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ADRIAMED - TECHNICAL DOCUMENTS

Report of the AdriaMed Technical meeting on Adriatic Sea Small-scale Fisheries (Split, Croatia, 13th 14th November 2012)

ADRIAMED

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SCIENTIFIC COOPERATION TO SUPPORT RESPONSIBLE FISHERIES IN THE ADRIATIC SEA
GCP/RER/010/ITA
GCP/RER/021/EC

Report of the AdriaMed Technical Meeting on Adriatic Sea Small-Scale Fisheries

(Split-Croatia, 13-14 November 2012)

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Preface

The Regional Project "Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea" (AdriaMed) is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Italian Ministry of Agriculture, Food and Forestry Policies (MiPAAF). The DG-Fish of the European Commission co-funded the project from 2007.

AdriaMed was conceived to contribute to the promotion of cooperative fishery management between the participating countries (Republics of Albania, Croatia, Italy, Montenegro and Slovenia), in line with the Code of Conduct for Responsible Fisheries adopted by the UN-FAO.

Particular attention is given to encouraging and sustaining a smooth process of international collaboration between the Adriatic Sea coastal countries in fishery management, planning and implementation. Consideration is also given to strengthening technical coordination between the national fishery research institutes and administrations, the fishery organizations and the other relevant stakeholders of the Adriatic countries.

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GCP/RER/010/ITA Publications

The AdriaMed Project publications are issued as a series of Technical Documents (GCP/RER/010/ITA/TD-00), Occasional Papers (GCP/RER/010/ITA/OP-00) and Scientific Reports (GCP/RER/010/ITA/SR-00) related to meetings and research organized by or conducted within the framework of the Project.

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Comments on this document would be welcomed and should be sent to the Project headquarters

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Preparation of this document

This document is the final version of the report of the AdriaMed Technical meeting on Adriatic Sea Small-scale Fisheries, organised by the FAO AdriaMed Regional Project (*Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea*) on 13th and 14th November 2012 (Split, Croatia).

Small-scale fisheries (SSF) became high priorities in recent years owing to their socio-economic role at national and local level. SSF provide an important contribution to nutrition, food security, sustainable livelihoods and poverty alleviation to coastal communities, especially in developing countries. Despite their importance, the issues constraining the sustainable development of small-scale fisheries remain poorly understood. The role of SSF in exploiting shared or straddling stocks, like in the case of the Adriatic Sea also deserve further investigation, especially in the semi enclosed basins like the Adriatic Sea.

The FAO Committee on Fisheries in its last meeting (COFI, July 2012) put high priority to addressing SSF issues at global and local level. The FAO Fisheries and Aquaculture Department is in the process to launch the adoption of the FAO International Guidelines on Securing Sustainable Small-Scale Fisheries. In the Mediterranean Sea, the FAO General fisheries Commission for the Mediterranean Sea is emphasising the importance to move toward the management of SSF.

The SSF issue was dealt with by the AdriaMed Project since its inception and a first regional meeting on this topic was held in Croatia in 2003 (AdriaMed Technical Document No.15) to identify priorities and joint activities to be carried out by the Adriatic experts under the framework of the AdriaMed Project.

To further foster the international discussion and to identify new SSF priorities in the Adriatic Sea, the Adriatic experts deemed necessary to update the information available and the work carried out so far on SSF in the Adriatic Sea.
In line with its mandate and coherently with the indications given by the FAO Code of Conduct for Responsible Fisheries, the issues related to SSF were dealt with during the AdriaMed Technical Meeting on Adriatic Sea Small-Scale Fisheries. The meeting aimed at: i) review the current knowledge and the state of small-scale fisheries in Adriatic countries; ii) consider the existing monitoring systems in place at national level; and iii) collate up-to-date information on the available knowledge and on the on-going programs focusing on small-scale fisheries in the countries.

This document provides a description of the information presented and the discussion held during the meeting. A compilation of national reports as well as some case studies presented during the technical meeting are also included.

It is hoped that this study will contribute to strengthening international cooperation and to promoting the assessment and monitoring of fisheries and fisheries resources in the Adriatic Sea

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ABSTRACT

The AdriaMed Technical Meeting on Adriatic Sea Small-Scale Fisheries was held on 13th and 14th November 2012 in Split, Croatia. The meeting was attended by 16 experts from all the countries participating in the Project (Albania, Croatia, Italy, Montenegro and Slovenia). The meeting reviewed, on the basis of participants' experience, the current knowledge and the status of small-scale fisheries in Adriatic countries, up dated the information on the available scientific and technical knowledge in each country and focused on the on-going programs on small-scale fisheries. The Technical Meeting identified gaps and priorities functional to promoting regional scientific cooperation, focusing on the small-scale fishery sector in the Adriatic Sea. As first step the meeting requested the AdriaMed Project to re-establish the Working Group on Small Scale Fisheries in the Adriatic Sea. The document includes five national reports on small-scale fishery exploitation dynamics and interaction with other fisheries presented during the meeting as well as five case studies.

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Opening of the Meeting (Agenda item 1)

The AdriaMed Technical meeting on Adriatic Sea Small-scale Fisheries was held on 13th and 14th November 2012 in Split, Croatia. The Technical meeting was organized in the context of the FAO-AdriaMed Regional Project (Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea). It was hosted by the Institute of Oceanography and Fisheries of Split (IOF).

The meeting was attended by 16 experts from the countries participating in the Project and the FAO-AdriaMed staff. AdriaMed staff constituted the Secretariat of the meeting. The list of participants is given in Annex A of this report.

The meeting was opened by Mr NedoVrgoć on behalf of the host institution (IOF) and its director Ms Ivona Marasović. He stated the importance of assessing the current state of the small-scale fishery sector in the Adriatic and of identifying common priorities at regional levels. Mr Vrgoć reiterated the important social role of fisheries in Croatia, and in particular of small scale fisheries (SSF). The importance of SSF is further increased by the future fisheries management plans that Croatia is called to prepare for the future integration in the European Union. He underlined that the complexity of fisheries research and, particularly of fisheries management in the Adriatic and in the Mediterranean in general, is due to the multispecies and multigear nature of fisheries and to the shared nature of the stocks. These characteristics ask for an urgent harmonization of the fisheries management plans strategies of different countries that cannot be developed without an appropriate knowledge of the status quo in each participating country. The definition of a common/ methodology on data collection and monitoring of SSF was also mentioned as an essential requirement for the definition fo management plan for SSF. He expressed his hope that this meeting will follow the success achieved by last meeting of AdriaMed in 2003 and in general by the project in promoting and strengthening scientific cooperation for fishery research and management.

The FAO-AdriaMed Project Coordinator, Mr Enrico Arneri thanked the Institute of Oceanography and Fisheries for hosting the meeting and for the excellent organization and assistance provided. He thanked and welcomed all the participants. He underlined the importance of having the experts in a joint discussion on the SSF in this moment, given the high importance of SSF set in the agenda of all the relevant international fishery fora. He recalled the need to continue strengthening the scientific cooperation in the Adriatic region and to reinforce particularly the support to the future development of this topic.

Mr Jakov Dulčić of IOF Split acted as a Chair for the meeting. The Agenda adopted by the meeting is attached as Annex B. As indicated in the Agenda, the meeting was organized around national reports and the presentation of specific working papers.

Current knowledge and status of small-scale fisheries in Adriatic countries (Agenda item 2)

The FAO-AdriaMed Fisheries Officer, Ms Nicoletta Milone, recalled the reasons for organizing this meeting, including the need to address small-scale fishery in consideration of the shared stocks issue, which is particularly relevant in the case of Adriatic fisheries. She explained that the FAO Code of Conduct for Responsible Fisheries (CCRF) and its implementation has been a central tenet of the AdriaMed Project that, in the case of small-scale fisheries, should mean securing employment, income and sustainable fishing practices. She recalled the outcomes of the first regional meeting on small-scale held in Split on 2003[1] and the decision taken by the 12th and reiterated by the 13th Coordination Committee meeting (Ljubljana, 2011 and Tirana, 2012 respectively) to support the organization of a second regional technical meeting on SSF given the importance of the topic and the need to update the information available.

She recalled that the 29th Session of the FAO Committee on Fisheries (COFI) held in February 2011 (Rome, Italy) agreed on the important role played by the small-scale fisheries sector, particularly for developing countries in the context of food security and poverty alleviation. It approved the development of a new international instrument on small-scale fisheries that would draw on relevant existing instruments, complementing the CCRF, COFI agreed that the instrument should take the form of international guidelines and that it should focus on the needs of developing countries. The Voluntary Guidelines on Securing Sustainable Small-Scale Fisheries.

She then introduced the objectives of the meeting: i) to review, on the basis of experts' experience, the current knowledge and the status of small-scale fisheries in Adriatic countries; ii) to consider the existing monitoring systems of SSF; iii) to have up-to-date information on the available scientific and technical knowledge in each country and on the on-going programs focusing on small-scale fisheries. Species whose stocks are shared among national SSF and fishing gears exploiting them are to be dealt with by the Technical meeting. Gaps and priorities related to the monitoring and evaluation of SSF should be identified and the basis established for cooperative future work either within AdriaMed or other contexts.

[1] AdriaMed. 2005. Adriatic Sea Small-scale Fisheries. Report of the AdriaMed Technical Consultation on Adriatic Sea Small-Scale Fisheries. Split, Croatia, 14th – 15th October 2003. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD15. *AdriaMed Technical Documents*, 15: 184 pp.

As starting point of discussion the Meeting then was called to agree on a working definition of small-scale fisheries.

For what concern the working definition of SSF some indication provided by the Draft "International guidelines for securing sustainable small-scale fisheries"[2] and the great diversity of the small fisheries sector in the Adriatic Sea were considered. As follow up, two general criteria were analysed: i) Size and engine of fishing craft/vessel; and ii) Type of craft/vessel.
In face of the necessity to define small-scale, artisanal fisheries, full consensus could not be reached. A wide discussion took place whether account or not, in the small-scale fishery category, fishing vessels larger than 12 m overall, active gears (e.g. beach seiners), or some type of bottom trawl net towed by small vessels. Various broad definitions were considered. The current European Commission classification of small-scale fishery was also considered (i.e. article 26 of the CR 1198/2006 including vessels not using towed gear as listed in Table 3 in Annex I of Commission Regulation (EC) No 26/2004 of 30 December 2003 regarding the fishing vessels register of the Community). It was concluded that, due to differences in the five countries concerned, a flexible and wide working definition would be preferable for the aims of the meeting to a complete and closed one.
The participants agree to refer to small-scale fisheries using the following description: "*commercial fishing carried out by all gears excluding trawlers, purse seiners targeting small pelagics and tuna fisheries*".

The present knowledge and status of the small-scale fishery sector of Adriatic coastal countries was then reviewed. National reports including the description of the systems adopted by the countries to monitor the small-scale fishery sector were presented.

Albania (Çobani, this report). Ms Jerina Kolitari presented the situation of SSF in Albania. Most small-scale, artisanal fisheries is practised without a licence. Only a small fraction of fishing units are licensed and therefore registered, while the large majority are not officially accounted for. Artisanal fishery has developed remarkably since the 1990s as an alternative to unemployment and low income in coastal areas. A preliminary survey exercise was carried out in summer 2003 in the framework of the AdriaMed Project. At that time total of 462 fishing units performing small-scale coastal fishing were recorded. A total number of more than 900 fishers was estimated. After ten years the situation has slightly changed. A new law *"On fisheries" (64/2012 of the 31.05.2012)* has been prepared in the framework of TAIEX[3] in January 2010, based and reflecting the key concepts of EU regulations. Some figures on the current situation of the sector in the country were reported. In 2011 an EC funded *IPA Project "Establishing and Strengthening a Monitoring, Control and Surveillance (MCS) System for Fisheries in Albania*" performed a social survey for artisanal fisheries 2011. (Kolitari &Kristo, this report)

[2] FAO. 2012. Zero Draft of the International Guidelines for Securing Sustainable Small-scale Fisheries.
[3] European Union Technical Assistance and Information Exchange instrument to support partner countries with regard to the approximation, application and enforcement of EU legislation

Croatia (Dulčić, this report). Croatia has a long tradition of small scale coastal fishing, as indicated by the 55 different fishing gears officially listed as currently employed. The types and quantities of fishing gear and equipment used in Croatia and the legal provisions regulating their use are outlined. One layer gillnets and three layer trammel nets are probably the most commonly used fishing gear for SSF along the Croatian Adriatic. The total amount of small-scale licences was estimated at around 8500 in 1999 by national experts but at present it could be much higher. The impact on coastal resources is believed to be significant. Commercial fisheries encompass commercial fisheries *sensu stricto* and the new category of small scale coastal "subsistence" fishery, which is limited in terms of gears and manner of operation. Official statistics of the Fisheries Directorate for the period 2009-2010 counted around 4,000 vessels (number of vessels approximately corresponds to number of licenses) in the professional fishery sector, of which 3,360 vessels are under 12 m indicating their artisanal character, and 12,000 vessels registered under the subsistence category. Long-term (1960-1995) localised monitoring of some small-scale fishing communities showed evidence of marked decline of CPUE, in contrast to the increased number of fishing gears. It is thought, although unsubstantiated because of lack of specific fishery statistics, that small-scale fishery could comprise more than half of the Croatian landings of demersal species. In order to reduce conflicts between fishing segments using active and passive fishing gears, particularly in the channels area of Croatia, current fishery regulations adopt a system of seasonal and spatial closure. This technical solution avoids the simultaneous use of potentially conflicting gears.
Priorities and main gaps related to the Croatian small scale fisheries sector were presented. Guidelines for future management in terms of the monitoring and data collection framework proposed by the EU (EU Data collection Framework DCF, (EC) No. 665/2008 of the 14 July 2008) were dealt with.

Italy (Sabatella, this report). In Italy small-scale fishery is the most relevant fishery sector from a social and job-related point of view. The small-scale fleet segment is composed of vessels with total length (LOA) of less than 12 m. They are allowed to use only passive gears excluding towed gears of whatever type. Italian small scale fisheries followed in 2011 the general path of the last few years: the sustained increase of intermediate costs, together with a decrease in the production level, eroded added value and profits, further weakening the sector already in economic recession. Several factors affected the decrease in total captures and unitary productivity, such as the increase in fuel price and the restrictions set by European Council Regulation (EC) n. 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea. Moreover, fishing activities, which have represented traditional working opportunities in fisheries dependent areas, are not attracting young generations anymore. Indeed the lack of recruitment is one of the most important factor of weakness for the segment.
In the reform of the UE Common Fisheries Policy, small-scale and coastal fisheries assumes an important role in consideration of the local society and cultural identity of numerous European coastal regions. The Commission, in developing its proposal, has taken in due account the introduction of more market-based instruments while taking into consideration the specific characteristics of small-scale fleets.
At national level, the expected management measures concerning small-scale fishery will be focused on the possibility of enforcing property rights on the country's actual situation. Recently, through the provision of Article 37 of Regulation (EC) 1198/06 on the European

Fisheries Fund - (EFF), which allows the possibility of financing the drafting of local management plans - local communities have been provided with an intervention tool that is totally innovative in relation to presently available management instruments. Key-factors to be taken into account for the sustainability of small-scale fisheries and their management were proposed. Possible options for the future development of the sector in terms of income integration (e.g. fishery tourism) and fishery management (e.g. rights-based management) were presented.

Montenegro (Ikica, this report). Legal framework in Montenegro recognizes small–scale fisheries (commercial), which differ from large–scale fisheries in vessel size, type and number of fishing gears permitted. There is only limited data available on the size and catch of the current small–scale fishing fleet. The number of licensed vessels (70) represents only a part of the total fleet, and apart from some estimations, poor data on catch of small–scale fishing fleet are available, both regarding the catch in weight and catch composition. Gillnets are the most common type of fishing gear used in small–scale fisheries, followed closely by trammel nets and beach seines targeting pilchard (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*). A new project focusing on small–scale fisheries, supported by the Ministry of Science of Montenegro, is expected to fill the gaps in knowledge of this type of fishery.

Slovenia (Švab, this report). Small scale fishery is one of the important segments of Slovenia fisheries sector. On the other hand it is also poorly explored and without systematic scientific surveys. Since 2004 small scale fishery is monitored as all other segments of Slovenian fishing fleet. Data on small scale fisheries are collected under the EU Data collection Framework DCF, (EC) No. 665/2008. A definition of small scale fisheries is not provided by the national fisheries legislation. Practically small scale fisheries are composed by small less than 12 m long vessels equipped with passive fishing gears. The current number of fishing units that may be attributed to the small scale fishery sector is estimated at 61 vessels. Indicatively, the average yearly catch could be estimated at around 54 tonnes. An integrated regional approach to the management of this fishery, through the preparation of harmonized multiannual management plans for the Northern Adriatic Sea was indicated as a priority action.

Small-scale fishery exploitation dynamics and interaction with other fisheries (Agenda item 3)

The heterogeneity of small-scale fisheries was well depicted through various examples and studies of fishing activities that fall within the small-scale fishery category. Interaction among fisheries, selectivity of some gears and the sustainability of fishing practices were discussed.

An example was provided by the analysis of long-term trends in the structure of eastern Adriatic coastal resources and their consequences for fisheries management (Matić-Skoko, this report). Although official statistics of small scale fisheries are probably underestimated the scientific data available in Croatia on SSF count on more than 65 years of scientific investigations. Data were collected through direct sampling using R/V “Bios” (now “Bios

II") or speed boat "Navicula" or through analysis of commercial landings in collaboration with numerous fishers and also through their logbooks and numerous questionnaires. Results of almost two decades of monitoring programmes of coastal fish resources were presented in terms of littoral communities' state and future management actions. Several positive effects were registered in concomitance with strictly management strategies adopted. To confirm the hypothesis that legislative changes can have the potential to shift artisanal fishery towards better sustainability, some specific investigation offshore the Adriatic region, in the island Vis area, was carried out. As a result, significant increases over time were observed in most of the community indices analyzed, as well as, directional changes in abundance and biomass catch composition of littoral fish resources. For example, comparison of catch structure of trammel nets with minimal inner mesh size of 28 mm and those that are now in use of 40 mm shows that positive responses were primarily related with a recovery of *Mullus surmuletus* stock.

The example of the small-scale fisheries in Marine Protected Areas (MPAs) in Croatian Adriatic Sea was illustrated (Stagličić, this report). According to the Croatian Nature Protection Act, which is the baseline regulation governing nature protection, protected areas are classified in 9 categories which easily translate into the corresponding internationally determined IUCN protection categories. Currently, there are 432 protected nature areas designated in various categories, covering 8,5% of total area of Croatia, 12,1% mainland area and a little less than 2% of marine area.
Regulation of fishing activities in each of the MPAs is variable, but there is a major distinction between national and nature parks. National parks afford greater protection since by definition they exclude all commercial activities and thus much of the fishing is automatically prohibited : all the large-scale industrial fishing as well as professional small-scale. However, engaging in traditional agriculture and fisheries for subsistence needs is allowed since parks are at least seasonally inhabited. Considering the critical socio-economic importance of small-scale artisanal fisheries a compromise solution between the need of local people and protection of biological resources has been made. Although some data are available on the interactions of the multiple uses of MPAs, including fisheries activities, there is the need to establish in MPAs systematic monitoring programmes to evaluate whether this kind of protection in MPAs manages and regulates small-scale fisheries in a way compatible with the sustainable use and conservation. Although, at present, a global picture of the fisheries activities in Croatian MPAs is not complete, some measures to be adopted for improving the situation have been addressed (e.g. setting up systematic monitoring of artisanal fisheries resources; ensure strict implementation of regulations through effective surveillance; remedying critical gaps regarding inter-sectorial cooperation in marine conservation-fisheries legislation). Full participation of fishing communities in decisions on the sustainable use of natural resources should be facilitated as well as monitoring and surveillance through innovative approaches to marine conservation (co-management). Scientific knowledge and research needs to be integrated with traditional knowledge of fishermen as participation and involvement of the local fishermen is really the key to a successful protected area.
Within the same country a brief overview of a project VIP (Ministry of Agriculture, Forestry and Water Management) carried in 2005-2006 on longline in Croatian open sea was provided by Mr Vrgoć (IOF). Two types of longlines are used in Croatia: longlines in open sea and

coastal longlines. The actual system of statistics collection does not allow to differentiate among the two types as all the data collected falls in the longlines statistics. Also the license system does not make any difference among the two types. So far is not possible to understand the impact on the natural resources of the two different lonline fishing segment. About 60 fishing vessels operate with lonlines in Croatia, 50% of them based in Komiza (Vis Island, Central Adriatic). The use of this fishing gear is only allowed on week-end while the Italian fishing fleet is not operating. Up to 1995, the information collected by the fishermen report that long line fisheries was generally used to catch *Raja clavata*. In comparison, nowadays, the same fishermen report that *Trigla lucerna* represents the majority of the total catches.

Some case studies from Italy on small scale fisheries in the Adriatic Sea were illustrated (Grati *et al.* this report). The artisanal fleets of the western Adriatic mainly include fiberglass planing vessels having an average GT of about 2 tonnes, Length overall (LOA) of 6-12 m and average engine power of about 30 kW. The crew is usually composed by 1-2 people. Set gears include gillnets, trammel nets and different types of traps. Different fishing gears are used seasonally on the basis of the ecological behaviour of the target species. Gillnets are mainly used to catch common sole (*Solea solea*) and mantis shrimp (*Squilla mantis*) from spring to autumn. Basket traps are used to target the gastropod *Nassarius mutabilis* from autumn to spring. Trammel nets, fyke nets and pots are used to target cuttlefish (*Sepia officinalis*) in spring during the inshore spawning migration. *S. solea* and *S. officinalis*, along with other abundant species which are not directly targeted by small-scale fishermen but retained and commercialised (i.e. *Chelidonichthys lucernus*, *Penaeus kerathurus*, *Mullus* spp., etc.), but belong to important stocks shared between Italy, Slovenia and Croatia fisheries. In the last 20 years the Institute of Marine Science (ISMAR-CNR) of Ancona (Italy) carried out several Research Projects on the technical features of artisanal fisheries in the Adriatic Sea. The technical features and selectivity of gears, and composition of retained and discarded catch were illustrated. The results of two research projects carried out to assess the selectivity of sole gillnet using a model of between-set variation and to analyse the efficiency and the impact of the diameter of the net line were also reported. The ultimate goal of these studies was to identify the most adequate mesh size and monofilament diameter to reduce the retention of juveniles soles and discard, without strongly affect fishermen income. Two studies, on "the selectivity of basket traps for *Nassarius mutabilis*" and on "the management of the resource *Nassarius mutabilis*: adoption of basket traps with a mesh size optimized for the retention of legal sized specimens" were also dealt with. Moreover the results of a study developed inside the framework of the EU Project COEXIST (FP7-KBBE-2009-3) were illustrated. COEXIST developed a broad, multidisciplinary approach to evaluate the interactions of human activities with the goal to provide a roadmap for a better integration, sustainability and synergies between these activities in the coastal zone.
The study on *Sepia officinalis* set within this framework had the ultimate goal to increase the knowledge on the set gears mostly used to exploit cuttlefish, investigating on an experimental basis their efficiency and catch yields. The assessment of importance of by-catch and discard also allowed to evaluate the impact of each gear on the target species and on the demersal community.

A detailed description of small-scale fisheries in the Maritime Departments of Veneto region (GSA 17) and Puglia region (GSA 18) is given by Gambino and Malvarosa (this report). A comparison between fishing vessels using passive gears less than 12 metres LOA and bottom trawlers less than 12 metres LOA was provided in the two region. The activity pattern of the different fishing segments, their fishing grounds, target, by-catch and discard species were studied. The structure and economic performance of the fleet, the production and the main species caught, the profitability of the fishing enterprises and the flee adjustment plans adopted were analysed over a four-year period (2008-2011). A list of six socio-economic indicators have been applied to establish whether a balance has been achieved between these fleets and the available fishing opportunities.

The importance to prepare specific fisheries management plans, even local management plans was addressed by the meeting that underlined the important role of specific local small scale fishery activities. The example of some fisheries that have an important sociological and cultural role and the need, then, to preserve small scale fisheries as important cultural value, were brought to the attention of the participants.
The situation of beach seiner fisheries in Croatia was illustrated. The participants were recalled that Croatia is in the process to developed a fisheries management plan for beach seiners. The management plan foresees spatial temporal restrictions in term of licenses (by reducing them) and time (by reducing the fishing period). The example of the beach seiner "*migavica*" was dealt with. Most of the beach seiners fishing area coincides with *Posidonia* beds, and consequently an active campaign to map *Posidonia* bed is foreseen by the management plan.
Some technical characteristics of beach seines like the mesh size, and the areas where beach seines are used in Croatia are not strictly in accordance with the EU as well as the Croatian regulations. Although the beach seiners fish on *Posidonia* beds, at present, no penalty are in place for the illegal use of the net. The Croatian law on fisheries already incorporated the Mediterranean regulation of EC, accordingly new fishing zones, which will not be *Posidonia* beds, should be identified. The yield of the main target species for beach seiners, *Spicara smaris*, is strictly related to the mesh size. If an increase of mesh size will take place to adapt with the EU regulations, the catch of *Spicara smaris* will drop dramatically (close to zero). During the negotiations with the EU, a derogation could be requested for the mesh size but this would not solve the problems related to the areas in which the beach seines are used.
The same problems applies to other fishing gears like *srdelara*. No derogation can be requested for s*rdelara* fishery as its target species is *Sardina pilchardus* which is included in Annex iii of the EC Mediterranean regulation.

