most numerous fishing gears used inside the Bay are set nets (trammel nets and gillnets) which are very selective and have minimal negative effects on marine environment. Mesh size on those nets are determined by legislation and they depend on target species and period of year, and they are already fully harmonized with the EU legislation. Other types of nets that can have more significant impact on the marine environment are beach seine nets. Those nets are pulled to the fishermen's post on the shore, and biocenoses of marine flowering plan-

ts (*Posidonia oceanica*) can be endangered, which is the main reason why EU regulations prohibit the use of those nets in the areas inside 3 nautical miles from the coast. In Boka Kotorska Bay beach seines are used for centuries and pulled always on the same places, fishermen's post, which are strictly localized and accurately defined dimensions. In this way impact on the marine environment and *Posidonia oceanica* is reduced to a minimum. Maximal number of licences for this type of fishery is determined and management plan will be developed in order to monitor impact of this type of fishery on fishery stocks and marine environment, and to prevent any possible negative effects.

Considering all, it can be concluded that fishery in Boka Kotorska Bay has no such significant impact on the environment, but lost and abandoned fishing gears are significant and persistent problem for marine habitats and wildlife. Ghost fishing presents commercial fishing nets that have been lost, abandoned, or discarded at sea. Abandoned nets, long lines, fish traps without anyone profiting from the catches, have affect on already depleted commercial fish stocks. Caught fish die and in turn attract scavengers which will get caught in that same net, thus creating a vicious circle. Every year ghost gears are responsible for trapping and killing millions of marine animals including sharks, rays, bony fish, turtles, dolphins, whales, crustaceans, and birds. Ghost nets cause further damage by entangling live coral, smothering reefs and introducing parasites and invasive species into reef environments.

Ghost nets are also a major contributor to the ocean plastics crisis. Most modern nets are made of nylon or other plastic compounds that can last for centuries. Marine animals mistake this microplastic for food and eat it, which can harm internal organs, keep them from eating, and expose them to toxic chemicals.

In addition, ghost nets affect the sustainability of well-managed fisheries by damaging boats and killing species with economic value. They also impact the beauty of shorelines, resulting in expensive cleanup costs and financial loss for the tourism and diving industry.

To reduce the impact of ghost fishing in Montenegro coast it necessary to organize sea bed cleaning every few years coordinated by the Municipality.

Before and above all, the areas with the highest amount of marine waste (fishing nets) should be mapped. Equally essential is the identification of land sites where deposited nets would be storage and deposited.

Due to problems with abandoned fishing gears, one of the main objectives of ADRINET project is to envisage benefits of investments in new technologies, which will provide endowing fishing boats with RFID and GPS systems to map fishing routes and ghost-nets, monitoring sea pollution, tracing fish caught and preventing over exploitation of the fish stocks.

This RFID technologies have been used for identification of the origin of the items that contains a RFID tag, and its movement history. It has been widely used in supply chain and logistics management. In fisheries research, the technology has been used for tagging and tracking fish to understand stock structure, migration, and movement. Nets and ropes set in the aquatic environment can often accidentally entangle whales and other megafauna species. Sometimes the animals stuck in the gear and die, while in other casesthe gear can be towed away, which can also cause injury and mortality. In order to assess which fishing gear types and seasons/locations are posing the greatest risk to these animals, it is necessary to determine the origin of fishing gear components (e.g. rope sections) remained on animals after accidentally entangled with the gear. This would provide scientific basis for implementing technical measures for specific gear types, at specific locations and in specific fishing seasons. Determining the origin (ownership and gear type) is also necessary for identifying fishing gear lost at sea for assessment of ghost fishing capacity and owner responsibility.




Figure (11-14) *of abundant fishing gears, marine litter on the bottom (photo from 11-14 by Slavica Petovic);*

Figure 15.
https://oliveridleyproject.org/what-are-ghost-nets

Ghost nets are fishing nets that have been left or lost in the ocean by fishermen. These nets can be left tangled on a rocky reef or drifting in the open sea. They can entangle fish, dolphins, sea turtles, sharks, dugongs, seabirds, crabs, and other creatures, including the occasional human diver. Acting as designed, the nets restrict movement, causing starvation, laceration and infection, and suffocation in those that need to return to the surface to breathe.

"Some studies estimate that over 90% of species caught in DFG are of commercial value, which can contribute to a significant loss of revenue for fishermen."

A United Nations (UN) Food and Agriculture Organization (FAO) and UN Environment Programme (UNEP) report states that while most gear is not deliberately discarded, the problem of abandoned, lost and discarded fishing gear is getting worse due to the increased scale of global fishing operations and the introduction of highly durable fishing gear made of long-lasting synthetic materials[12]. This suggests that the likelihood of ghost fishing may be increasing, although it is difficult to know exact numbers due to incomplete reporting of how much gear is actually lost and the difficulty in monitoring or retrieving DFG.

Preventive measures would reduce the likelihood that fishermen will discard gear at sea and make gear less likely to ghost fish and could include:

- Reducing ghost fishing efficiency of gear (improve biodegradable aspects for release or disabling of lost gear over time).
- Gear marking, integrated GPS to allow for immediate recovery, port or state monitoring, and inspection of gear.
- Provide affordable port disposal facilities and incentives to discourage improper disposal at sea. Many preventive mechanisms are already being implemented in various ways. Gear improvements such as the use of integrated GPS tags are already widely used in EU fisheries

The cost of disposing fishing gear properly can be high, so in some cases it is dumped at sea as a low cost disposal method (Pooley, 2000). The need for affordable port reception facilities and incentives for bringing DFG

back to shore for disposal is vital to the prevention of marine debris and DFG .

4.3.1. Water (and sediment) quality monitoring for prevention of pollution

Activities in this part of the coast are increasing during last decades and pollution problems (due to communal wastewater, maritime activities and industry) are expressed, exacerbated by the enclosed nature of the Bay and slow exchange of water with the open sea. The Bay is composed by three major basins (Herceg-Novi, Tivat and Kotor), connected by two narrow straits (Kumbor and Verige) with a maximum depth of 60m. Marine ecosystems are highly vulnerable, especially in the Bay's narrow part, in the section between Bijela Shipyard and Porto Montenegro Harbor, as well as in Igalo Bay- part of Herceg-Novi Bay.

For monitoring of marine environment trace metals pollution, which represent a basis for pollution control in marine environment has generally a lack of interest. Trace elements are considered serious pollutants of the marine environment because of their toxicity and persistence, poor biodegradability and tendency to concentrate in aquatic organisms

In frame of ADRINET project some chemical analysis were performed. Although analysis data indicates a low level of heavy metals, pesticides, PAHs and PCBs in fish samples, sediment and water it is very important to emphasize that continuous monitoring of heavy metals as well as various contaminants in this region are of crucial importance. Reduced speed of water exchange with the open sea affects the smaller capacity of the Bay for the reception and degradation of pollutants, which further burdens the living organisms in the Bay.

5. Small scale fishery and approaches

There is a global concern and empathy for small-scale fisheries today. While the social and cultural contributions of small-scale fisheries can hardly be overestimated, the management objectives for small-scale fisheries are not that different from those of large-scale fisheries, especially when we think about the need to maintain fish stocks and associated ecosystems in healthy conditions and avoid wasteful use of the means of production, in particular, over-investment into vessels, engines, nets, fuel, etc.

If a country wishes to consider a management approach, the approach which must be taken for management of small-scale fisheries will depend largely on the geographic, socio-economic and political systems in the country

The ecosystem approach to fisheries (EAF) should be the overarching approach to fisheries management including small-scale fisheries. As in large-scale fisheries, also small-scale fishing activities, though often to a much lesser degree, affect other components of the ecosystem in which the harvesting occurs; for example, there is often bycatch of non-targeted species, physical damage to habitats, food-chain effects or changes to biodiversity. In the context of sustainable development, responsible fisheries management must consider the broader impact of fisheries on the ecosystem as a whole, taking biodiversity into account. The objective is the sustainable use of the whole system, not just a targeted species.

In many countries exist different management plan for small-scale fisheries. Some suggestions on the approach which can be adopted are:

1. The overall fishery management framework, as well as the principles and objectives behind the approaches and institutional arrangements involved, must be articulated in simple terms. Easy-to-read documents which provide the essence of the management framework and the planning process should be available in the language of the fishers.
2. Organized efforts need to be made to ensure that these documents are effectively distributed and reach the communities. If there are

no genuine and representative organizations of small-scale fishers, then this task may be entrusted to civil society organizations that have the capacity and the empathy to do so.

3. There must be structured opportunities for communities to discuss the documents.
4. A finalized management plan needs to be discussed with the communities. This is necessary for awareness creation and to obtain greater credibility for repeating the process of participatory planning in the future. This will also be a major step in ensuring compliance with the management plan, as there is a sense of ownership over the process by which it was formulated.
5. When such a plan is finally 'put to the test', there is need for participatory monitoring of its application. There are likely to be numerous changes and adjustments which will have to be made when the management tasks are implemented. The results and reactions will need to be weighed against the objectives which were set out at the outset. This forms the basis of an important feedback loop – learning and relearning – ensuring that the management system which evolves from the plan remains vibrant and dynamic (A Fishery Manager's Guidebook, FAO 2009).

The modern fishery manager faces a difficult legacy. The last 60 years have demonstrated the capacity of the sector to increase production and more than match the growing demands fuelled by development and demography. They have equally demonstrated in most places that, for various reasons including poor implementation of scientific advice, conventional management had been unable to avoid a significant degradation of fishery resources. Nonetheless, significant expectations are maintained regarding the continuing role of fisheries as a source of livelihood and food security while maintaining biodiversity and ecosystems.

6. Future activities of fishery for prevention of marine ecosystem

Some activities which can be useful for future fishery activities to prevent pollution and protect marine ecosystem are:

- Continuously monitoring and conduction of action related to removing of lost fishing gears to reduced ghost fishing
- Organizing seminars, interviews with fishermen, visits of fishermen to other countries (as provided in frame of ADRINET project), scuba divers with aim to continue with collection of data about ghost fishing
- Identify a site on land to be a storage area for lost gears
- Establish contact relevant local authorities regarding the recovery activities in order to have support on the ground
- Supporting the use of RFID technologies which will help in identification of lost gears.

Figure Meeting of fishermen from Italy to Institute of Marine Biology (in frame of ADRINET project)

Figure Meeting of fishermen from Italy to Vlora (in frame of ADRINET project)

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