Main gaps and priorities concerning small-scale fisheries and their management (Agenda item 4)

The important role played by the small-scale fisheries sector, particularly for developing countries in the context of food security and poverty alleviation was illustrated by Matthieu Bernardon (FAO). He recalled some background information on the *iter* that will lead to the development of a new international instrument on small-scale fisheries. Small-scale fisheries have been accorded a standalone agenda item in the FAO Committee on Fisheries (COFI) since its 25th Session in 2003. In 2008, a global conference on *Securing Sustainable Small-Scale Fisheries: Bringing together responsible fisheries and social development* was held in Bangkok, Thailand (also referred to as Bangkok Conference). The Bangkok Conference was preceded by a civil society preparatory workshop that confirmed the urgency to address small-scale fisheries rights. The Bangkok Conference re-enforced the claim that small-scale fisheries have yet to fully realize their potential to significantly contribute to sustainable development and the attaining of the UN Millennium Development Goals (MDGs). Following a recommendation of the 28th Session of the COFI in 2009, the FAO Fisheries and Aquaculture Department embarked on a consultative process to examine the need and various options for an international instrument on small-scale fisheries and a global assistance programme for the sector. This consultative process also aimed at identifying good practices – in particular with regard to governance, resource management through the implementation of an ecosystem approach to fisheries, disaster risk management and climate change adaptation – that could serve as inputs into the development of an instrument. The outcomes of this process expressed strong support for the creation of an international instrument as well as the delivery of an assistance programme. At the 29th Session of COFI in February 2011, the Committee agreed to these suggestions and recommended that the international instrument should take the form of international voluntary guidelines. Accordingly, the FAO Fisheries and Aquaculture Department now continues its support to small-scale fisheries by preparing – in close collaboration with its partners and sector stakeholders – a proposal for *International Guidelines for Securing Sustainable Small-Scale Fisheries.*

The wide range of themes and issues indicated by the Guidelines, that relate to the small-scale fisheries sector were illustrated by Mr Bernardon. It was pointed out that this description could facilitate and lead the discussion during this meeting. Given the scientific background of the meeting emphasis was given to the "Research and information needs, sources and exchange" thematic area. The need of harmonization of the information available on small scale fisheries, the data collection and in general of the data needs was then underlined. The harmonization of information, in general, is fundamental if a common approach has to be discussed and developed for the Adriatic small scale fisheries.
To this extent the active role of fishermen in data collection with the added value of their empirical knowledge, was dealt with. The importance to reinforce the cooperation and collaboration between the small scale fisheries stakeholders (mainly the fishermen) and the research institutions was indicated as valuable steps to improve the flow of information, the data collection and the development of management plans for small scale fisheries.

The invitation to maintain the discussion on SSF both a sub-regional and national (even local) level was formulated by the experts. Further to this it was pointed out that when dealing with

shared stocks and subregional management processes, attention should also be paid at national management plans to tackle issues like territorial access rights.

Following the discussion, common constraints and priorities for the small-scale fishery sector of Adriatic coastal states were highlighted. The participants reviewed the gaps identified during the meeting of 2003 (reported below in *italic*), as starting point of the discussion and with great surprise concurred that few significant steps have been made to tackle them and major gaps still remain at national and subregional level.

Primarily, it should be pointed out and considered that some countries have monitoring programmes to collect data on SSF while others are dealing mostly with estimates that are mostly guess estimate. It was stressed that the social and economic component of small-scale fishery should be included in defining main gaps in and priorities for scientific knowledge.

Lack of appropriate and complete statistics was identified as one of the main constraints for most of the Adriatic coastal countries. It was pointed out that a distinction has to be made between types of statistics needed, such as biological and economic, and that economic statistics should, among other things, include data such as level of employment, catch quantity and value. Furthermore, data on fleet composition, fishing season, area and, ideally, on by-catch should be collected.

Another gap was the lack of up-to-date information regarding the different types of fishing gears used in small-scale artisanal fisheries.
However, the data collection itself, if not properly performed, cannot fulfil the gap. The need to proceed with a data collection system which is harmonized among all the Adriatic countries was urged. In addition an effort to standardize and compare the data already available and collected should be seen as priority.

The importance of recovering and making full use of available historical time series data was stressed, especially because data of this type are especially lacking in Mediterranean region. This also considers that it might be difficult to have sufficient financial resources to carry out new campaign of data collection, due to the current world economic situation.

In terms of management problems and future development, it was stated that up to now, management of SSF has often been targeted to fishing gear, whereas individual species are caught with variety of gear types, and that management needs to be based on all gear types used. The need to improve the knowledge on temporal and spatial occurrence and abundance patterns of the main species exploited by small-scale fishery was reiterated. This should be further integrated with the quantitative evaluation of interaction between different fishing gears. Interaction evaluation should be done for main target species, secondary target, and by-catch species.

Although some of the Adriatic countries are EU countries and most of them reflected in their national legislation the EU main directives on fisheries, differences between national normative frame in the Adriatic region are still evident. The need to harmonize regulation, in

order to improve also the development of harmonized fisheries management plans was brought as a gap/priority by the participants.

It was also highlighted that each country has its own objectives when developing a fisheries management plan (developmental, environmental, economical, etc.) and that reaching a consensus by encompassing all the peculiarities of each country, including geopolitical considerations, should be necessary and a priority when developing a subregional fishery management strategy and approach. To this extend o*ne* of the suggested priority included the hamornization of fisheries management plans, already in place or to be prepared. Within the process of preparation of sub-regional multiannual management plans, the expert from Slovenia reiterated the opportunity to consider alternative treatment of fisheries in specific subregions such as the Bay of Trieste (North Adriatic). Accordingly the important involvement of the AdriaMed Project as a neutral forum where to tackle such issues, was concurred by all the participants.

Marine conservation zones, in general, including Marine Protected Areas, Special Protection Areas, Special habitats and other type of protection measures should be then further dealt with. The participants were informed on the forthcoming meeting of the Forum on Marine Protected Areas in the Mediterranean (MEDPAN, 25th - 28th November, Antalya (Turkey). The implementation of MPAs was considered relevant for the development of SSF by the participants. Accordingly, it was agreed that one point of the agenda of the next meeting of the WG on SSF could be dedicated to the outcomes of the MEDPAN meeting. The AdriaMed Project, through synergies with AdriaPAN, may investigate the feasibility to gather/map the list of all the "special areas" existing in the Adriatic Sea. This could constitute a first step towards the characterization of the interactions between these special areas and the small scale fisheries.

Full participation of fishing communities in decisions on the sustainable use of natural resources should be facilitated as well as monitoring and surveillance through innovative approaches to marine conservation (co-management) should be considered.

Finally, given the economic situation at world level, the importance to ensure funds dedicated to research on small scale fisheries was considered as of utmost importance.

Outlining of a possible joint work-programme to be implemented at regional level in the Adriatic (Agenda item 5)

The Technical meeting identified the following activities to be regarded as priority and functional to promoting regional scientific cooperation, focusing on the small-scale fishery sector. Other issues that may be highly relevant at national level were not included. Although these were brought forward at the meeting, they were not considered in this context. All these activities will be brought to the attention of the next AdriaMed Coordination Committee meeting.

Upon extensive discussion the following topics were agreed on:

i) Re-establishment of the annual expert meeting on small scale fisheries, namely the Working Group on Small scale fisheries within the framework of the AdriaMed Project. The need to strongly cooperate and take advantage of the already established AdriaMed Working Groups on Fisheries Resources (both Demersal and Small Pelagic) was concurred. This could facilitate the work of the new Working Group and could support in addressing issues like the conflicts or interactions among small scale and industrial fisheries. As first step in this direction, the participants agreed to organize the next meeting tentatively back to back to the Working Group on Demersal Fisheries Resources meeting.

ii) A comprehensive case study aiming at characterizing the small scale fisheries in the Adriatic Sea. Given the difficulties to compare data in the different countries, a discussion was held to identify fishing gears commonly used in all the countries. Several differences and similarity are in place, target species are not necessary the same for each gear, but the effort to identify fishing gears that can be, somehow, representative of wide coastal communities was deemed necessary. The participants, then agreed to initiate a pilot study focusing on trammel nets and gillnets, that probably could be used as indicator of the state of coastal community. Long time series of fishery related data in some countries are available and they could be used as starting point to initiate the appraisal of the situation of small scale fisheries in the Adriatic Sea. This would also facilitate the development of a common strategy for the sustainable development of SSF at subregional level. The pilot study will address common points and differences, specificity, the importance and the role at local level and subregional level of small scale fisheries. One of the outcomes could be the description of the changes in the fishing community. The pilot study could be done according to a standard scheme that could potentially be applied later to other communities. This would improve the comparison of results, their validity and expansion to a wider scale.

iii) An appraisal of the critical areas. This could be initiated by the definition of critical areas (such as spawning and nursery areas) and their mapping. Stock will be taken on the work already carried out by the Project on these issues.

iv) An inventory list of all the data available at national level. The participants agreed to include in the national reports, a summary table which will constitute the basis of discussion for the next meeting of this Working Group. The Project will circulate a common template for the collection of data in the intersessional period.

v) Development of a database holding information on the new species (mainly lessepsian species) recorded in the Adriatic Sea.

vi) Identification and compilation of the list of species on which focus the future common analysis. One difficulty is related to the data available. For some of the selected species data could be available simply because they are included in the DCF, although this apply only to the EU countries. In order to avoid this problem and to ensure a proper coverage of data, the list was urged as priority. A tentative list was proposed, which include: *Solea solea, Sepia officinalis , Trigla lucerna, Squilla mantis, Merluccius mercluccius, Mullus surmuletus,*

Nephrops norvegicus, Merlangius merlangius. The participants agreed that the Project will circulate this preliminary list and among it two or two species may be indentified to initiate to work with.

Other matters (Agenda item 6)

The Meeting was briefed by the AdriaMed staff on the forthcoming meeting organized by the General Fisheries Commission of the Mediterranean (GFCM) on Small Scale Fisheries. The participation of Adriatic experts will be foreseen also to present the outcomes of the current meeting.

Annex A

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Annex B

Agenda

1. **Opening of the Meeting**
   The objectives of the Technical Meeting will be introduced to the participants and discussed.

2. ***Current knowledge and status of small-scale fisheries in Adriatic countries**
   Present knowledge and status of the small-scale fishery sector of Adriatic coastal countries will be reviewed and discussed through the presentation of national reports. The issue of small-scale fishery definition as used/adopted in each country will be tackled. The reports will also include description on the systems to monitor the small-scale fishery sector adopted by the countries. Current or planned research programmes at national or international level will be briefly described.

3. ****Small-scale fishery exploitation dynamics and interaction with other fisheries**
   Particular attention should be given to those species whose stocks are shared in the Adriatic as well as those targeted by large-scale fisheries. Possible interactions with other fisheries such as sports and recreational fishery could also be considered.

4. **Main gaps and priorities concerning small-scale fisheries and their management**
   On the basis of the above and of the ensuing discussion the Technical meeting will identify priority topics relevant to small-scale fisheries development, research and management in the Adriatic.

5. **Outlining of a possible joint work-programme to be implemented at regional level in the Adriatic**
   Hypotheses for cooperative research programmes will be formulated on the basis of the above points.

6. **Other matters**
   Arrangements for the finalization and publication of the Technical meeting report and any other matters as necessary.

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* Agenda items 2 will be dealt with through invited National Reports

** Agenda item 3 will be discussed on the basis of the working papers (case studies) presented

Small-scale fisheries in Albania

Mimoza Çobani[1]

Abstract

Artisanal fishery in Albania has developed remarkably since the 1990s as an alternative to unemployment and low income in coastal areas. More than 70% of the total licensed fishing vessels is represented by small scale (commercial) fisheries, and, apart from some estimations, poor data on small–scale fishing fleet catch are available, both regarding the catch in weight and catch composition. Gillnets, trammel nets, entangling nets are the most common type of fishing gear used in small–scale fisheries, targeting mainly demersal fisheries resources.

1. The definition of small–scale and/or artisanal fisheries currently adopted in Albania

Artisanal fisheries are a key sector of marine capture fisheries, which should be highly considered when "resource management" philosophy and practice are in place. The importance of this fishery category in Albania come to a very significance when analyzed, gathering the complexity and multidimensionality items, like managerial, biological, socio-economical, ecological, traditional, etc. Together with a big demographic pressure on the marine coast, the pressure and the irregularity of this fishing category is highest, also. In Albania, the artisanal fisheries sector and related fishermen represents a way of life; they fish for subsistence or to sell to local markets, generally using traditional fishing techniques and small boats and are vital to livelihoods and food security. Although this fishery, by the years, has been mechanized it tends to use traditional fishing gears such as small nets, traps, lines and spears. Biodiversity of the catch is relatively high. Harvests include a greater variety of high value species than in large-scale fisheries. The selectivity of fishing gears is also higher than large scale fisheries.

1.1 Legal aspects

According the National Legislation, namely the Law "On Fisheries" (Law Nr. 64, of 31.05.2012) fishing activity is divided into:

a. Commercial fishing: divided into Professional Commercial Fishing and Artisanal Commercial Fishing.
b. Recreational/sport fishing;
c. Fishing for scientific and study purposes.

Therefore, as per legal definition, the term small scale fisheries will be used in this document in reference to the artisanal commercial fishing.

[1] Ministry of Environment, Forestry and Water Management, Rruga e Durresit, Nr.27, Tirana, Albania-mcobani@moe.gov.al

Fishing licenses are included in category III.5 of Annex of Law No. 10 081, dated 23.2.2009 "On licenses, authorizations and permits in the Republic of Albania". The fishing licenses are released by the National Centre for Licensing (QKL) with the agreement of the License Commission at the Ministry. Several articles of the Law refers to artisanal fisheries[2].

Although the Albanian Fishing Fleet Register has a section dedicated to the Artisanal Commercial Fishing, no data covering this segments are collected by the fisheries administration on a routine basis.

1.2 Status of the national small scale fisheries

According to the National Fishing Fleet Register, the total number of commercial fleet in 2012 is composed by 468 vessels. Most of these vessels is older than 40 years old. Out of the total, the number of artisanal fishing boats accounts for 328units. This figure, however can be lower if considering that registered (licensed) fishing vessels that change owners can be registered (licensed) as new fishing vessels.
In contrast the real number of fishing vessels can diverge: in fact, according to an unofficial field survey exercise carried out by the Fisheries Department the approximated numbers of fishing boats accountable as small scale fisheries vessels is around 650. On average, the small scale fishing vessels unregistered/unlicensed, in each Albanian coastal segments, account for the 60% of the total small scale fishing vessels in the segment.
Generally the small scale fishing vessels operate within the 2-4 miles of the coastal areas. According to the shelf nature it varies from 2 miles in the Ionian part and 4 miles in the Adriatic Sea.

In addition, several lagoon areas cover the Albanian territory, the most important of which are: Patok, Karavasta, Narte (Narte), Gulf of Vlora (Vlore), Gulf of Drini River (Kune & Vaini) and Lake Butrint.

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[2] **Article 43 of the Law**: "Any navigation vehicle used for commercial fishing is registered in the Registry of Fishing Vessels (RFV), which is established and administered by the Fisheries Directorate (FD) in MEFWA".
Article 117 of the Law: "A multiannual National Programme for the collection, management and use of biological, technical, environmental and social-economic data is legally established".
Article 8 of the Law: Types of fish object to fishing/catch

1. To ensure and improve a sustainable development of the marine environment, the Ministry determines by Regulation the type or types of fish object to fishing at sea and inland waters of the Republic of Albania based on:
   a. fish species or group species; or
   b. respective fishing areas
2. The Regulation approved by the Minister, among others includes:
   a. Albanian and scientific name of the fish species;
   b. Geographic coordinates of the fishing area; and other data which is relevant for the management of fish species in accordance to this law

Article 20/1/e of the Law:
Support the small-scale coastal artisanal fisheries to improve and control the conditions of access to water and water resources, promoting the organization of the production chain, processing and trade of fish products, encourage initiatives of voluntary reduction of fishing effort and protection of resources, encouraging the use of new technologies (fishing techniques that increase selectivity beyond those provided by law and which do not increase the fishing effort).

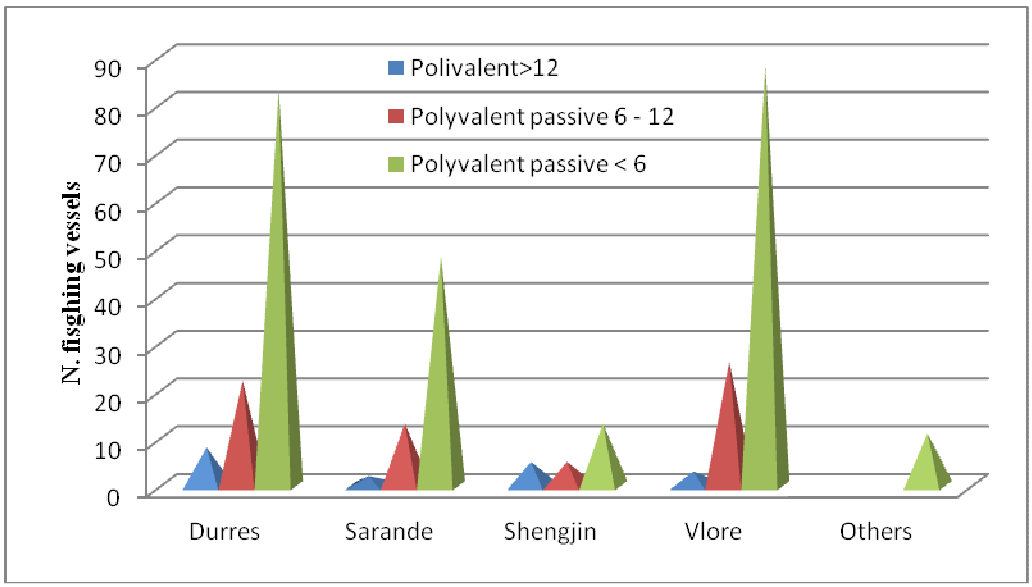

Figure 1. Distribution of artisanal (commercial) fishing vessels in the ports of Albania.

Within the artisanal fishing vessels there are two categories: coastal fishing vessels and coastal lagoons vessels. The difference between these two categories is mainly due to the registering/licensing system.

The Port Authorities/ Border Policy release the licenses for the coastal fishing vessels.

According to the current law, the fishing rights in the lagoon are of the company that manages the lagoon, so the company can release fishing licenses to vessels to fish in the lagoon. This situation cause some forced interaction in the areas closer to the lagoons: the coastal lagoon fishing vessels take advantage of the license and go often out of the lagoon in the area close to the lagoons to fish, thus creating some conflicts with the coastal fishing vessels with regular license.

Figure 2. Examples of artisanal commercial fishing vessels in Albania.

Social aspects:

About 1500 people work in this sector. the small scale fisheries is generally a familiar activity (often women and young members of the family are involved). Accordingly the fishers are involved in all the aspects of fishing activities, from merely fishing to the maintenance of the engine to the management of the nets (repairing, cleaning netting) to the sale.

Artisanal fishing in Albania is on a seasonal and part-time basis, oriented toward seasonal and high price species. Small scale fisheries is a traditional activity which is embedded in the culture and tradition of the country. The fish product, especially during May-October is sold on the boat, just anchored and removed from the nets, aims to be sold fresh and totally amount, since in this period the fish price is rather high, avoiding selling to the wholesale fish points to which is a secure point of selling but by less money.

During May-October generally the small fishing vessels sell the fish products directly on board. This ensures a high price due the higher market requests, and make the fishers avoiding the transportation to the wholesale points, where, the selling price is lower, although the selling is ensured.

During autumn and winter time, when the fishing activity is reduced, the fish product often is only used for personal use as an important food income of the fishers' family.

Conflicts are generally with other users of the resources rather than with other small scale fishing vessels. The small scale fisheries is often part of the economic activity of a family, that supplement the family income with agriculture activities, tourism and secondary services.

A source of conflict is often derived from the large industrial fishing vessels (mainly trawlers) that operate very close to the coasts, often destroying the small scale fishing nets. These conflicts urge the establishment at national level of small-scale/artisanal fisheries management plans and actions, vessel registration system and inspection schemes.

The total fishing days varies from 180 fishing days in Adriatic Sea and 200 fishing days in Ionian Sea.

The average catches per fishing day/trip are 4-7 kg fish by average earnings of 2-4 $/fishing day.

Generally around 30-40% of the total income is invested for boat and nets repairing, fuel, new boats gears and engines.

The main artisanal fishing gears are:

Gillnets, trammel nets, entangling nets, throw or cast nets, rakes and scrapers, traps, uncovered pound nets, hand lines, hooks, harpoons and spears are the fishing gears generally used by small scale fisheries.

In the Adriatic coast, the more frequently used are: trammel net, gillnetters, entangling nets, uncovered fishing ponds, different measures of concrete/metallic like –pots.

In the Ionian Sea the main fishing gears are long lines and gillnetters.

Specifically: Gillnetters 28mm mesh size in April-May, in marine water of more than 4m depth for fishing different breams.

Gillnetter's 40 mm mesh size, in June for fishing hake, gurnards, groupers and European flounder.

Gillnetters over 32 mm mesh size, in March- May for fishing mullet, cuttlefish.
The uncovered fishing ponds are widely used in Adriatic Sea area for catching spring species along the coasts, like big pelagic and, also sea bass, sea bream and mullets. Generally, in Albania the double room system is preferred.

The concrete pots and metallic cages are used for fishing octopod. The amount of fishing gears varies but generally 1000 ml/ fishing boats.
30% of fishing gears are built by fishermen's themselves and 70% in private professional manufactory. The photo below has been taken in such manufactory.

Figure3. Nets used by small scale fisheries and fishing vessels in the port of Durres.

Technical aspects:

Around 90% of small scale fishing boats have a 5-40 HP engine, 10 % are without any engine.
The fishing boats are generally made for about 80% of plastic and fiberglass (Vetro-resina), and about 20% of wooden material (100% produced in Albania). The larger percentage of wooden fishing boats is on Adriatic coast.
The small scale fishing boats generally do not use fishing ports but they are anchored capillary on the entire length of the Albania coasts.

Biological aspects:

According to the fishing gears used mostly in the Adriatic Sea, the most important species caught are: *Dentex spp. Soleidae, Diplodus, Parapenaeus longirostris, Octopus vulgaris, Mugilidae*, *Platichthys flesus, Sepia officinalis,* etc..
Secondarily there are: *Lichia amia Seriola spp, Sparus aurata, Dicentrarchus labrax, Merluccius merluccius, Sarda sarda, Scomber spp., Pagellus spp.,* etc.
On the contrary, on the Ionia Sea, the fishing gears used target: *Sciaena spp., Diplodus, Sarda sarda, Dicentrarchus labrax, Xiphias gladius, Lepidopus causatus, Scomber spp, Pagellus spp, etc.*
Secondarily they catch: *Dentex spp, Sparus aurata, Lophius piscatorius Merluccius merluccius, Mugilidae, Sparus aurata, Psetta maxima, etc.* (Table 1)

Table 1. List of caught species targeted by small scale fishing vessels. The relevance is indicated.

FAO Code	Latin name	English name	Fishing relevance	
			Ionian	Adriatic
LEE	*Lichia amia*	*Leer fish*	+	++
MUX	*Mullus spp.*	*Red mullets*	+	+
DEX	*Dentex spp.*	*Common dentex*	++	+++
SOX	*Soleidae*	*Sole*	+	++++
AMX	*Seriola spp.*	*Amberjack*	+	++
X026	*Trigloporus lastoviza*	*Streaked Gurnard,*	+	++
MON	*Lophius piscatorius*	*Monkfish*	++	+
SQC	*Loligo spp.*	*cuttlefish*	+	+
	Lepidopus causatus	*Silver scabbard fish*	++	+
DPS	*Parapenaeus longirostris*	*shrimp*	+	++++
GPX	*Epinephelus spp.*	*Groupers*	+	++
SBG	*Sparus aurata*	*Gilthead sea bream*	++	++
DRU	*Sciaena spp.*	*Drums*	+++	++
BSS	*Dicentrarchus labrax*	*European sea bass*	+++	++
PIC	*Spicara spp.*	*Pickerel*	+	+
HKE	*Merluccius merluccius*	*European hake*	++	++
OCC	*Octopus vulgaris*	*Octopod*	++	++++
BON	*Sarda sarda*	*Bonito*	+++	++
DGX	*Squalidae*	*shark*	++	+
	Diplodus spp.	*Annular sea bream*	++++	++
SWO	*Xiphias gladius*	*Sword fish*	+++	+
GUY	*Trigla spp.*	*Tub gurnard*	++	+
MUL	*Mugilidae*	*Grey mullet*	++	++++
LEZ	*Lepidorhombus spp.*	*Megrim*	+	+++
CTC	*Sepia officinalis*	*Common cuttlefish*	+	+++
FLE	*Platichthys flesus*	*European flounder*	+	+++
X075	*Psetta maxima*	*Turbot*	++	+
ASK	*Squatinidae*	*Angel shark*	+	+
MAZ	*Scomber spp.*	*Atlantic mackerel*	+++	++
PAX	*Pagellus spp.*	*Common Pandora*	+++	++
JAX	*Trachurus spp.*	*Atlantic horse mackerel*	++	+

National and international programmes focussing on the small-scale fishery sector

At present no monitoring programme are in place in Albania. In 2013 the Fisheries Policies Directorate of the Ministry of Environment, Forestry and Water Administration, with the support of the AdriaMed Project, will carry out a socio-economic survey that will produce useful information also on the small scale fisheries.

Identification of priorities and main gaps related to the Croatia small-scale fishery sector concerning management issues

One of the key priorities is to enable sustainable fishing activities in the Albania fishing through the implementation of policies and strategies aimed at the enhancement of small-scale fisheries governance and their development. A proper monitoring programme for small scale fisheries that includes all the aspects of fisheries is another priority for the country. The monitoring should also include some economic parameters to allow the estimation of the economic performance of small–scale fisheries (in terms of employment; incomes, etc.). The creation of infrastructures like small harbors and landing area will certainly be in support of small scale fishers that should be involved in the management of fishing resources (e.g. through co-management). To this extent the need to increase the awareness among the small scale fishers on the adoption of proper responsible fishing practices is fundamental. SSF should be taken into consideration when Integrated Coastal Zone management should be put into place.

Figure 4. Small scale vessels.

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Small-scale fisheries in Croatia1

Jakov Dulčić[2]

Abstract

Croatia has a long tradition of small scale coastal fishing, as indicated by the 55 different fishing gears officially listed as currently employed. The types and quantities of fishing gear and equipment used in Croatia and the legal provisions regulating their use are outlined. One layer gillnets and three layer trammel nets are probably the most commonly used fishing gear along the Croatian Adriatic. Regarding the fishing effort in Croatian small scale fisheries it is probably very high yet has steady throughout the last twenty years. The current Croatian legislative framework and legislative changes of small scale fisheries regulation in the last 15 years, as well as how these changes have impacted on the state of coastal fish resources, particularly target species condition, are discussed. Priorities and main gaps related to the Croatian small scale fisheries sector are presented. Guidelines for future management in terms of the monitoring and dana collection framework (DCF) porposed by the EU are demonstrated.

1. Definition of small scale and/or artisanal fisheries currently adopted in Croatia

Small-scale fisheries can be broadly characterized as a dynamic and evolving sector employing labor intensive harvesting, processing and distribution technologies to exploit marine and inland water fishery resources. The activities of this sub-sector conducted full-tine or part-time, or just seasonally, are often targeted on supplying fish and fishery products to local and domestic markets, and for subsistence consumption. Export-oriented production, however, has increased in many small-scale fisheries during the last one or two decades because of greater market integration and globalization. Small-scale fisheries operates at widely differing organizational levels ranging from self-employed single operators through informal micro enterprises to formal sector businesses. This sub-sector, therefore, is not homogeneous within and across countries and regions and attention to this fact is warranted when formulating strategies and policies for enhancing its contribution to food security and poverty alleviation (FAO, 2003). Defining small-scale and artisanal fisheries is a challenge as the terms have been used for decades by fishery politicians and administrators, legal officers, biologists, economists, sociologists, engineers, fishers, non-governmental organizations and the media to represent different points of view and socio-economic dimensions in different national contexts. Trying to combine all the characteristic dimensions of these fisheries, the FAO Glossary indicates that artisanal fisheries are:

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[1] This document has been based on the scientific article published by Acta Adriatica: MATIĆ-SKOKO, S.; STAGLIČIĆ, N.; KRALJEVIĆ, M.; PALLAORO, A.; TUTMAN, P.; DRAGIČEVIĆ, B.; GRGIČEVIĆ, R.; DULČIĆ, J. 2011. Croatian artisanal fisheries and the state of it's littoral resources on the doorstep of entering the EU: effectiveness of conventional management and perspectives for the future. *Acta Adriatica*;2011, Vol. 52 Issue 1, p87.

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"traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption. In practice, definition varies between countries, e.g. from gleaning or a one-man canoe in poor developing countries, to more than 20-m. trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. They are sometimes referred to as small-scale fisheries".

While small-scale and artisanal fisheries clearly differ from industrial and recreational fisheries, the subtle distinctions between them are hard to pin down. The FAO Glossary tends to equate "artisanal" with "small-scale". From a technological point of view, however, these are connected but have somewhat different concepts related, on the one hand, to the size of the fishing unit (the scale) and, on the other hand, to the relative level of technology (or "artisanality") expressed as the capital investment / man-on-board.

Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any, making short fishing trips, close to shore, mainly for local consumption. In practice, definition varies between countries, e.g. from gleaning or a one-man canoe in poor developing countries, to more than 20m trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. Sometimes referred to as “small scale fishery", 2005, FAO Online Glossary.

Croatia accounts for nearly 9% of the total Mediterranean coastline. The people of Croatia have traditionally been oriented towards the sea, and fisheries have always played a role in the lives of the Croatian people. The main features of Croatian marine fisheries are: the widespread presence of artisanal and subsistence fishery, which has great importance for the local socio-economy; the very old fishing fleet and old technology and the high number of small polyvalent boats with licenses for different types of fishing gear. Fisheries are particularly significant to island and coastal communities, and fisheries is an important element of national policy to stimulate development of these communities.

There are two main types of capture fisheries at sea in Republic of Croatia – commercial and non-commercial. Commercial fisheries encompass commercial fisheries *sensu stricto* and the new category of small scale coastal fishery, which is limited in terms of gears and manner of operation. Non-commercial fisheries at sea include sport and recreational fisheries, and over a transitional period expiring at 31st December 2010, non-commercial fisheries include small scale artisanal fisheries for personal needs. The Fishing Fleet Register of Croatia includes 4039 vessels. The largest percentage of the fleet (over 80%) is comprised of vessels less than 12 m LoA, which also constitute the largest segment of the fleet capacity in terms of power (some 50% kW). The most important part of total tonnage of Croatian fishing fleet belongs to purse-seiners, and the most important part of total power to multipurpose vessels. Total fleet power slightly exceeds 310.000 kW and total tonnage slightly exceeds 40.000 GT. The largest number of vessels is registered as multipurpose vessels (over 45%). These vessels are typical for the Mediterranean fisheries, where fishermen target assemblages rather than

species and where gears are changed several times over a year. Purse seiners account for some 5% of fleet, and these vessels account for the largest percentage of the catches, while bottom trawlers account for some 14% of the fleet. Total catches of Republic of Croatia in 2008 was 48.976 tonnes, in 2009 55.319 tonnes, and in 2010 52.360 tonnes. By far, the largest percentage of the catch is realized by purse seines (89%). Towed gears account for some 8% of the catch, while gillnets and trammel nets account for a bit over 1% of total catch. Percentages for other gears are less than 1% in the total catch. The largest part of the catch is represented by small pelagic species, sardines and anchovy – over 80%. Out of the total catch, fish represent 96%, cephalopods some 2% and crustaceans and shellfish some 2%. There are 264 landing places, out of which 63 represent 95% of the catches. The most important landing places in 2010 for small pelagic species were Kali, Zadar, Biograd na moru and Pula, while for the demersal catches these were Mali Lošinj, Tribunj and Zadar. In addition to the commercial fisheries at sea, sport and recreational fishery represent an important segment of the fishery in Croatia.

Four types of fisheries are defined by Croatia's Sea Fisheries Act: commercial, subsistence, recreational and sport fishing. Commercial fishing is a profit-making activity, while fish and other marine organisms caught in the course of subsistance, recreational or sport fishing are not to be placed on the market and are intended solely for fishers ' and their families' own consumption (daily catch limit is 5 kg). Allowance of use of limited type and quantity of nets primarily differentiates subsistence fishing practices from recreational and sport fishing which are trap and line fishing oriented. Additionally, the new Sea Fisheries Act (Narodne novine, 2010a) further distinguishes fishing for scientific purposes and tourism. In Croatia, subsistence fishing is still considered 'a socio-cultural activity for most of the island and shoreline inhabitants. Issuing of new licenses stopped in 2008 and official statistics of the Fisheries Directorate (FD) for the period 2009-2010 counted around 4,000 vessels (number of vessels approximately corresponds to number of licenses) in the professional fishery sector, of which 3,360 vessels are under 12 m indicating their artisanal character, and 12,000 vessels registered under the subsistence category.

2. Status of the national small-scale fisheries

The Adriatic Sea, as part of the Mediterranean Sea, shares with that region all common characteristics in terms of geographical features, available marine resources, their type and intensity of exploitation. Moreover, those fisheries functioned in very specific socio-economical and historical contexts. All Mediterranean coastal areas have a high diversity of littoral benthic communities at a very small spatial scale which implies high biodiversity and trophic complexity (Matić-Skoko *et al.*, 2011). Since ancient times fishing has played a role in shaping the Mediterranean food webs, becoming more and more crucial in recent times as the booming growth of human populations along Mediterranean coasts necessitates ever larger harvests of marine resources. The very characteristics of such fishery, i.e. numerous fleets using diverse fishing gears, multi species catches and extremely heterogeneous landing sites and marketing, place scientific research in a particularly complex context. In that manner Croatian artisanal fishery is without exception a typical Mediterranean example.

An introduction to the Adriatic Sea biodiversity together with an outline of the complexity of the Croatian small-scale coastal fishery sector and of the available knowledge is presented by Dulčić *et al.* (2005a, 2005b). Furthermore, scientific information on some important fish and invertebrate species mostly exploited by the Croatian small-scale fisheries is compiled and summarized by Dulčić *et al.* (2005c). Cetinić and Soldo (1999) reported on the types and quantities of fishing gear and equipmnet used in Croatia and the legal provisions regulating their use. The baseline regulation governing fisheries issues in Croatia is the Sea Fisheries Act (Narodne novine, 2010a). Together with its subordinate acts (Narodne novine 2010b, 2010c, 2010d) it regulates: spatial and temporal fishing restrictions; minimal landing size of commercial fish species and construction properties of fishing gear and application of fishing techniques. The Croatian Fisheries Act includes a large number of legal management issues applied worldwide. Following its provisions, catch and trade of juvenile fish and other marine organisms, and catch of fish and other marine organisms during the closed fishing season and their trade when fresh, have been banned. For rational management and protection of commercially important fish species the following are defined: minimal landing size, closed seasons, closed zones and areas, temporal fishing limitations in different areas and zones, allowable catch quantity per single license, total number of licenses that may be issued in a single fishing zone and area, construction and technical features, method of operation and purpose of individual fishing gear type and fishing equipmnet and special habitats of fish and othe rmarine organisms where fishing has been forbidden. The Sea Fisheries Act provides for a mandatory monitoring program of the state of economically important fish and other marine organsims populations as well as the monitoring of the quality of marine areas where rwaching activities are conducted. Furthermore, by sub-regulations a number of important issues are regulated. For example, no new license are to be issued for fishing Norway lobster with traps, bottom trawls int he internal waters, dredges for *Pecten jacobaeus*, tramata fishing, trammel nets, tuna seines and floating long-lines. Also construction and technical characteristics, operation methods and purpose of fishing gears are defined by sub-regulations. As protection measures, closed areas and closed seasons are determined. Control of age-length at recruitment is carried out by regulating the mesh and hook sizes, and with a declaration of the minimum size of commercially importnat species below which they must not be caught, collected or traded (Narodne novine, 2008).

Marine fisheries landing in the eastern Adriatic ranged from 24,000-54,000 tones in the period 1983-1993 according to the National Croatian statistics (Dulčić *et al.*, 2008). Jardas and Pallaoro (1997) reported that the Adriatic artisanal fisheries yield more than pelagic and trawl fisheries (total landing about 30,000 t). However, official statistics of the FD for the period 2008-2010 shows the annual landing is stable at about 50,000 tonnes of which 90% are landings of small pelagic while artisanal contribute only 1%. This contribution is certanily underestimated since the majority of arisanal landings go unreported.

The rich fishing tradition of the Croatian artisanal fishery is fully reflected in this typical Mediterranean multi-species and multi-gear fisheries sector employing more than 50 different types of fishing gear to catch about 150 different species of commercial interest (Cetinić and Soldo, 1999). Both commercial fishers, excluding larger-scale commercial fleets such as trawlers or purse seiners, and subsistence fishers are regarded as artisanal in the Croatian eastern Adriatic Sea based on their use of traditional, relatively small size fishing gear and

operating with relatively small fishing vessels not far from the shore. The key distinguishing features between commercial and subsistence artisanal fishers are the purpose of their activity, type and quantity of fishing gear allowed and daily catch limits. In the last 10 years the type and quantity of fishing gear with which commercial and quantity of fishing gear with which commercial and subsistence artisanal fishing could be undertaken have been the subject of fisheries management changes (Stagličić *et al.*, 2011). Although legislative changes in the fishery sector are numerous, they are usually more „cosmetic“ in nature.

Small-scale fisheries are carried out within a distance of one nautical mile from the mainland and islands coasts, in shallow waters at depths of no more than approximately 80 m, representing a little more than 3% of the total surface area of the Adriatic (Cetinić *et al.*, 1999a). The majority of commercially significant fish and invertebrate species live within this small area of the Adriatic Sea. Diversely constructed types of bottom otter trawls, dredges for shell fishing, purse seines, beach seines, gill nets, trammel nets, combined trammel-gillnets, pots, long-lines, hooks and lines, filter nets, surrounding nets, lift nets, falling gear, entangling nets, barrier gear, harvesting machines, grappling and wounding and fishing using ropes (tramata fishing) are used in this zone (Cetinić *et al.*, 1999b).

In accordance with the regulations in force (Narodne Novine, 49/96, 63/97, 118/97), for commercial fishing the use, type and quantity of fishing gear permitted are presented in Dulčić *et al.* (2005a).

One layer gillnets and three layer trammel nets are probably the most commonly used fishing gear along the coastal eastern Adriatic. Regional differences, conditioned by the distribution of target species, exist in the frequency of their use. While on the west coast of the Istra peninsula (northern Adriatic) trammel nets of smaller height called „listarice“, with *Solea solea* as main target, are the main trammel nets used in winter, in the middle and south Adriatic trammel nets called „poponice“ are prevalent (closed season 01.06. – 31.08.). In the area of the outer middle Adriatic islands from Dugi otok to Lastovo fishers also commonly use gill nets named „psare“ with 70 mm mesh size targeting mainly *Scorpaena scrofa* and *Palinurus elephas* at greater depths (>60 m). Trammel nets have traditionally been the favoured fishing gear of Croatia's artisanal fishermen as they regard it as the most efficient one providing them as with catches as rich as possible. On the other hand, numerous studies, besides confirming their ability to catch, have pointed out the low selectiveness resulting from their specific construction and operation properties (Jardas *et al.*, 1998 and references therein). Although artisanal fisheries are generally perceived as highly efficient, low impact fisheries that generate few discards, these fisheries affect numerous species due to continuous substantial fisherman practice, despite having preferred target species. Illustrative oft he aforementioned, trammel nets are often target species, but an important part of the catch consists of multispecies by-catch. Due to the fairly large number of species that may be caught they are also often used for research purposes and to study coastal communities (Stagličić *et al.*, 2011). Legislative changes to Croatian artisanal fishing regulations have mostly been aimed at trammel nets and encompass the increase in minimum inner layer mesh size of trammel net from 28 to 40 mm in 1999. and excluding the trammel net from subsistence artisanal fishing in 2002. Additionally, in 2002 for artisanal subsistence fishing, legal provisions proclaimed a daily catch limit of 5 kg and reduced the allowed quantity of

most types of gillnets, orienting it thus much more to trap and line fishing (Matić-Skoko *et al.*, 2011). „Strašin“ and „kogol“ are two types of small coastal bottom trawl which are used during the night primarily for picarel *Spicara smaris* fishing although other coastal bottom species can be caught with them. Both gears can be used only on boats with an engine power of 18.5 KW (25 HP) in the period from 1 October to 30 April. They are used from 5 to 20 m depth. The bar of mesh in the cod end must not be less than 12 mm. „Tartana“ is a small coastal otter trawl which can be used on boats with an engine power of 18.5 KW (25 HP). It is designed primarily for picarel fishing from 20 to 50 m depth during the period from 1 November to 1 March, exclusively during the night. With „tartana“ fishing otter boards are used. The bar of mesh not be less than 12 mm. The coastal beach seine („migavica“) is designed primarily for day time picarel fishing. It is used from 1 October to 30 April. Fishing with coastal beach seine is carried out on bottoms at up to 30 m depth. However, besides picarel, migavica catches almost 70 different fish species. Other species are mostly represented by bogue *Boops boops*, fish of the genus Diplodus, saddled seabream *Oblada melanura* and common pandora *Pagellus erythrinus*, and they constitue about 27% of the catch (Dulčić *et al.*, 2010). The problem with migavica is that it catches a relatively high percentage (around 35%) of immature specimens, especially of the Sparidae family. One of the possible solutions on how to increase the percentage catch of picarel and lower proportion of other non-intended species could be to determine exact locations particularly suitable for using this fishing gear or, in other words, for catching picarel. Another possibility is to shorten the time period when this gear is allowed to operate. In the near future, additional effort through pilot studies has to be invested and directed toward finding appropriate fishing grounds not hosting *Posidona oceanica* meadows as is suggested by EU directives. This net is pulled from the shore or from a boat towards the shore. The bar of mesh in the cod end of coastal beach seine must not be less than 12 mm. „Tramata“ fishing is the most efficient method for seabream (Sparidae) harvesting, primarily saddled seabream *Oblada melanura* and salema *Sarpa salpa*. It is based on the use of ropes, gillnets and beach seines. Ropes are used for enclosing a large sea area, herding fish by vibrations produced by pulling of ropes close to the coast; fish are then harvested by gillnets or beach seines. Depending on the enclosed area, length of the enclosing rope and „decorations“ on the rope, fishing gear used and the fishery tradition of the area, distinction has been made between „ludar“, „zagonica“ and „fružata“. This kind of fishing is only carried out in coastal areas of up to 50 m depth and only during the summer period. Decades ago, this method of fishing had provoked controversy and antagonism, and it was often forbidden or very restricted. By the findings of Dulčić *et al.* (2008, 2010). Fružata is a highly selective fishing technique, catching almost only adult specimens and primarily of the Sparidae family. If used properly it should not have negative impact on the biology and ecology of exploited species. However, this fishing gear tends to be misused – operated outside the time or spatial limitations, using it with help of SCUBA divers, or using nets with undersized mesh size.

Regarding the fishing effort in Croatian artisanal fisheries it is probably very high yet has remained steady throughout the last twenty years. The number of vessels more or less remained the same in that period and has consistently been composed of multi-purpose vessels smaller than 10 m. The only positive trend was in early 1990's during the War period when socio-economic reasons led to a high number of people engaging in fishing (Stagličić *et al.*, 2011). After 1995 a more restrictive fishing regime forbid the issuing of new licenses and

from there on the number stagnated (Dulčić *et al.*, 2005a). In principle, reliable data on the type, dimension and quantity of fishing gear are needed for the accurate assessment of fishing effort in artisanal fisheries worldwide as well as in Mediterranean and Adriatic Seas. Even when they exist, they are unsystematically monitored and recorded, making them practically unusable for any serious analysis (Stagličić *et al.*, 2011). Fishing effort is complex to measure, especially given the diversity of gears and vessel types characterizing artisanal fisheries, so management assessment has been based mainly on the number of boats and/or number of fishers thus limiting the evaluation of the actual fishing pressure on the resources. Moreover, the reliability of the catch statistics is also questionable since it's based on fishermens' logbooks and has never been validated by a systematic observer programme or sampling at landing. In Croatia, artisanal fisheries catches are merely presumed for statistical purposes and thus may be considered as underestimated. In the current political and socio-economic environment, it is very difficult to reduce fishing effort by decreasing the number of fishing licenses because of unpopularity of such measures. Therefore, it is essential to apply other forms of fishing regulations.

Brief outline of Croatian fisheries legislation

The Croatian Law on Marine Fisheries includes a large number of legal issues applied worldwide.

Following the provisions of the Law the following have been banned:
– Catch and trade of juvenile fish and of other marine organisms;
– Catch of fish and other marine organisms during closed fishing season and their trade when fresh.

For rational management and protection of commercially important fish species under the provisions of the Law on Marine Fisheries and its specific regulations the following have been decided on:

- What is meant by the juvenile fish and other marine organisms;
- Minimum size limit of commercially important fish species and marine organisms, below which they cannot be caught, collected or traded;
- Rules governing closed seasons for the gathering and trading of individual species of fish and other marine organisms;
- Catch banned in some fishing zones and areas;
- Number and size of fishing vessels, engine power, type and quantity of fishing gear and Equipment allowed to be used in some fishing zones and areas;
- Time limits on fishing in some fishing zones and areas;
- Allowable catch quantity in some fishing areas and zones (i.e. allowable catch quantity per single license);
- Number of licenses that may be issued in a single fishing zone and area;
- Construction and technical features, method of operation and purpose of individual fishing gear type and fishing equipment;
- Special habitats of fish and other marine organisms where fishing has been banned.

The Croatian Law on Marine Fisheries in force also includes the legal provisions for the monitoring program of the state of populations of fish and other marine organisms of importance for marine fisheries all over the fishing zones or their parts as well as the monitoring of the quality of marine areas where rearing activities are conducted.

Fishing effort as a measure of fishing regulation in Croatian marine fisheries

Even though Croatian legislation does not explicitly mention fishing effort as a measure of fishing regulation, various regulations provided by the Law the function of regulating and monitoring fishing effort. Of the provisions of the Law only some have been detailed by sub regulations:

- Engine power not to exceed 184 kW (250 HP) for bottom trawlers fishing in the interior sea (channels area);
- Restriction of the types and quantities of fishing gear and time of fishing in some fishing areas and zones;
- No new licenses shall be issued for certain kinds of fishing such as fishing for Norway lobster with traps, bottom trawls in the interior sea, dredges for *Pecten jacobaeus*, tramata fishing, trammel nets, tuna seines and floating long-lines;
- Definition of some construction and technical characteristics, methods of operation and purpose of fishing gears.

Even though these are the measures that limit any further increase in fishing effort, they are not sufficient for fishing effort reduction. It is believed that present fishing effort is too high, particularly in the case of demersal trawl fishing. Therefore a more efficient measure of protection of living marine resources would be to limit the maximum annual catch by establishing maximum sustainable yield in individual areas and zones. In particular this could apply to bottom trawling in the interior sea, with special attention to channels along the mainland coast. Since it would appear very difficult and unpopular to limit the number of licenses for defined fishing methods in a defined area, in order to protect resources, it would be simpler, more practical and more efficient to determine maximum allowable yield per single license.

One of the protection measures that can control fishing effort, is a fishing ban in some areas and closed seasons. Establishing special habitats for fish and other marine organisms in which all fishing or some types of fishing gear would be forbidden permanently or for some time during the year, would be a far more efficient measure.

Since present legal provisions regulate some construction-technical characteristics of individual gear types, such as mesh size and gear size, it would be necessary to regulate other construction-technical characteristics of other gear that are known to adversely affect the state of exploited species. For instance, consideration should be given to technical aspects such as the hanging ratio and webbing cut, thread thickness and some other details of gear design.

Protection of juveniles

Control of age/length at recruitment is carried out by regulating the mesh and hook sizes, and the minimum size of commercially important species, below which they must not be caught, collected or traded. Even though the minimum legal sizes should correspond to that at the species' sexual maturity, they are considerably smaller than those provided by the current regulations. Therefore their effect as a management measure is practically very limited (Cetinić *et al.*, 1999a). Even though the survival rate of fish and other marine organisms caught by bottom trawls and returned back to the sea is unknown, this measure should be applied for two of the most important species targeted by trawl fishing (the European hake, *Merluccius merluccius*, and the Norway lobster, *Nephrops norvegicus*) in order to oblige fishermen to avoid those grounds when juvenile specimens of these species significantly occur in trawl catches. This particularly refers to the Norway lobster, which after having been caught is, in most cases, alive and undamaged so that the chances of its survival after returning it to the sea are high. The minimum size limit of fish and other marine organisms is of considerable importance when combined with the minimum mesh size or hook size of gear. This is also true in the case of the Adriatic Sea that is characterized by a large number of exploited species and of fishing gear types, some of which are even named after fish they target. Moreover, this particularly applies to the protection of species in coastal fishing which change sex and therefore both sexes should be protected.

Specific regulations are set for the minimum mesh size for almost all fishing gear, but since these measures are for the most part not based on any research results but on fishing practice itself, the catches comprise considerable percentages of immature specimens.

Closed seasons

Some regulations order closed seasons only for three crustacean species, common spiny lobster, European lobster and spider crab, but not for any fish species. Given the importance of closed seasons for the recovery of species, this should be extended to all commercially important species, since no other means of protection can replace undisturbed spawning, which is not only the prerequisite for the survival of any population but also for the successful fishing. It is believed that spawning individuals of some species are more vulnerable to fishing. Therefore, closed seasons should be applied to some commercially important fish species for improved protection and management of eastern Adriatic Sea fishery resources.

Some fishing gears and target species

The bottom trammel net is the most widely distributed gear type in Croatian coastal fisheries. It can be used from August 15th to April 30th. All benthic and benthopelagic species and even large pelagic species can be caught with it. This gear is used during the night on all types of bottoms, usually up to 30 m depth.

«Strašin» and «kogol» are two types of small coastal bottom trawl which are used during the night primarily for picarel fishing although other coastal bottom species can be caught with them. Both gears can be used only on boats with an engine power of 18.5 KW (25 HP) in the

period from October 1st to April 30th. They are used from 5 to 20 m depth. Bar of mesh in the cod end must not be less than 12 mm.

«Tartana» is small coastal otter trawl which can be used on the boats with the engine power of 18.5 KW (25 HP). It is designed primarily for picarel fishing from 20 to 50 m depth, during the period from November 1st to March 1st, exclusively during the night. With the «tartana» fishing otter boards are used. Bar of mesh must not be less than 12 mm.

Coastal beach seine («migavica») is designed primarily for daytime picarel fishing, but some other demersal fish and invertebrate species could be caught. It is used from October 1st to April 30th. Fishing with coastal beach seine is done on bottoms up to 30 m depth. This net is pulled from the shore or from a boat moored to the shore. Bar of mesh in the cod end of coastal beach seine must not be less than 12 mm.

«Tramata» is the way of fishing with gill nets using ropes for fish scaring. Ropes are used for enclosing a larger sea area and the fish gathered are harvested by the gill nets. This kind of fishing is done only during the summer period and mostly sparid fish are caught, primarily saddled sea bream and salema. This kind of fishing is only carried out in coastal areas up to 50 m depth.

Present state of Croatian coastal resources

In order to apply better and more successful measures for fishery resources protection, constant monitoring and assessment of the impact of fishing gear on coastal fish and other marine organisms' communities has to be performed, especially for fishing gear that is classified as harmful owing to its construction-technical characteristics. A common situation in the whole Mediterranean is that only are long-terms studies and monitoring programmes lacking but also no accurate assessment of fishing effort or catch statistics can be found (Stagličić *et al.*, 2011). In particular, long term time series data are needed in order to estimate the real status of exploited resources and their evolution over time, yet even for fish those are rarely available. Data have mostly been obtained from scientific research projects which are typically short in duration, between 3 and 5 years. Fortunately, owing to long term data sets of experimental trammel net catches Institute of oceanography and fisheries is in position to analyze and determine the state of littoral communities along the esatern Adriatic coast.

In Croatia, fortunately, owing to long term data sets of experimental trammel net catches scientists were in position to analyze and determine the state of littoral fish communities along the eastern Adriatic coast (see Table 1).

Firstly, it was analysed the effectiveness of conventional management in the Mediterranean type artisanal (Matić-Skoko *et al.*, 2011a) at small spatial scale, in a pilot region around Vis island. The primary goal was to investigate whether a more restrictive fishing regime, as mentioned earlier, that has progressively been put in place during the study period has been accompanied by expected positive changes of littoral fish resources' abundance, biomass and structure. As a result, significant increases over time were observed in most of the community

indices analyzed as well as a directional change in the abundance and biomass catch composition of littoral fish resources. Positive responses were, however, primarily related to a recovery of *Mullus surmuletus* stock. Taking into account minimal landing size of this species (11 cm; although it has to be mentioned that this size is given for both Mullidae species inhabiting the Adriatic – *M. surmuletus* and *M. barbatus*, and it is not biologically justified for *M. surmuletus*), no undersized specimens were present in the overall catch. Even when „poponica“ destructiveness is assessed, considering a biologically justified size at first sexually maturity (18 cm), the catches contained a rather low, satisfying 1.2% of immature specimens. On the other hand, results indicate a rather alarming status of the *Scorpaena scrofa* populations. It could be seen that the overall catch is dominated by undersized specimens (62.5%). The situation is even more troublesome if biologically justified size at first sexual maturity is applied (total length 30 cm) since the proportion of immature specimens is in that case as high as 90% (Matić-Skoko *et al.*, 2009; Matić-Skoko *et al.*, 2011b). Some authors (Uiblen, 2007), in terms of aforementioned, gives an opinion that Mullidae could be considered as an indicator species owing to their fast and strong response to human-induced factors such as fisheries and habitat modifications. Assessing the destructiveness of „poponica“ nets for spiny lobster populations by taking into account the minimal landing size of this species (24 cm), there are 34.6% of undersized specimens int he overall catch. The results also indicate that the spiny lobster hunting season partially coincides with the beginning of their reproductive period. Specifically, about 10-15 of the last days of the hunting season are characterized by catches dominated by females carrying external eggs and an increased number of undersized specimens (Matić-Skoko *et al.*, 2009). Therefore, these results indicate that temporal restrictions should be rearranged. Stagličić *et al.* (2011) reported in summary that littoral fish assemblages along the eastern Adriatic coast are characterized by continuous changes throughout the last 16 years as patently evidenced through trends in abundance, biomass, diversity and structure which all indicate that fish assemblages are going through a restoration process. A common pattern among time trajectories of studied areas implies that the factor affecting the littoral fish assemblages is not localized but regional in nature. Since positive effects are seen at multiple levels and are so consistent and widespread it was suggested that the most plausible causative factor is stricter fisheries management, the implementation of which coincided with the study period.

It is obvious that legislative changes have the potential to shift small scale fishery towards sustainability as has already been shown in an off-shore Adriatic region (Matić-Skoko *et al.*, 2011a) and along the eastern Adriatic coast (Stagličić *et al.*, 2011). Their effectiveness was observed through positive changes of littoral fish resources' abundance, biomass and structure as well as through community indices and catch structure. An agreement between the studies is the recovery of the specific indicator species, *Mullus surmuletus* after 2002 when the trammel nets were excluded from subsistence artisanal fishing. Due to the fact that longer time series (more than 10 years) are difficult to maintain and keep funded and that available time series of landing data or official statistics of commercial catches are often very far from reflecting the reality since underestimation of total catch due to misreporting and/or not quantifying discards are widespread and are also not representative of the whole community as they are dominated by commercial species, compared with scientific surveys. Institute of oceanography and fisheries is now investigating the sensitivity to short term changes of some species like *Mullus surmuletus* or *Scorpaena porcus* which would than possibly nominate

them as effective ecological indicators of changes in coastal communities. namely, most existing community indicators are only sensitive to long term changes or to the effects of developing fisheries while the effects of fishing and management actions are still assessed over very short time scales.

Studies of small scale fisheries in Croatia have to date taken into consideration only the biological aspect. Socio-economic issues of artisanal fisheries are almost completely unknown. Interviews and questionnaires were conducted in the Vis area with the aim of getting relevant information on fishers' perceptions (Matić-Skoko *et al.*, 2011a). Fishing intensity is highest in the warm period (April-October) owing to suitable weather conditions. Previously, Forcada *et al.* (2010) stated that artisanal fishing effort strongly depends on proximity to home harbor and habitat heterogeneity. Fishers rotate fishing gears throughout the year not only in accordance with legislative regulations, but also to optimize yields, based on their knowledge of the behavior and catchability of target species. Fishing respondents varied widely in age and fishing experience, but on average they were around 40 years old with 19 years of being professionally engaged in artisanal fishing. Only 11% were younger than 30 years indicating little interest in entering the fishing profession among the younger generation. A search for more profitable employment opportunities in urban surroundings is perceived as the main reason for the lack of interest by all the respondents.

Regarding the trends in total catches fishermen reported not perceiving any changes, except for the fishermen with more than 15 years of professional engagement in fishing who experienced a substantial decline in trammel net catches. Nevertheless, the economic viability of their fisheries did not wane since the drop in the overall fish catches was compensated by catching on average larger sized, commercially more valuable specimens and by the continuous increase of fish prices in general. All the respondents felt that artisanal fishing, as it is currently prescribed, is to a rage extent compatible with the sustainability of littoral fish resources. However, as major threat they perceived is the widespread misuse of fishing regulations by subsistence artisanal fishermen.

From the aforementioned, it seems that a different approach to management is needed, and also from a social perspective. Obviously, current fisheries management provokes resentment between commercial and subsistence artisanal fishers (Matić-Skoko *et al.*, 2011a). Limited institutional capability to effectively conduct surveillance and monitoring of fishing activities is exploited by subsistence fishers who don't comply with regulations mainly regarding restrictions on quantities of allowed fishing gear, thus also leading to violation of the daily catch limit of 5 kg. On the other hand, commercial artisanal fishers with what and how they're allowed to fish, are in no need of violating the regulations. They argue that the catches of subsistence fishers, who greatly outnumber the, are in no way negligible and are often sold in unofficial markets, hindering sales by commercial fishers. Future management approaches aiming to alleviate the existing conflicts should increase the involvement of fishers in the management process.

Fishers' perceptions on trends in littoral resources are not entirely in line with what has been observed by assessments of long-term experimental fishing (Matić-Skoko *et al.*, 2011a). Recent improvements went unnoticed by fishers since they are to a large extent involving

only *M. surmuletus* – a species which, due to management changes of gear specific regulations, has been rarely present in their catches for the last 15 years. Fishers' perception can be different from the real state due to different valorization of catches. Moreover, management changes of what fishers are allowed to fish with inevitably influence their perception of trends in the catches. Also, fishers may in general be more sensitive to decreases rather than increases and are more likely to be more pessimistic than formal fisheries resource assessments. These findings suggest that consistent, standardized fisheries data collection is likely the better approach for documenting the trends of exploited resources. The importance of interviewing should in no way be discounted, as the information provided through this approach yields an important overview of the fisheries and provides an opportunity to build relationships with local fishers. Additionally, it could be point out that on shorter time-scales, not encompassing management changes, fishers perceptions can be accurate and do have the potential to act as early warning signals.

Croatian small scale fisheries on the threshold of entering EU

Obligations regarding future management in terms of the monitoring and data collection framework (EU Data collection Regulations DCR, EC no. 199/2008) proposed by EU is one of the tasks that Croatia will have to carry out in the near future, yet at the same time it is necessary not to give up on current investigations and scientific approaches to artisanal fisheries issues. The guidelines for the data collection framework are defined by the EU Scientific, Technical and Economical Committee for Fisheries (STCF) and they are directed toward the submission of National Data Collection Programme proposals and annual reports. The main steps in that process is to determine métiers and to establish own sampling scheme in all fisheries sectors. As was previously mentioned, the main characteristics of artisanal fisheries is heterogeneity, and which greatly complicates its management. Efficient sampling of this complex and poorly known sector is undoubtedly difficult and thus even a definition of métiers is not an easy task. Each métier is a group of fishing operations defined by combination of fishing gear, target species, area and season. A métier-based approach is likely to be useful for the design of stratified sampling surveys for the small-scale fisheries but will also be helpful for understanding the spatio-temporal patterns of fishing effort allocation. Based on realized fishing effort (days), total catch (kg), and value (kn), 5 groups of métiers were determined for Croatian artisanal fisheries: gillnets, trammel nets, pots, beach seines and longlines. Sampling strategy (on board or/and at the landing place), sampling programme and expected number of sampling trips for each of the métiers are suggested. Pilot studies will be provided for all métiers to confirm the selected sampling strategy and sampling intensity. Also métiers related variables and stock related variables are defined according to DCR. Based on total landing, priority species for which Institute of oceanography and fisheries have an obligation for collecting stock related variables (age, length, weight, sex) were defined. Only flatfish *Solea solea*, with a realized total catch of over 300 tonnes in 2009, meets the conditions of being a G1 species (those managed on the international level) for Croatian artisanal fisheries while others species are classified under G2 (main by-catch species) or G3 (other by-catch species) group. Sampling protocols and methodology have to ensure data quality. It has to be emphasized that the DCF (Data Collection Framework) has minimal demands needed for the ecology-based approach as advocated by STCF. Also, Council Regulation (CE) 1967/2006 proposes allowed types of

fishing gears together with their technical specifications and has a huge impact on both artisanal and open sea fisheries in all EU member states. Exceptions for some countries, e.g. for traditional fishing gear like beach seines „migavica“ in Croatia, are possible, but should be within consistent local or national „Management Plans“ that are to be previously approved in Brussels. Moreover, it must be stated that an important matter is enforcement of the rules and recently new important EU rules have been put in place.

Legislative changes have the potential to shift artisanal fishery towards sustainability, as has already been shown in an offshore Adriatic region (Matić-Skoko *et al.*, 2011a). Thus, conventional management can have positive effects although changes in provisions and regulations have to be accompanied with monitoring and studies that will give answers about the direction and extent of the effectiveness of such changes. It is also important that it has to be accompanied by a greater institutional capability to effectively conduct surveillance and monitoring of fishing activities of both professional and subsistence fishermen.

Unfortunately, the biological aspect, particularly knowledge of spawning properties and larvae dispersion and retention of most economically valuable or ecologically interesting fish species in the Adriatic and Mediterranean Sea, is still insufficient. This is particularly true for those fish undertaking more extensive spawning migrations to deeper open sea waters. Future studies should be carried out in the southern Adriatic Pit, leading to support of the hypothesis of this area being a spawning place for numerous meso- and bathypelagic and bathybenthic Adriatic fish, but also for a number of coastal fish that undertake open sea spawning migrations to complete the life cycle. Knowledge about fish spawning places, nurseries and mechanisms of retention and dispersion of their larvae are exceedingly important to override some of the largest gaps related to recruitment and processes affecting survival of the early life stages. All of this is necessary for better species conservation and stock assessment.

In principle, reliable data on the type, dimension and quantity of fishing gear are needed for an accurate assessment of fishing effort in artisanal fisheries worldwide as well as in the Mediterranean and Adriatic Seas. Even when such data exist, they are not systematically monitored and gathered, thus making them practically unusable for any serious analysis. It is now appropriate time to become more meticulous in official data gathering and statistics. The large heterogeneity of artisanal activities implies differences in duration of fishing trips, in time and places of landings and different destinations of products representing additional difficulties in collecting information. In future, it is necessary to find a way on how to determine specific landing places for small scale fisheries. Better knowledge of recent changes in littoral fish communities, accompanied with better flow of communication and a sense of trust between scientists, fishermen and fisheries managers should significantly facilitate the desired outcome for the fisheries – i.e. fisheries managed in a sustainable way.

Worldwide experience has shown that introducing MPAs (Marine Protected Areas) into fisheries management has numerous benefits: protection and preservation of ecosystem structure, function and integrity, habitat and biodiversity protection, protection of ecological processes, but also improvement of fisheries through increased abundance of otherwise overfished stocks, increased spawning potential and spillover of juveniles and adults and, finally, enhancement and diversification of economic opportunities. In addition to

permanently closing an area to fishing, currently is testing whether a dynamic, rotational MPA management can confer the aforementioned benefits in the specific context of Croatian small scale fisheries.

In the end, as a step in Croatia's accession to the EU, we are obliged to accept the monitoring and data collection framework (EU Data Collection Regulations, EC no. 199/2008 and related legislation) as proposed by the EU. However, according to our current scientific research and promising results related to this theme, it is necessary not to give up on current investigations and scientific approaches to artisanal fisheries issues. Moreover, since the DCF has minimal demands needed for an ecology based approach, detailed investigations can aid progress in this complex fisheries segment.

3. National and international programmes focusing on the small-scale fishery sector

Since monitoring of the status and changes of coastal ichthyo-communities and artisanal fisheries management effects is a complex issue, the scope of the Institute of Oceanography and Fisheries work, through Laboratory of ichthyology and coastal fisheries, encompasses as many different aspects as possible to get an accurate insight from systematic research of fish biology, coastal fish community composition, biological characteristics and distribution of species, population dynamics and stock assessment of characteristic, commercially important coastal fish species, qualitative and quantitative catch structure, demographic structure of the most important stocks, exploitation level, by-catch composition, evaluation of selectivity properties and destructiveness of fishing gears, estimating potential impact of global climate change on fish biodiversity and other living resources in the Adriatic Sea, colelction of new ichthyological data and finally, as a result of all aforementioned activities, preparing recommendations for conservation, sustainable use and management of Croatian coastal living resources. Those activities are supported through various projects, mostly financed by the Ministry of Science, Education and Sports and the Ministry of Agriculture, Fisheries and Rural Development. Thus, an extensive monitoring program of coastal fisheries was conducted in 2008 and 2009 (Dulčić *et al.*, 2008; Dulčić *et al.*, 2010). It is important to point out that exploration of coastal ichthyo-communities in the eastern Adriatic Sea goes as far back as the last 65 years.

a) „Biodiversity and the status of ichthyocenosis in Croatian coastal area“ (2002-2006) (Ministry of science, education and sport Republic of Croatia)

The aim of the project is the systematic research on the state and changes in coastal areas studying population dynamics of commercially important fish, cephalopod and crustacean species. An additional aim is to obtain new biological knowledge in order to enable the realization of reasonable and sustainable fishery management together with protection of fish communities. It has been presumed that the coastal communities have significantly declined in number or even split, thus their effective protection is needed. One of the major criteria for sustainable exploitation and successful protection is the well-rooted understanding of species population dynamics. The expected results of the project will be used as necessary scientific support to fishery management of living coastal sea resources.

b) „Biodiversity and management of sea living resources of Croatia" (2007-2012) (Ministry of science, education and sport Republic of Croatia)

The aim of this project is systematic researches of state and changes in coastal areas, studying of population dynamics of commercially important fish, cephalopod and crustacean species. Another aim of project is obtaining of new biological acquaintance in order to enable realization of reasonable and sustainable fishery management together with protection of ichthyo-communities. A target fish species are those suggested by Croatian Fishery Strategy, although characteristic, important and dominant coastal species are also studied. The expected project results will be used as necessary scientific support to reasonable and sustainable management of coastal sea living resources.

c) Monitoring of coastal water quality (Vir-Konavli area) (1982-2010) - Monitoring of coastal resources (trammel bottom sets)

d) Project «Jadran» (1998-2009) - Management of biological resources and protection of biodiversity

The project focuses on the degradation of ecologically and economically important areas (spawning and nursery areas, *Posidonia* meadows, estuaries, rocky shelters) formulating advice for fishery management and sustainable development. The project aims at the appraisal of the state of commercially important species and at establishing biologically acceptable catch levels. Considerations is also given to the protection of biodiversity elaborating measures to protect the biodiversity of the Adriatic ecosystem.

e) Project COAST –UNDP - Institut za oceanografiju i ribarstvo, Priobalni ribolovni resursi Viškog akvatorija

4. Identification of priorities and main gaps related to the Croatian small-scale fisheries sector concerning management issues

A lack of the appropriate and complete statistics could be identified as one of the main gaps in knowledge of Croatian fisheries. For example, Croatia has no statistical data regarding supposedly 18000 small-scale fishermen. It could be pointed out that a distinction needs to be made between types of statistics needed, such as biological and economic statistics the latter should, among other things, include data on parameters such as level of employment, catch quantities and value. Furthermore, data on number of vessels, fishing season, area, and quantitative composition of by-catch should be collected. As one of the priorities which could be considered would be to conduct a case-study on small coastal communities mostly dependent on fishery. There may be never enough resources to do a proper statistical analysis with appropriate coverage. Case-study is a realistic approach to collecting data on small-scale fishery. It should be pointed out that a lack of knowledge on distribution, behavior and biomass of several common species is also one of the main gaps. Furthermore the importance of recovering available historical time series of data that are often lacking should be taken into account. Due care should be used in the interpretation of these data since different data collectors may have been involved (fishermen, technicians, scientists) and collected species are sometimes misidentified. In terms of small-scale fisheries management, it should be remarked that, currently, management is mainly based on single fishing gears while

individual species are caught with variety of gear types. Management would need to be based on all gear types that are used, for example in Croatia lobster management is based on traps while lobsters are currently mostly exploited by gill net and trammel net fisheries which are not considered in this case. However, it could be observed that such complex management should be a second step and that first is what is needed to know about the species distribution in the whole Adriatic Sea since we presently lack basic information. A further need would be the quantitative evaluation of interaction between the different fishing gears employed in Croatian small-scale fisheries.

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Table 1. Chronological summary of investigations on fishing gear effects on the fish assemblage in the Croatian coastal area (long term series data). (for all references see in Dulčić et al, 2005b).

Year	Area of investigation	Gear	Note	Author
1951-1953	Croatian coast	Small coastal trawl "tartana"	Coastal resources	Županović (1956, 1963)
1953-1957	Island Dugi otok	Beach seine "migavica"	Coastal resources	Morović (1962, 1963)
1958-1961	Split area	Beam trawl	Coastal resources	Morović (1962, 1963)
1960-1964	mid-Adriatic coastal area	Trammel bottom sets	Coastal resources	Morović (1965)
1962-1965, 1968-1970	Islands Lastovo, Sv. Andrija and Palagruža	Trammel bottom sets	Coastal resources	Morović (1971)
1960-1994	Coastal area of Kornati Islands, Split, mid-Dalmatian Islands,Palagruža,	Trammel bottom sets	Coastal resources	Jardas *et al.* (1998c), Jardas (1999)

	southern Adriatic – Montenegro coast			
1961-1989	Palagruža Islands	Trammel bottom sets	Coastal resources	Jardas *et al.* (1996)
1962-1992	Kornati Islands	Trammel bottom sets	Coastal resources	Jardas et al, (1995)
1985-1986	Along the Croatian coast	«tramata» fishing	Coastal resources	Cetinić *et al.* (1987)
1980-1990	Along the Croatian coast	«strašin», «kogol», «tartana», «migavica»	Family Centracanthidae	Cetinić & Pallaoro (1992)
1980-1989	North and Central Adriatic (Croatian coast)	Seine net «kogol»	Coastal resources	Cetinić & Pallaoro (1990b)
1980-1992	Savudrija, Island Korčula, Island Lastovo	«tramata» (using ropes)	Coastal resources	Cetinić & Pallaoro (1993)
1988	Island Krk	«ludar»	Coastal resources	Cetinić *et al.* (1989)
1989-1992	Western coast of Istra	«ludar» (using ropes)	Coastal resources	Pallaoro & Cetinić (1993b)
1980-1994	Tar Cove, Mirna Esturay, Istra	Mullet nets-big seine net, tow net «ciplarica»	Coastal resources	Kraljević *et al.* (1993, 1994)
1980-1990	Croatian coastal area	«tartana»	Coastal resources	Cetinić *et al.* (1999a)
1995-2000	Tar cove, Neretva estuary, Cetina estuary, Kornati archipelago	Small beach seine	Fish juveniles	Dulčić *et al.* (1999b)
1980-1982	Velebit channel	Pots for Norway lobster	Norway lobster	Homen (1983)
1989-1992	Velebit channel	Pots for Norway lobster	Norway lobster	Obradović *et al.* (1991)
1997	Hvar and Brač channel	Pots for Norway lobster	Norway lobster	Soldo *et al.* (1999)
1992-1996	Šibenik area (central Adriatic)	Coastal beach seine «migavica»	Coastal resources	Cetinić *et al.* (1999b)
March – July 1997	Two stations (Umag, Rovinj)	Dredge («rampon»)	Pilgrim's scallop	Cetinić & Soldo (1999)
1986-1996	Along the Croatian coast	trammel bottom sets, «strašin», «kogol», «tartana», coastal beach seine, «tramata»	Sparidae	Jardas *et al.* (1998b)
1986-1999	Middle Adriatic	«tramata» fishing	Sparidae	Cetinić *et al.* (2002)
1998	Velebit channel	Traps for Norway lobster	Norway lobster	Cetinić *et al.* (1999c)
1998	Velebit channel	«prostice»	Hake	Cetinić *et al.* (1999c)
1999	Zadar area	«bukvare» gillnet	Coastal fish	Bosnić (2000)

		for fishing bogue		
1999	Island Korčula	Long line hook	Trigla lucerna	Vlašić (2000)
1999-2000	Brač channel	«tartana»	Coastal resources	Soldo (2001)
1999-2000	Western coast of Istra, mid-Dalmatian Islands	Lobster trap, «psare» nets	Homarus gammarus, Palinurus elephas	Cetinić *et al.* (2001), Soldo *et al.* (2001)
1998	Velebit channel	Trap for Norway lobster	Norway lobster	Dulčić *et al.* (2001)
1999-2000	Mid-Dalmatian Islands	«trammel» bottom sets	Sepia officinalis	Jardas *et al.* (2001)
1998-2000	Along the Croatian coast	Gillnet	Lobster, hake	Soldo *et al.* (2001), Soldo *et al.* (2002)
1986-1999	Along the Croatian coast	«tramata»	Sparidae	Cetinić *et al.* (2002)
1997	Island Čiovo (northern coast)	«gavunare»	Atherina hepsetus	Perić (2002)
2002-2003	Northern Adriatic and channels in the mid Adriatic	fish traps, long line hook, «prostice»	*M. merluccius M. barbatus, P. erythrinus, N. norvegicus, E. moschata*	DeMMon Project (Vrgoc, pers. com.))
1998-2009	Eastern Adriatic	small beach seine	coastal resources	Project Jadran
1998-2009	Eastern Adriatic	„poponice“	coastal resources	Project Jadran
1982-2010	Eastern Adriatic	„poponice“	coastal resources	Project Jadran

Small-scale fisheries in Italy

Rosaria Sabatella[1]

Abstract

The small-scale fleet segment is composed of vessels with total length (LOA) of less than 12 m. They are only allowed to use passive gears excluding towed gears of any type. Small-scale fishing is the most relevant sector from a social and job-related point of view. In 2011 Italian small scale fisheries followed the general trend of the last few years. The sustained increase of intermediate costs, together with a decrease in the production level, eroded added value and profits, further weakening the sector that was already in economic recession. Several factors affected the decrease in total captures and unitary productivity, such as the increase in fuel price and the restrictions set by Council Regulation (EC) n. 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea. Moreover, fishing activities, which have represented traditional working opportunities in fisheries dependent areas, are not attracting young generations anymore; indeed the lack of recruitment is one of the most important weakness factors in the sector.

In the reform to the UE Common Fisheries Policy, small-scale and coastal fisheries assume an important role in consideration of the local society and cultural identity of numerous European coastal regions. The Commission, in developing its proposal, has taken into due account the introduction of more market-based instruments while also taking into consideration the specific characteristics of small-scale fleets.

At national level, the expected management measures concerning small-scale fisheries will focus on the possibility to enforce property rights on the country's actual situation. Recently, through the provisions described in Article 37 of Regulation (EC) 1198/06 on the European Fisheries Fund - (EFF), which allows the possibility to finance the drafting of local management plans - local communities have been provided with an tool that is totally innovative in relation to currently available management options. To date in Sicily alone 10 Local Management Plans have been adopted and implemented up to September 2012.

1. Definition of small-scale and/or artisanal fisheries currently adopted in Italy.

The small-scale fleet segment is composed of vessels with total length (LOA) of less than 12 m. They are only allowed to use passive gears excluding any type of towed gears.

The fleet is segmented according to the main fishing gear of the vessel, according to Council Regulation (EC) n.199/2008, which created a framework for the collection and management of the data needed to implement the Common Fishery Policy (CFP), and Commission Regulation (EC) n.26/2004 of 30th December 2003, regarding the Community fishing fleet register – annex I "definition of data and description of a registration".

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2. Status of the national small-scale fisheries

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2. 2.1 Role in the whole fishery sector

The small-scale segment includes vessels using passive gears, mainly fixed nets, and are less than 12 meters in length.
The largest segment within the fleet is still represented by small-scale fishing, which consists of 8764 vessels, followed by trawlers (2525 vessels), hydraulic dredges (706), passive polyvalent gears, (186), purse seiners (268) and mid-water pair trawlers (132).
In terms of capacity the small-scale segment makes up only 10% of the national GT, but covers 67% of fishing boats in number and 67% of the total days at sea.
The average size of these vessels is 1.9 GT and 29 kW, while the average size of national fleet is 13 GT and 80 kW. Small scale vessels are older than other segments of the fleet, 30 years on average.
The small-scale fisheries segment accounts for about 17% of the national catch and for 27% of national value of landings. The difference between the above two figures depends on the target of small-scale gear, which is mostly high value species.
The vessel owner usually works on board with an additional person. The number of fishermen in 2011 was 14,000, which is the highest employment level by fleet segment.

Table 1. Italian fishing fleet by segment, 2011.

Fleet segments	*N. of vessels*	*GT*	*kW*	*Employment*	*Days at sea*
Bottom Trawler	2,525	103,854	498,829	8,431	374,245
Midwater Pair Trawler	132	10,572	48,059	678	16,696
Purse seiner	268	16,186	67,382	1,813	25,653
Dredger	706	9,394	76,332	1,480	59,870
Small scale fishery	**8,764**	**16,817**	**250,937**	**14,008**	**1,176,920**
Multi-purpose	483	6,501	69,859	1,589	71,598
Longlines	186	5,540	36,479	726	23,479
Total	**13,064**	**168,864**	**1,047,877**	**28,724**	1,748,461
% small scale fishery/total	67	10	24	49	67

Source: Mipaaf-Irepa

As far as the geographical distribution is concerned, the fleet shows a low level of concentration – with the exceptions of Apulia and Sicily, both in terms of number of vessels and tonnage – and strong differences in specialization, productivity and profitability between the Adriatic and Sicilian fisheries on one hand and the Tyrrhenian fleet on the other.
The number of vessels registered in the Adriatic regions is 2,351; they account for 27% of the total number of the segment and cover 26% of total GT.

Table 2. Geographical distribution of small scale vessels, 2011.

	Adriatic regions	Tyrrhenian and Ionic regions	Italy
Absolute values			
Number of vessels	2,351	6,413	8,764
Total GT	4,390	12,427	16,817
Total kW (1000)	77,302	173,635	250,937
Days at sea (1000)	324	853	1,177
Average values			
GRT	2	2	2
kW	33	27	29
Days at sea	138	133	134

Source: Irepa-Mipaaf

The small scale fishery sector shows low capital intensity and it is highly affected by climate conditions, market fluctuations and by the interaction with trawlers fishing the same species, often in the same grounds, which substantially reduce the availability of fish.
Data collection (landings and effort) and estimates of economic parameters concerning the Italian small scale fishery are produced through a National Observatory. The survey is based on a single panel. Around 400 vessels of the small-scale sector are monitored each week and elementary data are later expanded to the whole Italian fleet using statistical sampling procedures.

2.2 Main trends

A decline in fishing activity characterizes the Italian small-scale fleet: between 2004 and 2011 it fell by an average of 5%, dropping from 141 average days at sea in 2004 to 134 in 2011, with the lowest level in 2008 (111 days at sea per vessel). Due to the small size of vessels, fishing activities are highly affected by weather conditions.
Landings from this segment in 2011 amounted to 36 000 t with a 23% decrease compared to 2004.
Average catch per vessel and revenue dropped considerably, and in particular the landings in volume by day at sea, which fell below 32 kg, the lowest value since 2004.

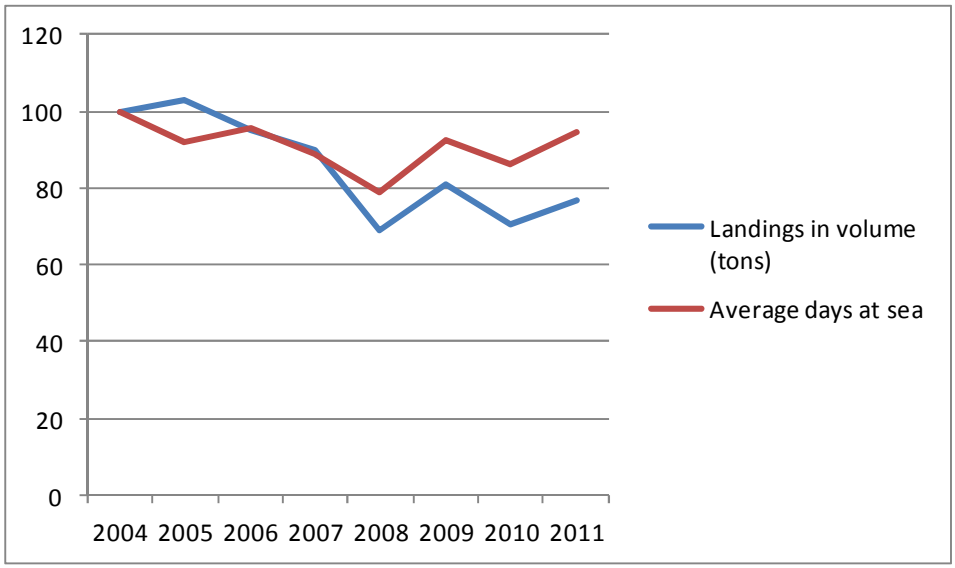

Figure 1. Trends in fishing activity and landings in volume, small–scale fishery, Italy, 2004-2011. Source: Mipaaf-Irepa

This trend could partly be due to the increase in fuel prices, this issue has certainly had an impact on the trend over the last three years. Several factors affected the fall in total captures and unitary productivity: changes in fishing zones, increased production costs, and different catch composition, which targeted the most sought-after species on domestic and international markets.

The new restrictions imposed by Council Regulation (EC) n. 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, also had a direct effect on production. New rules concerned: mesh size, distance from the coast, minimum size of several species and therefore brought about modifications in fishing activities. In particular, some measures imposed by Council Regulation (EC) n. 1967/2006 were implemented on 1st June 2010 and restrictions were applied fully for the first time. These - especially the ban on bottom trawling activities within 3 miles from the coast - had direct repercussions on several fishing communities, such as that of the northern Adriatic sea.

As a consequence of the entry into force of Regulation (EC) No 1967/2006, the catch of juvenile pilchard (bianchetto) is no longer allowed as of May 31, 2010.

The fishing of sardine juveniles held particular importance in the fishing communities in which it was carried out. The seasonal aspect of this type of fishery allowed small boats to achieve a considerable income during the winter season. Hence this type of fishery represented a significant source of income integration for many coastal communities, and therefore had socio-economic and employment-related importance.

Approximately 730 vessels were authorised in Italy for this special bianchetto fishery; most of these vessels were concentrated in GSA 18 (115 vessels per 1,767 GT).

The socio-economic importance of bianchetto fishery using trawling nets was extremely high; authorised vessels had the typical characteristics of small-scale fishery and achieved a high percentage of their income from bianchetto fishery, as there is high demand for “bianchetto” on the market.

2.3 Workers employed in the small-scale fishing sector

The fishing sector in Italy employed 29 000 workers in 2011. Small-scale fishing is the most relevant sector from a social and job-related point of view, followed by trawling and purse seining.
Measures such as the reduction of fishing capacity, the introduction of marine protected areas and the closure of fishing areas had a negative impact in terms of employment and income of those communities strictly dependent on fisheries.
Comparing 2004 data to 2010, the socio-economic impact of the decline in fishing activities is considerable; the number of employees in small scale fishery fell last year to 14 100. Since 2004 jobs lost in small scale fisheries amount to 2000 units.
This trend is mostly due to the reduced number of fishing vessels, but also to the decline in their physical and economic productivity. The increase in production costs, especially in the past two years, contributed to a decline in the economy of fishing enterprises and thus of workers. The annual cost of labour per worker fell by 20%, both on an annual and a monthly basis in the last six years.
Given the labour-intensive nature of small-scale fishing, any restrictions to fishing effort could have serious impact on the employment level. Moreover, fishing activities, which represented traditional working opportunities in fisheries dependent areas, are not attracting young generations anymore. Indeed, the lack of recruitment is one of the most important weakness factor for the segment.

2.4 Landings by geographical area

Geographically, the Tyrrhenian sea holds the highest number of vessels (3560), landings (14 178 t) and revenue (112.7 million euro, which amount to over 10% of all fishing activities in Italy). The main species in catch composition is octopus (with 1711 tonnes, 12% of landings and 9.6% of revenue), followed by hake (6.4% of landings and 9% revenue) and cuttlefish (5% in quantity and 6.7% in value).
Around 2400 vessels operate in the Adriatic sea; their production in 2011 was 11 500 t generating 94.4 million euro. Changeable nassa, a traditional product in the area, is the main species amounting to 19.6% in catch, followed by cuttlefish (13.7%) and mantis shrimps (10.5%). Revenue is generated by cuttlefish (15%), soles (14.7%), snails (13%) and mantis shrimps (11.4%).
Small-scale fishery in Sicily is carried out by 2054 boats, with landings at about 6300 tonnes generating 57,3 million euro in revenue. Traditionally this segment targets large pelagic fish like swordfish, albacore tuna and dolphinfish, that represent a large share of landings and revenue. Dolphinfish accounts for 10.2% of the total landings in this segment, though its economic impact does not rise above 6.1% due to the low average price being around 5€/kg. Swordfish landings (441 t) have increased since 2010. Amongst the other species harvested, cuttlefish accounts for 6.7% in volume and represent the main source of revenue with 5.8 million euro, 10.2% of the total. Anchovy landings with small driftnets (called “menaide”), mainly set on the eastern side of the island, fell abruptly by 51% in 2011; they now represent 5.5% of the landings (down from 11.8% in 2010) and 4% of revenue.
The Ionian fleet is composed of 800 boats, with a total volume of landings of 4700 tonnes. The average productivity per boat was higher than in other regions, due to much higher

activity rates in 2011 with 170 fishing days per vessel compared to 134 of the overall segment. Catch composition is made of bogue, octopus and cuttlefish.

Table 3. Composition of landings by main species and geographical area, small-scale fishery, year 2011.

	Adriatic sea	**Ionian sea**	**Tyrrhenian sea**	**Sicily**	**Total**
	Tons				
Common cuttlefish	1,577	345	733	420	3,075
Octopuses	275	427	1,712	200	2,614
Changeable nassa and murex	2,354	0	72	0	2,425
European hake	176	171	910	228	1,486
Mantis squillid	1,181	4	123	0	1,308
Mullets nei	724	75	315	23	1,137
Picarels	3	26	454	580	1,064
Red mullet	73	182	601	170	1,027
Soles	686	11	206	11	914
Bogue	37	439	288	111	875
Other species	4,419	2,977	8,763	4,535	20,694
Total landings	11,505	4,659	14,178	6,279	36,620

Source: Mipaaf-Irepa

2.5 Profitability of fishing enterprises

The fishery sector in 2011 continued to record substantially negative performances; the revenue produced by the fishery sector has consistently declined since 2008, a particularly negative year for the industry. The added value produced by the segment in the last year (2011) was 574.40 million euro.

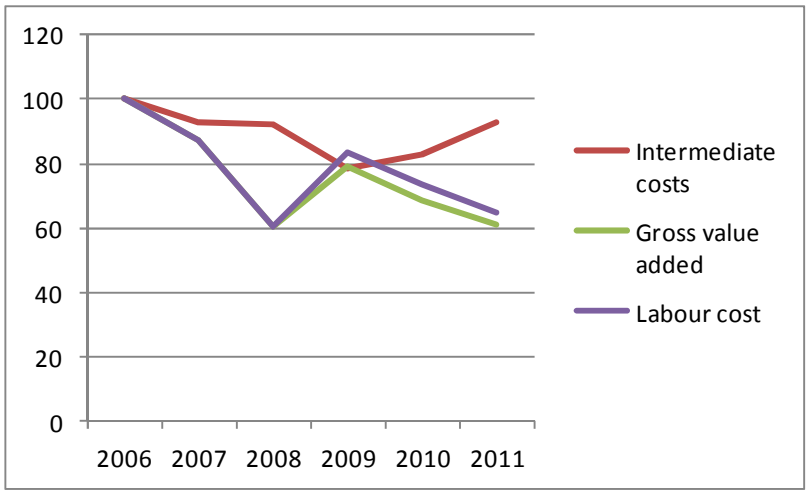

Figure 2. Main economic indicators for the national fleet, 2006-2011. Source:Mipaaf-Irepa.

Intermediate costs reached in 2011 the highest levels for the last three years: the share of intermediate costs over revenues amounted to 47% against 42% in 2010 and 37% in 2009.

The general economic recession of the sector, due to an increase in intermediate consumptions and a fall in revenues, had negative repercussions on labour costs: only 25,6% of revenue was allocated to crew payments in the last year.

Table 4. Economic performance indicators, Italian fleet, 2006-2011.

		2006	2007	2008	2009	2010	2011
Intermediate costs/income	%	37,1	38,6	47,3	36,9	41,6	47,3
Labour costs/income	%	28,9	28,2	24,1	30,5	28,7	25,6
Gross value added/income	%	62,9	61,4	52,7	62,9	58,4	52,7
Gross profit/income	%	33,9	33,1	28,6	32,6	29,6	27,1

Source:Mipaaf-Irepa

The rise in intermediate costs was driven by the considerable increase in fuel prices, which rose from 0.59 €/lt in 2010 to 0,70 €/lt in 2011. At vessel level, the average fuel expenses per boat increased by 30% and its impact on the overall costs rose from 46% in 2009 to 58% in 2011.

In the context of small-scale fisheries, the added value should be chosen as an indicator of profitability and fishermen's income. The crew in this segment often consists of a single person who is both the vessel owner and fisherman. Consequently, the economic accounts for these fishing vessels is simplified. Indeed, given that the labour cost item is absent, the added value, which represents the remuneration both of the labour and the capital, can be obtained simply by deducting the consumption items from the income items.

Intermediate costs sustained by small scale fishing amount to 13 000 euro per vessel; the gross value added per vessel (about 21 000 euro) were allocated for labour costs and the rest represented the gross profits of the vessel.

Table 5. Income statement - small-scale fishery, 2011, 000 €

	Income	Intermediate costs	Gross added value
absolute value (mln €)	296	111	185
average by vessel (000 €)	34	13	21
% on income	100	37,6	62,4

Source:Mipaaf-Irepa

In the last 6 years, some factors greatly reduced the profit margins of fishing enterprises; in particular, this negative trend is due to the higher level of operational costs in the last few years compared to the past. Particularly, since the year 2008, the price of fuel has increased remarkably and its percentage impact on the total intermediate consumption is higher than other costs.

The level of annual income registered in the small scale fleet is still low compared to other productive activities. Over the years, the persistence of such standards of revenues could even lead fishermen, who are socially and culturally closer to seafaring life, to quit the activity. This phenomenon is mainly registered where the fishery industry is larger, such as, for example, the Sicilian provinces and the largest Adriatic fishery centres. Given the inadequate

level of revenues, it is only the high degree of ownership share that prevents the fishermen from quitting the activity.

Table 6. Energy costs by vessel, 2004-2011

Year		Bottom Trawl	Small scale fishery
2004	000 €	46,20	3,63
2005		59,92	4,32
2006		66,18	4,04
2007		66,46	3,75
2008		75,75	4,47
2009		50,88	3,36
2010		60,53	3,94
2011		75,95	6,26
var. 2011/2004	%	64,40	72,46

Source:Mipaaf-Irepa

3. National and international programmes focussing on the small-scale fishery sector

3.1 European programmes

Small scale fishery is managed at national level as a consequence of the fact that target stocks are primarily distributed in national waters and caught only by one Member State.
On 13th July 2011, the European Commission presented its proposals for the reform of the EU common fisheries policy and, on 2 December 2011, it proposed a new fund for the EU's maritime and fisheries policies for the period 2014-2020: the European maritime and fisheries fund (EMFF). During 2012, the reform proposals will be discussed in the European Parliament and in the Council. The reformed CFP will enter into force in 2013
The reform of the Common Fisheries Policy[2] (CFP) will contribute to the Europe 2020 Strategy[3] by working towards sustainable and inclusive growth, enhanced cohesion in coastal regions, and robust economic performance of the industy.
The small-scale coastal fleets assumes priority importance in CFP; in the 2008 European Commission Green Paper on the reform of common fishing policies, point 5.1 reads "*...the fishing industry, mainly composed of small and medium companies, has an important role for the local society and cultural identity of numerous European coastal regions. The income of many coastal communities depends on it, which in some cases have little possibility of economic diversification. It is therefore essential to guarantee a future to all those who practice small-scale, inshore and recreational fishing, fully taking into account the specific situation of small and medium companies...*".
In the proposal for a new regulation of the European Parliament and of the Council on the common fisheries policy COM(2011) 425, the Commission proposes to extend the current restrictions on the right to fish within the 12-nautical mile limit until 2022. These restrictions

[2] COM(2009)163 final of 22 April 2009.
[3] Communication from the Commission *EU 2020 A strategy for smart, sustainable and inclusive growth* (COM(2010)2020 of 3 March 2010) sets out the strategy to help the EU come out stronger from the crisis and turn the EU into a smart, sustainable and inclusive economy delivering high levels of employment, productivity and social cohesion. Europe 2020 sets out a vision of Europe's social market economy for the 21st century.

have reduced fishing pressure in the most biologically sensitive areas and have contributed to economic stability for small-scale, coastal fishing activities. Small-scale and coastal fisheries are considered important but limited support was shown for the idea of a differentiated regime beyond current legal provisions. More market-based approaches in fleet management and the market policy were seen by many as useful drivers for sustainability. The Commission, in developing its proposal, has taken into due account the introduction of more market-based instruments while also taking into consideration the specific characteristics of small-scale fleets.

The social and economic importance of *small-scale coastal fleets* and aquaculture in certain regions calls for specific measures for these fleets. The measures should support green, smart and inclusive growth and should contribute to sustainable, low-impact fishing and aquaculture, innovation, income diversification, reconversion, improvement of science and a culture of compliance.

The main tool of the new CFP to achieve its objectives is the new European Maritime and Fisheries Fund (EMFF). Compared to the European Fisheries Fund (EFF), the EMFF brings about a fundamental change of approach to public funding to the fisheries sector through a focus on collective actions and on the viability of coastal areas rather than fleet subsidies mostly benefitting vessel owners. Therefore, the EMFF proposes to eliminate most of the current fleet measures and use this part of the funding to achieve economic viability of the fleets and aquaculture sector instead (innovation, added value and marketing) and for the promotion of the development and diversification of areas on fishing. The EMFF focuses on people, particularly small scale fishermen and on coastal areas dependent on fisheries.

The focus on small scale fishermen is achieved by the inclusion of dedicated measures (such as business advisory services), by higher aid intensity and by the creation of the link between the financial allocation and the share of these fleets. Beyond the EMFF, the new CFP would maintain the current access limitations within the 12 nautical mile limit and existing provisions in relation to control, such as the derogation to the vessel monitoring system equipment.

3.2 National programmes

In accordance with art. 19 of Reg. (EC) 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, that obliges each Member State to prepare a Management Plan for the fishing systems, in 2010, 22 National Management Plans were adopted. Each national Management plan contains:

- the state of conservation of a fish stock or stocks;
- the biological characteristics of a fish stock or stocks;
- the characteristics of the fishing activities which result in fish stocks being caught;
- the economic impact of the measures on the fishing activities concerned.

Amongst the measures introduced in the national plan are:

- fishing effort management measures;
- specific technical measures;
- other temporary or permanent restrictions;
- the closure of fishing area.

For the first time, strategies based on Management Plans, according to fishery area and fishing system were adopted in Mediterranean sea; the much referred to specific nature and management complexity of Mediterranean fishery resources, has, for many years, limited the choices made by competent authorities to merely controlling fishing effort and to introducing technical measures.

In relation to small scale fishery, 7 Management plans were adopted, one for each Geographical Sub Area (GSA 9, GSA 10, GSA 11, GSA 19, GSA 18 and GSA 17) and one for Sicily.

As regards the management of the fishing capacity, adjustment plans contained in the EFF operating programme were adopted. The adjustment plans contain decommissioning levels calculated in order to be compatible with a gradual pathway toward rebalancing fish stocks.

In accordance with the status of biological resources and in compliance with the available financial resources, the new decommissioning plans are divided according to the fishing system in a geographical area, as follows:

- one decommissioning plan drawn up pursuant to Regulation (EC) 1198/06, for the fishing of bluefin tuna using a seining system;
- one decommissioning plan for the oceanic fleet in the framework of the EEC – Mauritania fishing agreement affected by adjustment plans;
- seven decommissioning plans for bottom-trawling, for the protection of demersal resources,
- six decommissioning plans for fleets operating with "other systems", i.e. small scale fishery and polyvalent;
- five decommissioning plans for the fleet that operates using seining and midwater pair trawling systems deployed in the fishery of small pelagic species.

For the small-scale fleet, with reference to biological resource status and on the basis of biological parameter estimates, the decommissioning plan should bring about a reduction that ranges between 8% and 3% of fishing effort.

Table 7. Planned reduction in GT and kW by geographical area (GSA), small scale and polyvalent fishery

		Reduction	Reduction at 2015	
Small scale fishery and polyvalent		%	GT to be withdrawn	kW to be withdrawn
	Sicily	7	899	7.642
	GSA 10 (lower Tyrrhenian)	8	292	3.261
	GSA18 e GSA 19 (lower Adriatic and Ionian)	8	334	3.331
	GSA17 (upper and mid Adriatic)	3	424	5.000
	GSA 9 (Upper and mid Tyrrhenian)	3	131	1.986
	GSA 11 (Sardinia)	3	130	1.923
	Total small scale fishery and polyvalent	5	2.211	23.143

Source: EFF operating programme for the fishery sector in Italy

The current fishing effort reduction scheme is helping to achieve a better balance between fishing effort and the available biological resources.

4. The identification of priorities and main gaps related to the Italian small-scale fishery sector concerning management issues

Over the last few years, the opportunities for redevelopment offered to the marine fishery sector have included activities such as marine aquaculture and fishery tourism. The latter in particular is growing rapidly and spreading throughout the country as well as in areas mainly devoted to tourism, but the economic outcome of this activity has not been very high.

At this moment, a new and coherent management approach is needed which will make use of the various available tools in an integrated way; some "key factors" of small scale fisheries such as flexibility, high level of knowledge and experience of fishermen, the complexity of the fisheries, in terms of species and diversity of fishing techniques and practices should be considered in order to identify the priorities concerning management issues.

In order to overcome the main gaps related to the management of small scale fisheries, the expected management measures concerning this sector centre on the possibility to enforce property rights on the country's actual situation.

Territorial Use rights could be successfully enforced in case of fisheries exploited by small artisanal vessels fishing in the very close coastal areas (FAO 2000).

For small-scale fishery, it is difficult to establish a system of "strong" property rights because of the multispecific nature of the activity, but it is possible to introduce the principle of "exclusivity", moreover a rights-based fishery management system can combine resource protection with economic and social objectives.

In recent years there has been significant global development of co-management experiences regarding coastal resources. The Italian experience in the area of property rights is, at present, very limited; aside from the management of the hydraulic dredge division by the Bivalve Mollusc Management Consortia, there is little experience in Italy involving co-management systems or assignment of territorial property rights. Recently, through the provision of Article 37 of Regulation (EC) 1198/06 on the European Fisheries Fund - (EFF), which allows the possibility of financing the drafting of local management plans, local communities have been provided with an intervention tool that is totally innovative in relation to presently available management options.

Local Management Plans are a completely innovative intervention tool in the range of available management tools. The novelty introduced by this specific type of plan lies in the fact that, once established organisational criteria have been satisfied, such as a minimum percentage of 70% of registered eligible beneficiaries in the area that has subscribed to an *ad hoc* management consortium, it will be possible to introduce self-management rules thereby attributing local ownership rights in favour of these consortia.

A non-marginal novelty associated with implementing Local Management Plans concerns the possibility of envisaging a strategy that harmonises coastal fishery resource conservation needs with socio-economic and structural requirements, within the framework of a local area development approach.

In Sicily, 10 Local Management Plans were adopted and implemented in September 2012. The Local Management Plans cover almost all coastal fishing areas and contain restrictive management measures in order to reduce fishing effort, to improve the state of fishery resource and to limit the conflict between other users (sport and recreational fisheries, tourism).

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Small–scale fisheries in Montenegro

Zdravko Ikica[11], Mirko Đurović, Aleksandar Joksimović, Milica Mandić, Olivera Marković, Ana Pešić

Abstract

The legal framework in Montenegro recognizes small-scale (commercial) fisheries, which differ from large–scale fisheries in vessel size, type and number of fishing gears permitted. There is only limited data available on the size and catch of the current small–scale fishing fleet. The number of licensed vessels (70) represents only a part of the total fleet and, apart from some estimations, poor data on small–scale fishing fleet catch are available, both regarding the catch in weight and catch composition. Gillnets are the most common type of fishing gear used in small–scale fisheries, followed closely by trammel nets and beach seines targeting pilchard (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*). A new project focusing on small–scale fisheries, supported by the Ministry of Science of Montenegro, is expected to fill the gaps in knowledge of this type of fishery.

1. The definition of small–scale and/or artisanal fisheries currently adopted in Montenegro

Current legislation in Montenegro (Law on Marine Fisheries and Mariculture[12] and The Rulebook on construction–technical basis, mesh size, method of use and purpose of certain net types and other means for commercial fishing[13]) recognizes the category of small–scale commercial fishing (Montenegrin: *mali privredni ribolov*).

The law defines small–scale commercial fishing as a fishery using a vessel of up to 12 m length overall (L_{OA}) with fishing gear allowed for small–scale commercial fishery:

- gillnets and trammel nets — 2 in total (artificial lights of up to 800 cd are also permitted)
- fish pots and traps — up to 10
- harpoons (with or without artificial light)
- longlines (up to 250 hooks) and other hooks (rods, hooks and lines, etc.) (up to 4 pcs.)
- beach seine for pilchard („srdelara"; mesh size up to 12 mm) (Fig. 1)
- Chinese net — 1 pc.
- "grib"[14] — 1 pc.

In accordance with the 2009 Law on Marine Fisheries and Mariculture, up to 180 licences can be issued for small–scale commercial fishing. In order to obtain a licence, the subject must be registered as a legal entity (legal person) at the Central registry of commercial subjects (under

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[12] Zakon o morskom ribarstvu i marikulturi, Službeni list Crne Gore/Official Gazette of Montenegro 56/2009

[13] Pravilnik o osnovnim konstrukcijsko–tehničkim karakteristikama, načinu upotrebe, vremenu, namjeni, količini i vrsti ribolovnih alata i opreme koja se smije upotrebljavati u velikom i malom privrednom ribolovu, Službeni list Crne Gore/Official Gazette of Montenegro, 8/2011

[14] "Grib" is a type of beach seine net specific to the Montenegrin coast, especially for area around the river Bojana estuary. Two types are in use, one for catching meagre (*Argyrosomus regius*), shi drum (*Umbrina cirrosa*) and sturgeon (*Acipenser* spp.), and the other for mullets (Mugilidae).

Tax Administration of the Ministry of Fincance)[15], must possess a vessel registered for commercial activities with the Harbour master's office and must obtain an expert opinion from the Institute of Marine Biology in Kotor, stating that all fishing gear the subject wishes to obtain licence for is in accordance with the Law on Marine Fisheries and Mariculture and The Rulebook on construction–technical basis, mesh size, method of use and purpose of certain net types and other means for commercial fishing. The subject can then apply for the actual fishing licence, issued by the Fisheries Unit of the Ministry of Agriculture and Rural Development. The licensee is required to pay a fee for each item of fishing gear, according to the Decision on the individual fees for commercial fishing and aquaculture[16]. The licence is valid for five years.

Figure 1. Gillnets for bonito ("polandara") and beach seines (IBMK).

In 2011, licenses were issued for a specific sub–type of small–scale commercial fisheries for low income persons (up to 150.00 € monthly income) and people in retirement, with a specific set of allowed fishing gear, which is similar to the gear list for the small–scale commercial fisheries, but with a reduced amount of gear permitted:

- gillnets or trammel nets — 1 pc. (artificial lights of up to 800 cd are also permitted)
- fish pots and traps — up to 5 pcs.
- harpoons (with or without artificial light)
- longlines (up to 100 hooks) and other hooks (rods, hooks and lines, etc.) (up to 2 pcs.)
- Chinese net — 1 pc.
- "grib" — 1 pc.

[15] Mne. *Centralni registar privrednih subjekata, Poreska uprava, Ministarstvo finansija*

[16] Odluka o visini pojedinačne naknade za obavljanje privrednog ribolova i marikulture, Službeni list Crne Gore/Official Gazette of Montenegro 14/2011

These licenses (10 were issued in total) were only issued in 2011, and no further licenses of this type will be issued.
Gillnets and trammel nets are traditionally divided according to the target species and mesh size, and the types that can be licensed according to the Law on Marine Fisheries and Mariculture are:

- gillnet for bogue ("bukvara", mesh size 40–52 mm)
- gillnet for sand smelt ("gavunara", mesh size 20 mm)
- gillnet for picarel ("girara", mesh size 30 mm)
- gillnet for picarel ("menulara", mesh size 32–40 mm)
- gillnet for crabs ("rakovica", mesh size 300 mm)
- gillnet for demersal fish ("prostica", mesh size 56 mm)
- gillnet for small pelagic fish ("vojga", mesh size 32 mm)
- gillnet for rays ("sklatara", mesh size 80 mm)
- gillnet for sharks ("psara", mesh size 120 mm)
- gillnet for bonito ("polandara", mesh size 80 mm) (Fig. 1)
- trammel net "popunica" (mesh size on central net 56 mm) (Fig. 2)
- trammel net for flatfish ("listarice", mesh size on middle net 72 mm).

Two types of combined gillnet–trammel nets are permitted in Montenegro, both primarily used to catch salema (*Sarpa salpa*), two part gillnet–trammel net, and three–part trammel net–gillnet–trammel net. Minimum mesh size for both gillnets and inner netting of trammel nets is 80 mm.
Of the listed net types, the most common in licensed vessels are gillnets for demersal fish ("prostica"), gillnets for bogue ("bukvara"), and "popunica" trammel nets.

Figure 2. Trammel net "popunica" (IBMK).

2. Status of national small–scale fisheries

There are seven landing ports for small–scale fisheries in Montenegro: Herceg Novi, Zelenika, Kotor, Tivat, Budva, Bar and Ulcinj. Kotor has the greatest number of registered vessels (17), while Ulcinj has a single registered vessel. This, however, does not reflect the

actual situation in the field, but the exact number of unlicensed fishing vessels in Montenegro remains unknown. Table 1 gives the number of vessels registered for small–scale fisheries by port and length overall.
All data regarding licenses was obtained from the Fisheries Sector of the Ministry of Agriculture and Rural Development (MARD). Data regarding types of fishing gear used was obtained through the expert opinions on fishing gear given by the Institute of Marine Biology (IBMK).

Table 1. Number of vessels registered for small–scale fisheries according to vessel length and by port (MARD).

	Port						
L_{OA} (m)	**Kotor**	**Budva**	**Herceg Novi**	**Tivat**	**Zelenika**	**Bar**	**Ulcinj**
3	1	—	—	2	—	—	—
4	7	4	3	2	4	—	1
5	5	4	3	2	1	1	—
6	1	2	2	1	—	2	—
7	—	3	3	2	2	1	—
8	1	—	—	1	1	1	—
9	—	1	—	1	1	—	—
Unknown	2	—	1	1	—	—	—
Total	**17**	**14**	**12**	**12**	**9**	**5**	**1**

Of the 70 vessels registered for small–scale fisheries, 50 (71%) are from the Boka Kotorska Bay (ports of Herceg Novi, Zelenika, Kotor and Tivat), the area where small–scale fisheries, particularly those involving beach seines, have been present for centuries, and are a part of the cultural identity of the people from the region (Fig. 3). Around 61% are vessels with length overall below 6 m, and the rest (39%) are in the 6–12 m category (the largest vessel in the small–scale fishery fleet is 9.76 m L_{OA} (Table 2)). In Boka Kotorska Bay (Herceg Novi, Zelenika, Kotor, Tivat), the ratio is 65:35% in favour of boats of fewer than 6 m L_{OA}, while in the open sea ports (Budva, Bar, Ulcinj) it is 50:50.

All vessels using beach seines registered for small–scale fisheries (20) are from the Boka Kotorska Bay.

Table 2. Main characteristics of the Montenegrin small–scale fishing fleet (IBMK).

	Minimum	**Maximum**	**Total**
Length overall (m)	3.60	9.76	—
Engine Power (kW)	2.20	147.00	1443.83
Gross register tonnage	0.43	8.50	132.80

Figure 3. Fishermen pulling beach seine net out of the sea in the Boka Kotorska Bay (IBMK)

Most of the vessels in the small–scale fishing fleet are equipped with more than one type of fishing gear. Only about 23 vessels (33% of the fleet) use a single type of gear, 27 (39%) use two types, 13 (19%) three, 4 (6%) use four types, and only 1 vessel (1% of the fleet) uses five types of fishing gear. Therefore, 45 vessels in the fleet could be considered multipurpose[17] (polyvalent) vessels.

Although the vast majority of the gear used by the vessels falls either in the beach seine or passive fishing gear category, two vessels have licenses to use purse seine nets. This type of fishing gear, although not part of the gear normally associated with small–scale fisheries, has nonetheless been included in the analysis above.

As shown in Fig. 4, the gillnet is the most commonly used type of gear, i.e. most fishing vessels are equipped with gillnets, followed by trammel nets and beach seines. Set (bottom) longlines are slightly less common than drift longlines.

[17] For the purpose of this document, the term multipurpose (or polyvalent) vessel applies to any fishing vessel licensed to operate with more than one type of fishing gear.

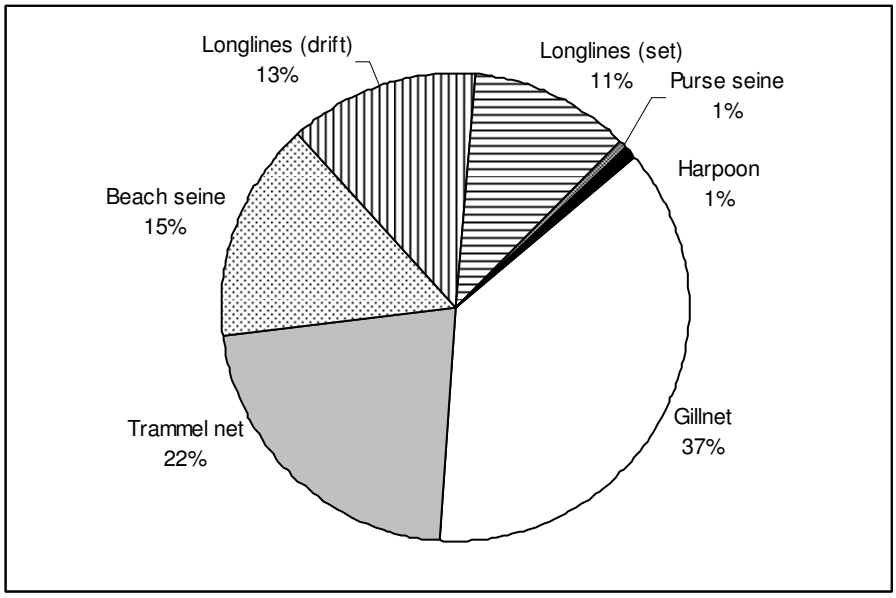

Figure 4. Types of fishing gear used by the vessels in the Montenegrin small–scale fishery fleet (IBMK).

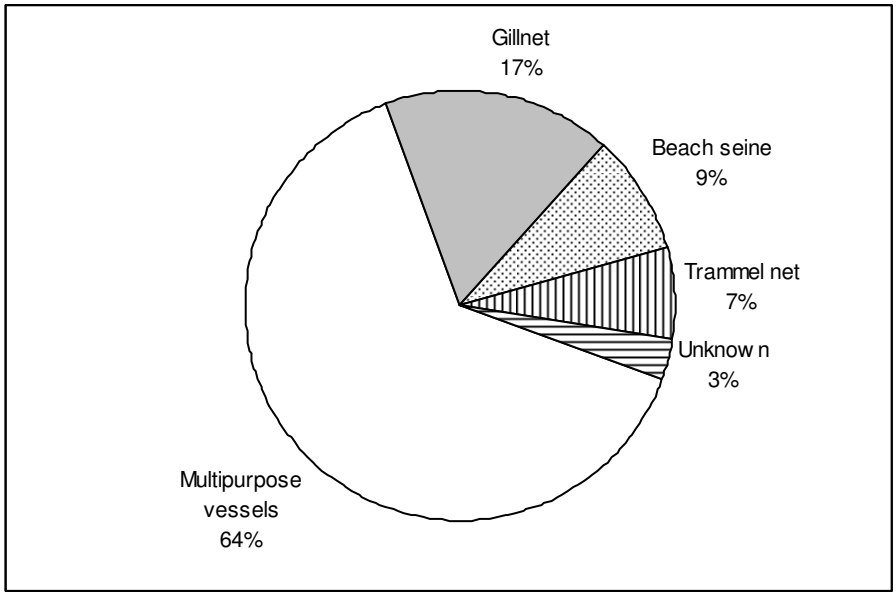

Figure 5.The structure of the Montenegrin small–scale fishing fleet according to the gear used (IBMK).

As already mentioned, 64% of the small–scale fishing fleet can be classified as multipurpose (polyvalent) vessels. Vessels dedicated to using gillnets are the most numerous single–gear vessels (17%), followed by beach seines and trammel nets (Fig. 5).

Out of the total number of fishing gear in use (137, spread over 68 vessels in 7 ports), the largest number is concentrated in Kotor (30), and the fewest are in Ulcinj (1). The data on type of fishing gear by port is given in Table 3.

Table 3. Types of fishing gear by port (IBMK).

Gear	Budva	Bar	Herceg Novi	Kotor	Tivat	Ulcinj	Zelenika
Beach seine	0	0	1	13	4	0	3
Gillnet	14	5	10	10	5	1	6
Harpoon	0	0	0	1	0	0	0
Longlines (drift)	3	1	6	2	1	0	5
Longlines (set)	3	0	4	1	4	0	3
Purse seine	0	0	1	0	0	0	0
Trammel net	8	1	9	3	6	0	3
Total	**28**	**7**	**31**	**30**	**20**	**1**	**20**

Figure 6 shows the ratio of various fishing gear types used in Boka Kotorska Bay ports (Herceg Novi, Zelenika, Kotor, Tivat) and the ports facing the open sea (Budva, Bar, Ulcinj). Beach seines, as already mentioned, are only found in the Boka Kotorska Bay area and, along with trammel nets, represent 21% of the total number of gear types used. The most common type of fishing gear used is the gillnet, which represents 56% of the gear types used in the open sea ports and 30% in the Boka Kotorska Bay. Open sea ports use only four types of fishing gear, compared to six used in the Boka Kotorska Bay.

2.1. Catch

Small-scale fisheries are poorly known and not monitored. No specific studies of Montenegrin small–scale fisheries have been carried out and no catch data are available. However some figures can be estimated from the results of several research projects. Traditionally, emphasis is given to bottom trawl catches, as the most significant field of marine fisheries in the country. In a study done for the Centre for ecological planning[18], Regner and Joksimović (2000) provided a theoretical estimate of 1174 tonnes of yearly catch from coastal fisheries, with most of that estimate attributed to longlines (908 tonnes), followed by beach seines (156 tonnes), gillnets and trammel nets (50 tonnes), Chinese nets (for mullets) (50 tonnes) and fyke nets (for eels, *Anguilla anguilla*; around 10 tonnes).

[18] Mne. *Centar za ekološko projektovanje*, CEP

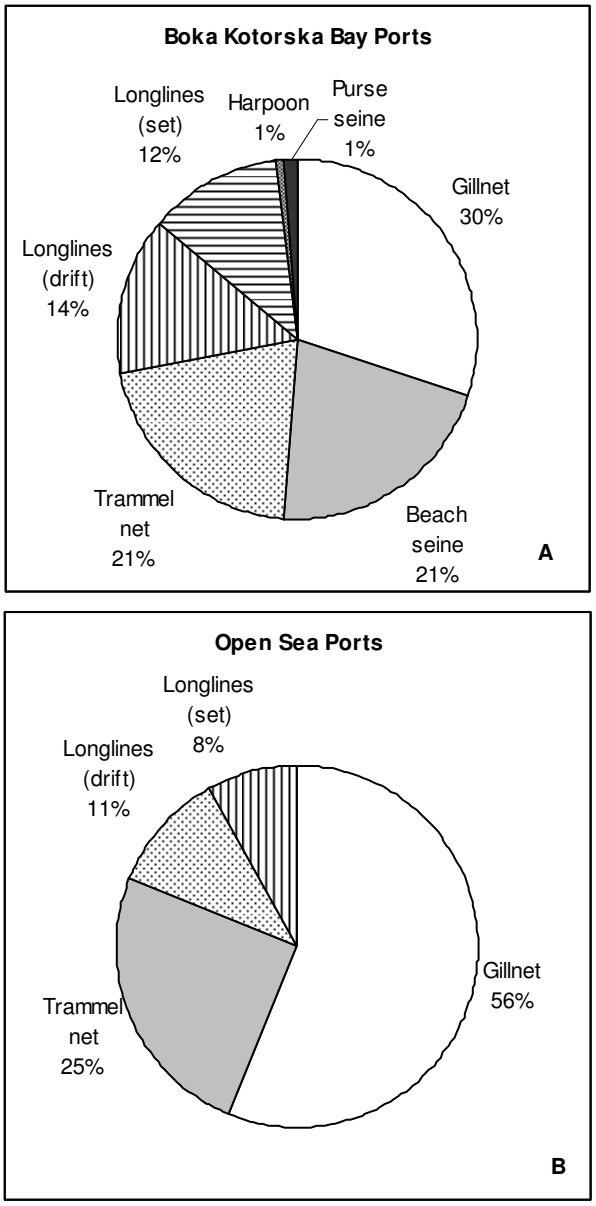

Fig. 6. Distribution of fishing gear for Boka Kotorska Bay ports and the ports on the open sea (IBMK).

More recently, in 2012 the Institute of Marine Biology in Kotor, within the framework of the project "Sustainable Management of Marine Fishery" (Europeaid/128947/C/SER/ME) with the support of European Delegation in Montenegro estimated gillnet bogue (*Boops boops*) catches to 27.9 tonnes in September 2007 to August 2008 period, and 35.9 tonnes in September 2009 to August 2010 period. Those values were obtained through the reconstruction of bogue gillnet fisheries using virtual population analysis function of the VIT for Windows program.

Fig. 7. Beach seine for pilchard ("srdelara") (IBMK).

In the framework of the FAO AdriaMed Project, of which Montenegro is one of the participating countries, a project to monitor the fisheries (by catch/effort survey) in Montenegro has been carried out since 2007. In this project, catches of selected species were estimated. The total catch was estimated by raising the catch of the sample vessel to the total number of vessels using gillnets, estimated. The number of vessels used in the estimation was based on number of sampled vessels.

Table 4. Average monthly gillnet catches (kg) of some sampled species (IBMK; 2012).

Species	**2007/08**		**2009/10**		**2010/11**	
	<6 m (26 vessels)	**6–12 m (14 vessels)**	**<6 m (22 vessels)**	**6–12 m (14 vessels)**	**<6 m (22 vessels)**	**6–12 m (14 vessels)**
E. encrasicolus	600	850	450	650	500	700
S. pilchardus	700	800	400	550	500	800
B. boops	600	900	800	1000	600	900
Spicara spp.	900	850	450	350	400	400
Trachurus spp.	800	950	550	700	500	600
Mugilidae	600	1100	4500	1800	2000	1400

3. A description of planned national and international programmes focusing on the small–scale fishery sector

In 2012 the Ministry of Science of Montenegro approved a new national project to be executed by the Institute of Marine Biology in Kotor under the name of "Monitoring of small–scale coastal fisheries and composition of fish fry with the aim of conservation and management of marine fishery resources" (MORMONT). The project is expected to last for three years (2012–2014). The first part of the project consists of landing data retrieval from 6 landing ports (Herceg Novi, Tivat, Bigova, Budva, Bar and Ulcinj). The second part will include collection of biological data (length, weight, maturity stages, gonad weight) from selected species important in small–scale fisheries.
Until this project, there has been no dedicated study of small–scale fisheries in Montenegro.

4. The identification of priorities and main gaps related to the Montenegro small–scale fishery sector concerning management issues

The establishment of a basic monitoring system would be the first step towards proper management of this sector. The monitoring should also include some economic parameters to allow the estimation of the economic performance of small–scale fisheries (in terms of employment; incomes, etc.). All these data could in turn facilitate the comprehension of the possible interactions/conflicts that small–scale fisheries may have with the other fisheries activities or coastal activities and be therefore beneficial for the management of the coastal zone.

5. Reference

Regner S., Joksimović A. 2000. Ribarstveno–biološki potencijali akvatorija Crnogorskog primorja. Studija za potrebe Prostornog plana Morskog dobra Republike Crne Gore. 16 pp.

Ikica, Z. Đurović, M., Joksimović, A. Mandić, M., Marković, O., Pesić, A., Arneri, E., Milone, N. and Ceriola, L. Report of the monitoring of fisheries sector in Montenegro: BIOLOGICAL SAMPLING (September 2007-August 2011). AdriaMed Technical Documents, 32: 87pp. (*in press*)

Small-scale fisheries in Slovenia

Jernej Švab [1]

Abstract

Small-scale fishery activities represent one of the most important segments of the Slovenian fisheries sector. However it is poorly explored and without systematic scientific surveys. Since 2004 it has been monitored together with all other segments of the Slovenian fishing fleet. Now data on small-scale fisheries are also collected under the Data Collection Framework. Officially it is not recognized as a category within national fisheries because there is no agreed common definition of small-scale fisheries. In practical terms, small-scale fisheries comprise small vessels, less than 12 m long and equipped with passive fishing gears. The current number of fishing units that may be attributed to the small-scale fishery sector is estimated at 61 vessels. Indicatively, the average yearly catch could be estimated at around 54 tonnes.

1. The definition of small-scale and/or artisanal fisheries currently adopted in Slovenia

Small scale fishery (SSF) is the most numerous fishing segment of the Slovenian fishing fleet. Although the Slovenian fishing fleet has never been officially classified into categories of small-scale and large scale fishery, unofficially the division has always been present.
The division between small-scale and large scale fishery is mainly based on the length overall (LOA) of the vessels and on the use of the fishing gears employed in fishing operations. The fishing grounds of small-scale fishing units are limited to the Slovenian territorial waters. We are still lacking an appropriate definition what SSF is and some general studies and research on SSF are needed. From 2004 we have good data on the Slovenian fishing fleet and the data series are available. For the purposes of data collection, Slovenian legislation does not make any difference between small-scale and large scale fisheries, all vessels from the Slovenian fisheries fleet register are included in the data collection framework (DCF) and all vessel owners regardless of the LOA have an obligation to compile log books (LB).

For the purposes of the implementation of the European Fisheries Fund (EFF) (Council Regulation (EC) No 1198/2006 of 27 July 2006) we are currently using the definition from Article 26 of the EFF Regulation, which states: "small-scale coastal fishing means fishing carried out by fishing vessels of an overall length of less than 12 metres and not using towed gear as listed in Table 3 in Annex I of Commission Regulation (EC) No 26/2004 of 30 December 2003 regarding the fishing vessels register of the Community". The list of Slovenian fishing gears is based on the fishing gears described in Commission Regulation No 1799/2006 of 6 December 2006, amending Regulation (EC) No 26/2004 on the Community fishing fleet register.

Taking the above-mentioned information into account, the subject of this report is Slovenian SSF, consisting of vessels with LOA under 12 meters and equipped with following categories

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of fishing gears: surrounding nets, gill nets and entangling nets, traps, hooks and lines. These categories of gear are known as passive fishing gears.
This report aims to represent an overview of the Slovenian SSF based on the size of fishing vessels and as well on the type of fishing gears used to carry out fishing activities.

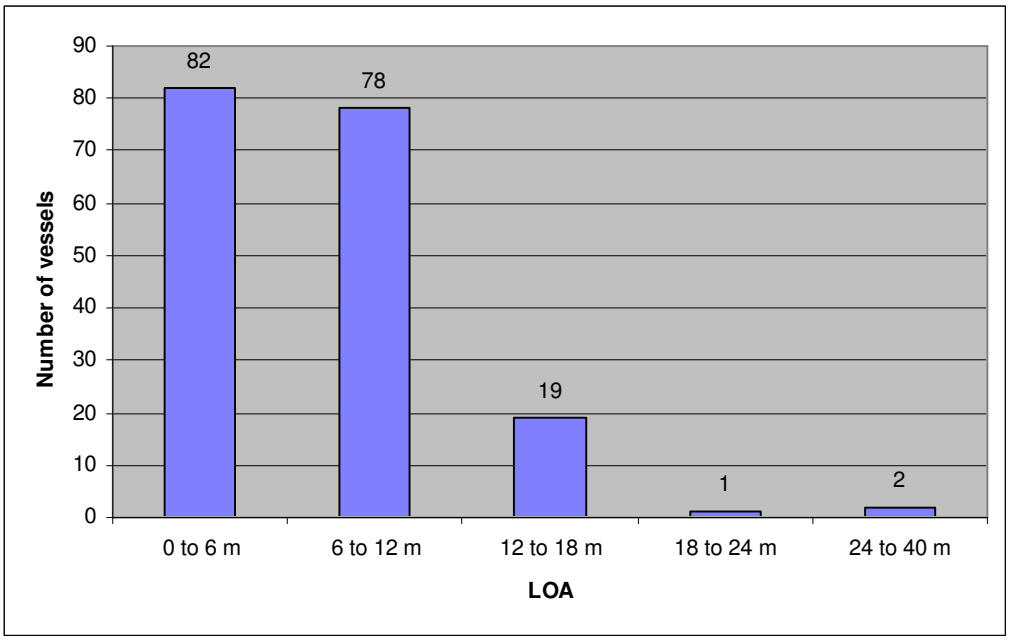

Figure1: Length distribution of the Slovenian fishing fleet. (Source: FVR Snapshot from 1. 10. 2012).

According to the data from the Fishing Vessel Register (FVR) for the year 2011, the Slovenian fishing fleet consists of 182 units, of which approximately 151 units, considering their LOA and main fishing gears, can be considered as part of the SSF sector.
Only 61 SSF vessels were active in 2011, while the total number of active vessels in 2011 was 85. Active small-scale fishing vessels in 2011 represent approximately 71,8 % of all active vessels in 2011.
After the year 2012 the Slovenian fishing fleet changed significantly. In this year we started a programme of permanent cessation of fishing activities. Since then we have very few large vessels and some of them will be scrapped; we expect the SSF segment to increase considerably and, as a consequence, the importance of SSF for the Slovenian fishing sector will also increase.

2. Status of the national small-scale fisheries

2.1. Fishing units:

Referring to national law all fishing vessels have to obtain a fishing licence and all owners of fishing vessels have to compile the LB after each fishing trip. This obligation is also compulsory for SSF. The main characteristics regarding the Slovenian fishing fleet are given in Table 1.

Table 1 Facts on the Slovenian Fishing fleet.

LOA	Number of vessels	Average age	Average GT	Average kW
0 to 6 m	82	34,63	0,93	10,39
6 to 12 m	78	34,10	3,65	66,60
12 to 18 m	19	42,63	15,47	169,74
18 to 24 m	1	8,00	30,76	199,00
24 to 40 m	2	32,00	156,20	600,00

The Slovenian fishing fleet consists of 182 fishing vessels. Their average age is over 30 years. The majority of the fleet is made up of vessels less than 12 m LOA. Next figure represents the average age distribution of the Slovenian fishing fleet.

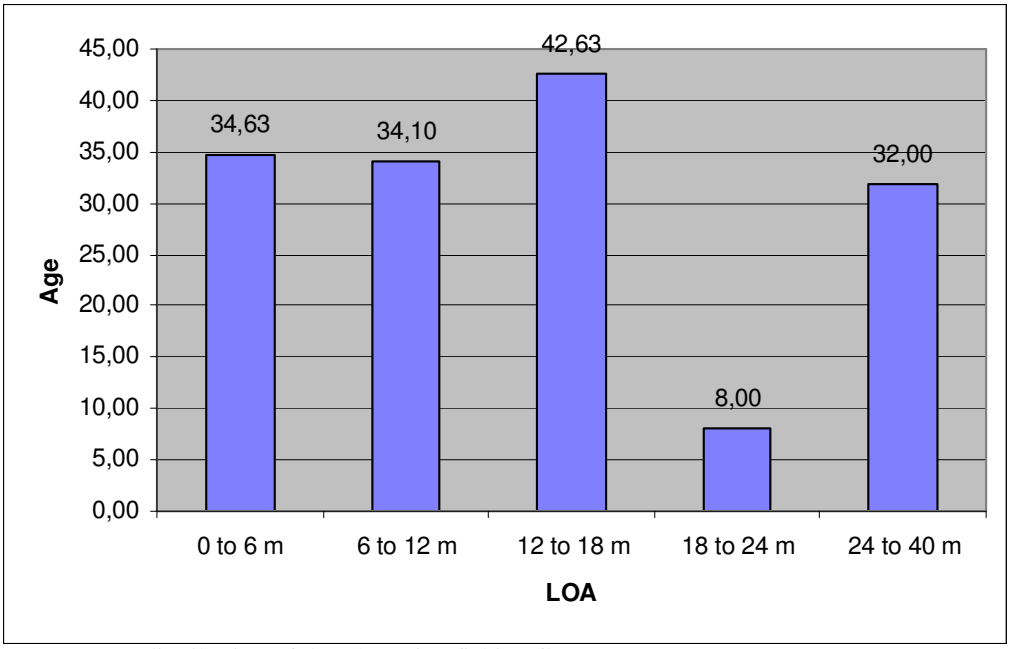

Figure 2: Average age distribution of the Slovenian fishing fleet.

The oldest LOA segment of the Slovenian fleet is that from 12 to 18 m, followed by the segment under 6 m and the one from 6 to 12 m. For the purposes of this review, we had to exclude some vessels that do not fulfil the requirements of the SSF definition.

To obtain a list of SSF units from the Slovenian fishing fleet the following units were excluded:

- All units with LOA equal to or above 12 m;
- All units using active fishing gears as their main fishing gear (in this case towed gears only) irrespective of their LOA.
- All units without valid fishing license for commercial fisheries.

The results of the query are in this table showing data for the year 2011. As mentioned before, 61 vessels from the SSF segment were active in 2011.

Table 2. Number of vessels operating in small-scale fisheries in 2011.

LOA	Number of vessels	Average age	Average GT	Average kW	Number of fishing trips	Landings (tons)
0 to 6 m	27	34,96	0,94	11,38	1478	11,17
6 to 12 m	34	31,24	3,68	59,12	2397	42,60
Total	61				3875	53,77

Currently we have 61 fishing units operating that can be classified as SSF. Their average age is over 30 years and their average GT and engine power are low, as shown in Table 2. During the calendar year, they perform on average 63,5 fishing trips per active fishing unit.
In the period from 2004 to 2011 the number of vessels involved in SSF varied from 50 to 65. In the future we expect that the number will vary between 65 and 75 fishing units.

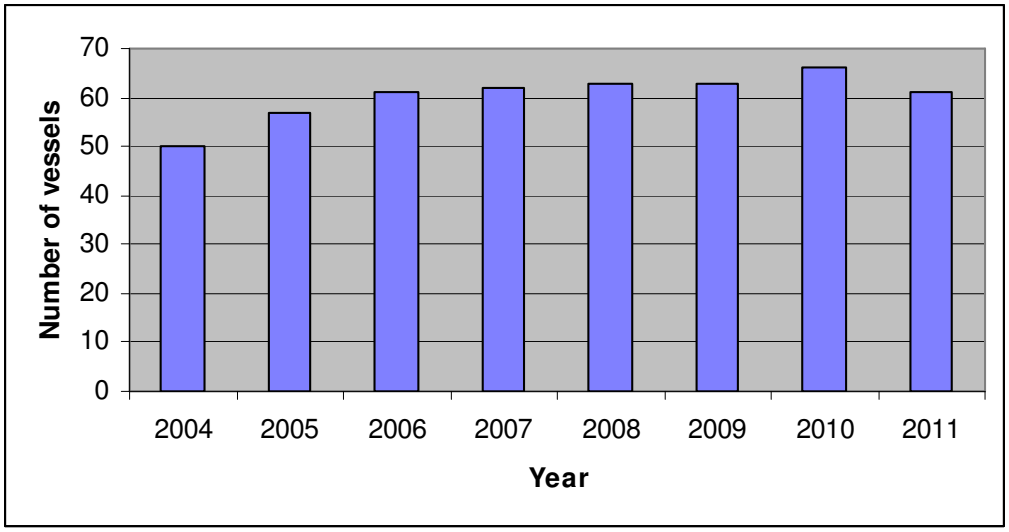

Figure 3. Approximate number of vessels operating in small-scale fisheries in the period from 2004 to 2011.

SSF vessels perform around 3900 fishing trips per year, approximately 63 per fishing unit. From 2004 the number of fishing trips per SSF units has increased (Figures 4 and 5).

Many vessels carry out around 150 fishing trips per year and some even more. On the other hand many vessels that are involved in small-scale fisheries only make a few fishing trips per year, in many cases even less than 10. There are various reasons for such low activity; sometimes fishery is not the main activity for some fishermen and it just represents a supplementary activity to their permanent jobs outside fisheries sector. In many cases fishermen have more than one vessel and they carry out fisheries activities with several vessels. In these instances the number of fishing trips of some of the vessels owned by the same owner can be very low, while the activity of other vessels can be higher. Other reasons for a low number of fishing trips can also be attributed to illness and injuries of the fishermen, maintenance of the vessels, retirement and other personal and professional reasons.

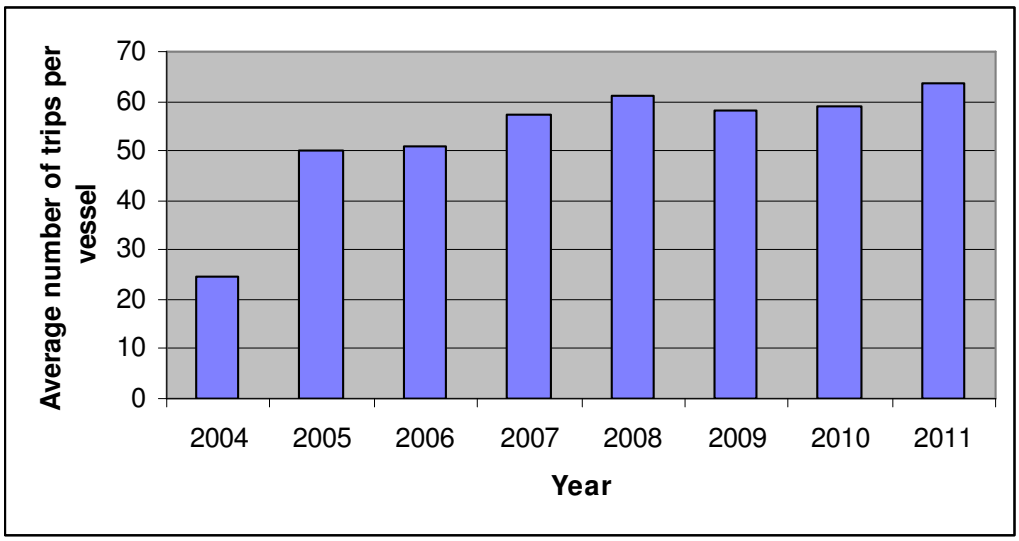

Figure 4. Average number of fishing trips per vessel operating in small-scale fisheries during the year. The value for 2004 is only an estimation.

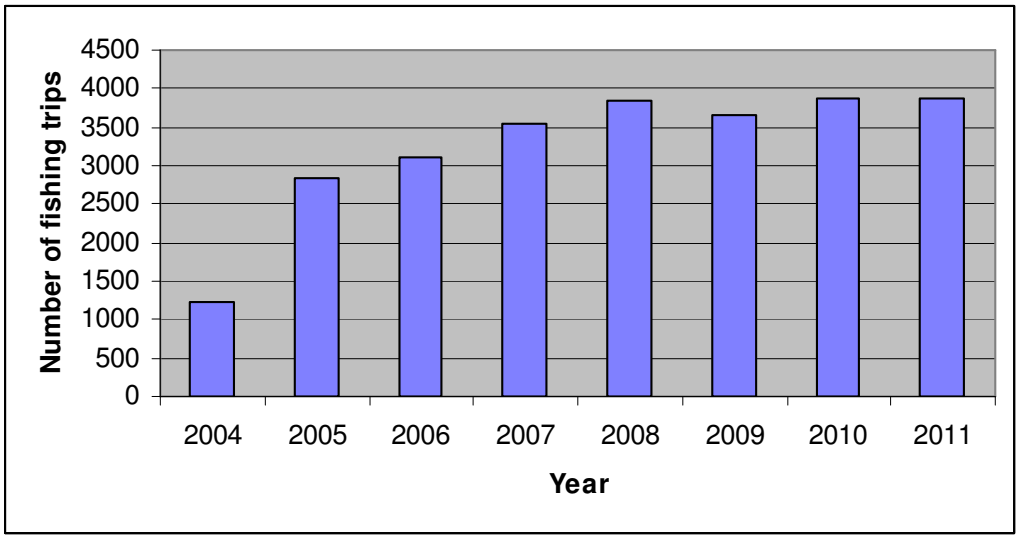

Figure 5. Approximate number of fishing tips in small-scale fisheries from 2004 to 2011. The value for 2004 is only an estimation.

The main gears used in SSF in 2011 were from the category gill nets and entangling nets. The structure of the small-scale fleet and data concerning the category of the main gear used are given in Table 3.

Table 3: Small-scale fisheries fleet in 2011.

Main gear category	Number of vessels	Landings (tons)	Average LOA	Average GT	Average kW	Number of fishing trips
Gill nets and entangling nets	59	53,25	6,45	2,35	37,60	3748
Hooks and lines	1	0,17	10,60	10,70	95,55	76
Traps	1	0,35	5,68	0,89	2,94	51
TOTAL		53,77				3875

Other fishing gear categories that can be used in small-scale fisheries are those gears, with the exception of trawls, that are listed in the Commission Regulation No 1799/2006 of 6 December 2006, amending Regulation (EC) No 26/2004 on the Community fishing fleet register. Slovenian fishermen involved in SSF mainly use set gill nets (GNS), driftnets (GND) and trammel nets (GTR). Until 2008 the use of purse seines (PS) was also frequent. In the last few years, PS have only been used occasionally.

2.2. Landings

Landings from SSF vessels consist of several different species. Slovenian small-scale fishermen do not target only one species. The main target species are: Whiting (Merlangus merlangus), Gilthead seabream (Sparus aurata), European flounder (Platichthys flesus), Common pandora (Pagellus erythrinus), Common sole (Solea solea) and many other species with a lower share of total landings.

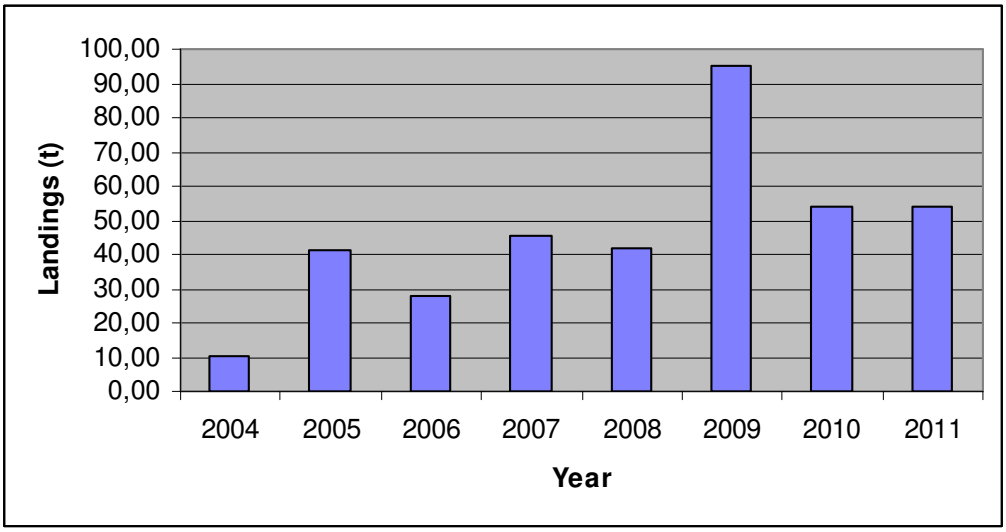

Figure 6. Landings of SSF vessels from 2004 to 2011, in tons. The value for 2004 is only an estimation.

Data on landings are obtained from the InfoRib database. The estimation of the SSF landings was carried out by subtracting the landings made by vessels using any type of active fishing gear and all vessels equal to or above 12 m LOA. In the next figure, the average landings per

single fishing activity in the period 2004-2011 are shown. The quantities are expressed in kg. We foresee that the quantities will remain at the same levels in future.

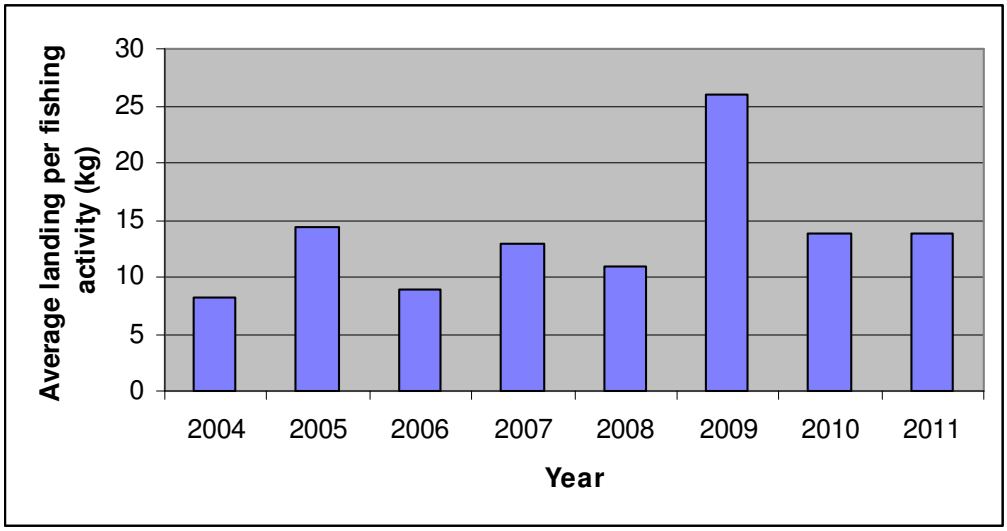

Figure 7. Average landings for each fishing activity per single year, from 2004 to 2011, in kilograms. The value for 2004 is only an estimation.

Since 2004, landings have been increasing and a peak was reached in 2009. Now landings from SSF are between 50 to 60 tons per year. In the future we expect that the landings from SSF will continue to increase slightly. During the year 2011, on average 13,9 kg were landed on each fishing trip per vessel operating in the SSF sector. Total landings from SSF vessels in 2011 were around 54 tons. In comparison to total landings, this represents only 7,5 % of the total landings in 2011. In the period from 2004 to 2011, the share of landings of the SSF vessels in comparison to total landings of Slovenian fishing fleet varied from 6,2 % to 9,5 %. We expect to see an increase in both the importance and the share of SSF landings in 2012 and in the next few years. The main reason for this expectation is the implementation of the programme for permanent cessation of fishing activities, which started in the second half of 2012. Many vessels subject to this measure are those with an LOA greater than 12 m.

A list of the species with the greatest share of landings in the period 2004-2011 is shown in Table 4. They are listed in alphabetical order applying ASFIS code.

The Slovenian SSF sector does not specialize, targeting only one species. From the list of most-landed species in the period 2004-2011, it is evident the nature of multispecies fishery of SSF in SLovenia.

Table 4. Codes and names of most landed species. (Source: ASFIS List of Species for Fishery Statistics Purposes, http://www.fao.org/fishery/collection/asfis/en, 13.10.2012).

3A CODE	Scientific_name	Slovenian name	English_name
ANE	*Engraulis encrasicolus*	sardon	European anchovy
ANN	*Diplodus annularis*	špar	Annular seabream
ATB	*Atherina boyeri*	mali gavun	Big-scale sand smelt
BSS	*Dicentrarchus labrax*	brancin	European seabass
CTC	*Sepia officinalis*	sipa	Common cuttlefish
FLE	*Platichthys flesus*	iverka	European flounder
HKE	*Merluccius merluccius*	oslič	European hake
JAX	*Trachurus spp.*	šuri	Jack and horse mackerels nei
MAC	*Scomber scombrus*	skuša	Atlantic mackerel
MGA	*Liza aurata*	zlati cipelj	Golden grey mullet
MTS	*Squilla mantis*	morska bogomolka	Spottail mantis squillid
MUL	*Mugilidae xxxx*	ciplji	Mullets nei
PAC	*Pagellus erythrinus*	ribon	Common pandora
PIL	*Sardina pilchardus*	sardela	European pilchard(=Sardine)
SBG	*Sparus aurata*	orada	Gilthead seabream
SLM	*Sarpa salpa*	salpa	Salema
SMD	*Mustelus mustelus*	navadni morski pes	Smooth-hound
SOL	*Solea solea*	morski list	Common sole
SPC	*Spicara smaris*	girica	Picarel
VEV	*Venus verrucosa*	ladinka	Warty venus
WHG	*Merlangius merlangus*	mol	Whiting

The average landings per vessel in a given year of the SSF segment reached a peak in 2009. In 2011, the average landing per vessel was around 900 kg. If we take an overview for the entire period 2004-2011, we can notice that the average annual landings per single vessel increased moderately.

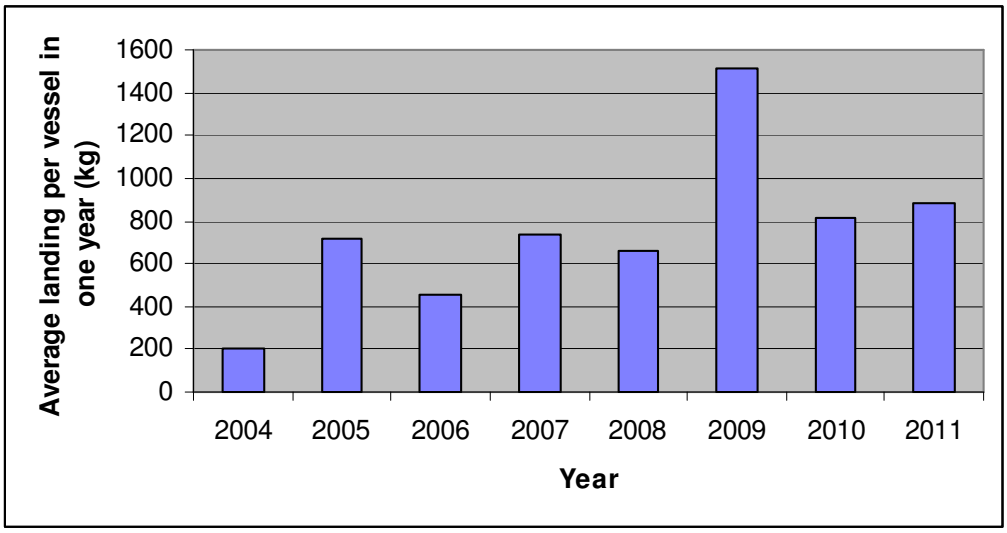

Figure 8. Average landings per vessel operating in the SSF segment from 2004 to 2011. The value for 2004 is only an estimation.

The landings structure per single species for the period 2004-2011is shown in next figure.

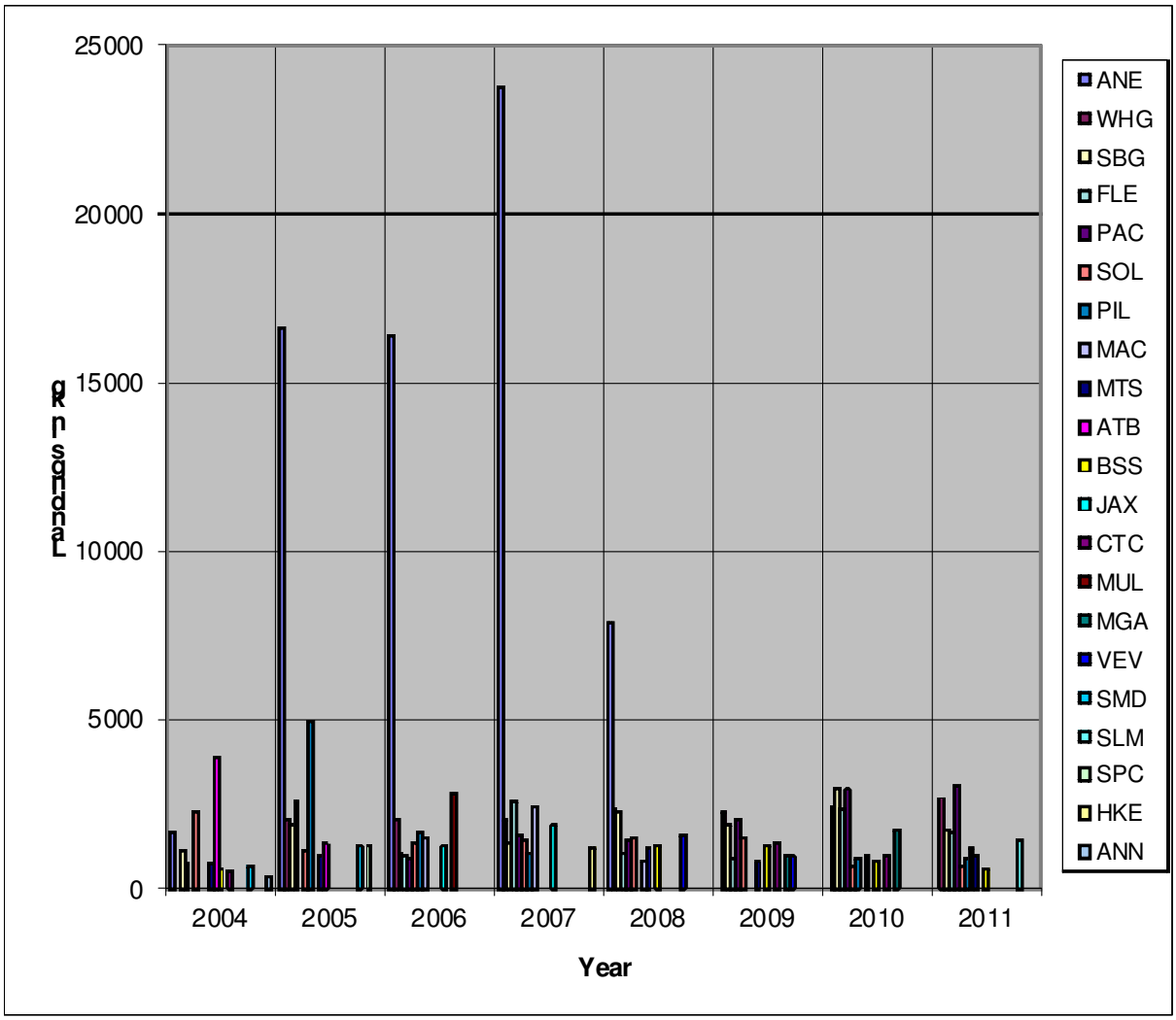

Figure 9. Landings per species in the small-scale fishery sector in the period 2004 – 2011. The values for 2004 are only estimations.

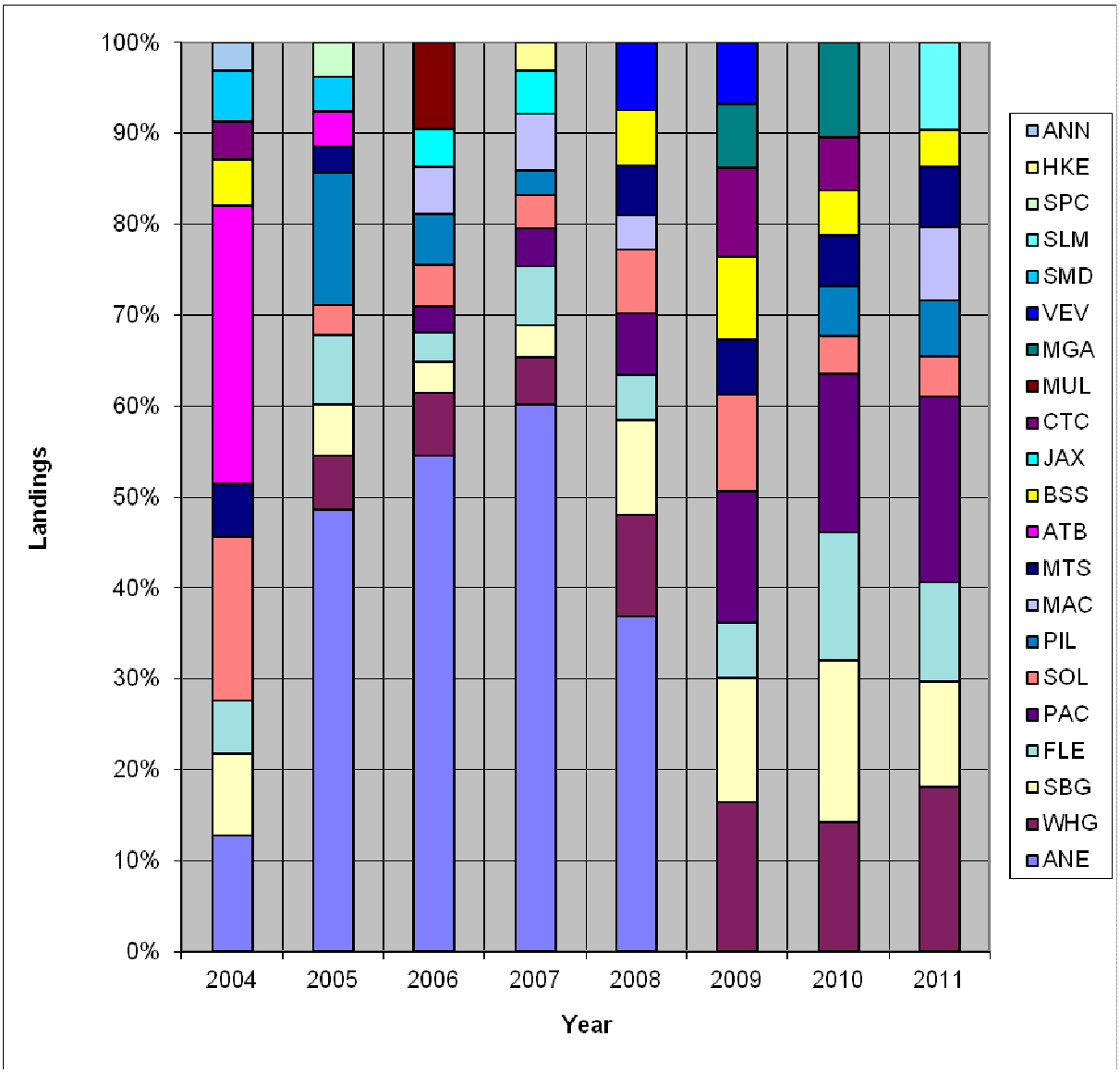

Figure 1. Share of the landed species of the SSF segment in a single year in the period 2004-2011. The values for 2004 are only estimations.

In figures 9 and 10, the share of the 10 most landed species are shown for each year. From 2005 to 2008 the quantity of European anchovy (*Engraulis encrasicolus*) landed was dominant over the landings of other species. It represented between approximately 40 – 60 % of total SSF landings in the same period. The gear used to catch anchovy was PS, from 2009 onwards PS gear was not used that often in SSF, and this is the reason for the decrease in the landings of anchovy by the SSF sector.
The most landed species in terms of quantity in the period 2004-2011 were European anchovy (ANE), Whiting (WHG), Gilthead seabream (SBG), European flounder (FLE), Common pandora (PAC), Common sole (SOL), European pilchard (PIL), Atlantic mackerel (MAC), Spot tail mantis squillid (MTS), Big-scale sand smelt (ATB) and European seabass (BSS).

In the future it can be expected that the structure will generally remain the same, except for the European anchovy and the European pilchard. Quantities of European anchovy and European pilchard landed depend on the frequency of the use of PS gears. In the last 3 years,

fishermen in the SSF sector have not been using PS gears as often as in previous years; the landings of these two species have also decreased due to the state of these two stocks in the Northern Adriatic. A similar trend will probably continue in the future. In next table, landed quantities per single species are shown.

Table 5. Landed quantities in kilos per single species in period 2004-2011. The values for 2004 are only estimations.

	Landings in kg per year							
Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
ANE	1642,5	16615	16421	23768	7904,5	0	0	0
WHG	0	2059,9	2076	2065,2	2386,7	2312,4	2411	2701,2
SBG	1140,9	1911,1	1032,3	1354,5	2248,8	1918,9	3008,9	1732,9
FLE	741	2625,4	956,5	2604,6	1037,4	868,6	2372,5	1637,4
PAC	0	0	890,4	1616,7	1452,4	2035,2	2939,5	3049,6
SOL	2306,7	1138,7	1358,4	1462,7	1522,8	1512,2	691,95	664,35
PIL	0	5003	1692,5	1044,8	0	0	932,5	918
MAC	0	0	1548,8	2456,1	794	0	0	1203,5
MTS	750,9	968	0	0	1172,5	825,26	953,52	991,29
ATB	3909	1332,3	0	0	0	0	0	0
BSS	634,5	0	0	0	1303,4	1292,2	824,1	605,3
JAX	0	0	1279,5	1876,1	0	0	0	0
CTC	546	0	0	0	0	1374,5	992,7	0
MUL	0	0	2847,8	0	0	0	0	0
MGA	0	0	0	0	0	981,7	1755,5	0
VEV	0	0	0	0	1597,1	960,2	0	0
SMD	707,1	1279,2	0	0	0	0	0	0
SLM	0	0	0	0	0	0	0	1429,9
SPC	0	1299	0	0	0	0	0	0
HKE	0	0	0	1228,9	0	0	0	0
ANN	399	0	0	0	0	0	0	0

3. National and international programmes focussing on the small-scale fishery sector

Currently Slovenia is not involved in any national or international programme that focuses on the SSF sector alone. For the purposes of the collection of fisheries data, Slovenia developed its own information system for the collection and management of fisheries data and statistics. This information system is called InfoRib and its main purpose is to fulfil all obligations under the framework of the EU data collection - DCF (Council Regulation (EC) No 199/2008). The system has been in use since Slovenia's entry into the EU in 2004. The system is designed to collect all data required under DCF. The data cover the entire fisheries sector, including SSF.

In Slovenia, the importance of SSF will increase after the conclusion of the programme of permanent cessation of fishing activities, which will probably end in 2013. The majority of the Slovenian fishing fleet is now SSF, and in the future the importance of this sector is destined to increase.

Slovenia supports, and is ready to participate in any initiatives focusing on SSF in the framework of the FAO-AdriaMed Project or any other regional or sub-regional program, especially in Adriatic region and in the Mediterranean.

4. Identification of priorities and main gaps related to the Slovenian small-scale fishery sector concerning management issues

Slovenian SSF is facing big challenges. In the near future, SSF will become the most important sector of the Slovenian fishing fleet, and therefore the position of SSF will be completely different from its current status. Management authorities are already taking into account the fact that the composition of the Slovenian fishing fleet is changing and that some segments that were not so important in terms of landed quantities are becoming increasingly significant.

One of the key priorities is to enable sustainable fishing activities in the Slovenian fishing area, thus facilitating fishing activities that will take into account the needs of the fishermen and also respect the environment and the status of the stocks. This will be only possible when an integrated, regional approach to the management of the fisheries is implemented and when good cooperation between the countries in the Northern Adriatic is established. Such cooperation is crucial as the majority of the stocks in the Adriatic are shared and migratory stocks, therefore a single management plan for the North Adriatic Sea should be prepared. In addition, the SSF sector is similar all over the Adriatic, and a common approach towards its management should be established.

Slovenia believes that, within the process of preparation of multiannual management plans, particular attention should be devoted to sub-regional characteristics and specific features of the marine environment, as well to traditional fishing techniques. For example, the Bay of Trieste, where Slovenian fishermen mostly carry out their fishing activities, is very shallow and specific fishing techniques have evolved. Therefore, in the context of the on-going process to prepare regional multiannual management plans, Slovenia sees an opportunity for alternative consideration of the fisheries in specific sub-regions, such as the Bay of Trieste due to their particular characteristics.

Slovenian fisheries are predominantly mixed fisheries and as such it would not be sufficient to regulate them with respect to one fishery species alone. Slovenian fisheries are also characterized by SSF. Another important characteristic of Slovenian fisheries management is that Slovenian fishermen target shared and highly migratory stocks, however, only a very small fraction of these shared stocks is actually caught by the Slovenian fishermen, as a result Slovenia is unable to collect data on these stocks on its own. Taking the issue of shared stocks into account, management measures also need to be shared if they are to be effective. Slovenia therefore sees an opportunity to prepare a regional multiannual management plan concerning mixed fisheries in the Bay of Trieste. Slovenia therefore looks forward to cooperating with other countries in this sub-region in a process that could eventually lead to the preparation of a potential multi-annual management plan.

Within that process, Slovenia identifies a few very important issues that would need to be worked upon. The most important one is the collection of scientific data on fisheries. To prepare accurate assessments of shared stocks, data on these stocks need to be shared or joint

assessments need to be prepared. The process of scientific data collection and assessments needs to take place prior to making actual management decisions, as good decisions can only be made on the basis of reliable data. This is particularly important given the conditions produced by the current economic crisis.

Second, equally important issue is related to the collective understanding of SSF. A common definition of SSF, at least on a regional level is needed. With the common understanding of SSF the use of different fishing gears and techniques should also be better researched and explained.

Within the framework of the FAO-AdriaMed Project, we would like to carry out different surveys regarding fishing gears that are already used and those that could be used in SSF. We think that surveys regarding the selectivity of different fishing gears, studies regarding the impact of fishing gears on the marine environment and studies regarding new fishing gears and innovations in SSF would be very useful. All these different studies would provide a valuable contribution to fill the current gap in the existing knowledge regarding SSF in this region.

5. References

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Small-scale fisheries in the Adriatic Sea: some case studies from Italy

Fabio Grati[1], Luca Bolognini, Filippo Domenichetti, Gianna Fabi, Roberto Gramolini, Piero Polidori, Angela Santelli, Giuseppe Scarcella

Abstract

As in other parts of the world, small-scale fisheries in the Adriatic Sea have evolved in time and space from specific ecological, socioeconomic and cultural contexts. Traditional fishing gears have been developed over the years to adapt to local conditions, target species, and size targeted.
In the last 20 years the Institute of Marine Science (ISMAR-CNR) of Ancon, Italy, has carried out several Research Projects on the technical features of artisanal fisheries in the Adriatic Sea. The present document summarizes the actual knowledge on the artisanal fisheries of the western coast of the Adriatic focusing on the technical features and selectivity of gears, and composition of retained and discarded catch.

1. Introduction

As in other parts of the world, small-scale fisheries in the Adriatic Sea have evolved in time and space from specific ecological, socioeconomic and cultural contexts. Traditional fishing gears have been developed over the years to adapt to local conditions, target species, and size targeted. The most successful fishing methods of a given region are those that have stood the test of time.
In recent decades the increase of the opportunities for innovation and technology such as advances in fibre technology, mechanization of gear handling, improved performances of vessels and motorization, navigation aids, and fish detection strongly contributed to small-scale fishery development.
The artisanal fleets of the western Adriatic mainly include fibreglass planning vessels having an average GT of about 2, Loa of 6-12 m and average engine power of about 30 kW. The crew is usually composed by 1-2 people.
Set gears include gillnets, trammel nets and different types of traps, which are used seasonally on the basis of the eco-ethology of the target species. Gillnets are mainly used to catch the common sole (*Solea solea*) and the mantis shrimp (*Squilla mantis*) from spring to autumn. Basket traps are used to target the gastropod *Nassarius mutabilis* from autumn to spring. Trammel nets, fyke nets and pots are used to target cuttlefish (*Sepia officinalis*) in spring during the inshore spawning migration.
S. solea and *S. officinalis*, along with other abundant species which are not directly targeted by small-scale fishermen but retained and commercialised (i.e. *Chelidonichthys lucernus*, *Penaeus kerathurus*, *Mullus* spp., etc.), belong to important stocks shared between Italy, Slovenia and Croatia fisheries.
In the last 20 years the Institute of Marine Science (ISMAR-CNR) of Ancona carried out several Research Projects on the technical features of artisanal fisheries in the Adriatic Sea. The present report summarizes the actual knowledge on the artisanal fisheries of the western coast of the Adriatic focusing on the technical features and selectivity of gears, and composition of retained and discarded catch.

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CASE STUDY: GILLNET FISHERY FOR *SOLEA SOLEA*[2]

Introduction

The common sole *S. solea* is targeted from spring to fall by small-scale vessels using loosely hung monofilament gillnets characterised by a low buoyancy of floats allowing the gear to partially lay down on the seabed thus favouring the capture of benthic fish (Grati *et al.*, 2002). The mesh sizes commonly used by gillnetters are 64 and 68 mm (stretched), but some of them shift towards a 72 mm opening in fall, according with the growth of the species. The diameter of monofilament ranges from 0.20 mm to 0.23 mm. Fishermen carry out daily trips to the fishing grounds located from 2 to 6 km from the shoreline and exploit soles belonging to the age classes 1 and 2 (Grati *et al.*, 2002). In spring and summer, when this fishing activity is greater, 20-30% of catch biomass consists of individuals smaller than the Minimum Landing Size (MLS = 20 cm TL; Grati *et al.*, 2002). These undersized specimens are not discarded, but usually sold to retail. The assessment of sole stock in the northern and central Adriatic Sea has been undertaken only recently (2005-2006) and the available data indicate that the stock is fully exploited (GFCM, 2006), leading to suggest an improvement of studies aimed to reduce the capture of juveniles.

In the light of the state of the resource and given the relevance of static gears, understanding the impact of different gears which compete for its exploitation is crucial to develop adequate management and conservation measures. Basing on these statements and taking into account the scarcity of information on the selectivity of gillnets in the Mediterranean Sea (Francesconi *et al.*, 2005; Sbrana *et al.*, 2007), estimates of its selectivity, efficiency and impact on the ecosystem are required to adopt adequate management measures aimed to maintain the sole stock and to assure the sustainability of this fishery.

Aims of the studies

In order to fill out, at least in part, the existing gaps, two research projects were carried out to assess the selectivity of sole gillnet using a model of between-set variation and to analyse the efficiency and the impact of the diameter of the net line. The ultimate goal of these studies was to identify the most adequate mesh size and monofilament diameter to reduce the retention of juveniles and discard without strongly affect fishermen income. The adoption of a suitable mesh and line diameter would also allow to reduce the catch of accompanying species mainly including *C. lucernus, S. mantis, Aporrhais pespelecani*, and *Liocarcinus vernalis* which are discarded either because represented by small and/or damaged individuals or for their low commercial value (Grati *et al*., 2004).

Materials and methods - The studies were carried out in the North-central Adriatic Sea in an area extending from 2 to 6 km from the coast, on a sandy-mud seabed and at depths ranging from 10 to 20 m. This fishing area was suggested by the local gillnetters for the great abundance of soles. The technical parameters of gillnets used for the selectivity experiments were chosen on the basis of a previous study carried out on the local small-scale fisheries (Grati et al., 2002).

In the selectivity study five mesh sizes were adopted: three of them were currently used by fishers

[2] Fabi G, Grati F. 2005. Study of the selectivity of gillnet for sole in the northern Adriatic Sea. SFOP 2000-2006N. 3 MI 16/06/03. Final Report for the Marche Region. 44 pp.
Grati F. 2011. Study of the effect of monofilament diameter on the efficiency and selectivity of gillnet for sole. PO FEP 2007-2013 N. 06ACO271109. Final Report for the Marche Region. 54 pp

(nominal mesh opening = 64, 68 and 72 mm; effective mesh opening: 64.2, 67.8 and 71.8 mm), while the other two were experimental measures (nominal mesh opening: 66 and 70 mm; effective mesh opening: 65.2 and 70.2 mm). All the nets were made of 0.20 mm PA monofilament and the colour of the line was green.
In the study of the monofilament diameter five different diameters were tested: 0.18 mm, 0.20 mm, 0.22 mm, 0.25 mm, and 0.30 mm. In this case all the nets had the same mesh size: 71.8 mm (stretched) and the colour of the line was green.
A total of 40 nets (8 for each mesh size) and 50 nets (10 for each monofilament diameter) were randomly arranged in some fleets leaving an escaping area of about 1.5 m between adjacent nets to avoid any guiding effect from one net to the next. The Total Length of each sole in the catches was measured at the nearest 0.5 cm below and recorded by mesh size and line diameter. In order to evaluate whether the method of capture affected the size selectivity of the caught soles, each specimen retained by gillnets was characterized as follows (Baranov, 1914):

1. mouth clamped (MC) – net line caught in the mouth;
2. gilled (GI) – fish meshed immediately behind the gill cover (no line in the mouth);
3. wedged (WE) – fish meshed around the body somewhere behind the gill cover (no line in the mouth).

The size selectivity of a gear may be defined by a curve giving for each size of fish the proportion of the total population of that size which is caught and retained by a unit operation of the gear (Lagler, 1968). In the present study the size selectivity of sole gillnets was calculated indirectly using the SELECT (Share Each Length-class's Catch Total) method (Millar, 1992) through the GILLNET (Generalised Including Log-Linear N Estimation Technique) software (Constat, 1998a). Initially developed for trawling (Millar, 1992), the SELECT method was then extended to set nets (Millar and Holst, 1997) and represents a general framework for the analysis of the selectivity of all types of fishing gears, where parameter estimation is carried out by Maximum Likelihood (ML), also allowing to take into account the between-haul/set variability (Millar, 2000). The parameters of five selectivity curves (normal scale, normal location, log-normal, gamma and bi-modal) generated by GILLNET software and usually employed in studies on set net selectivity (Miller and Holst, 1997; Madsen et al., 1999; Fonseca et al., 2005; Erzini et al., 2006; Sbrana et al., 2007) were estimated in order to identify the curve that best fitted the catch data. The selectivity parameters of the mean curve were estimated using REsidual Maximum Likelihood (REML) analysis through EC MODEL (Vers. 1.1) software (Constat, 1998b) in a similar way to the model of Fryer (1991) of between-haul variation for towed gears in order to avoid underestimation of variance.

Results of the selectivity study

A total of 398 specimens of *S. solea* were caught with the 64.2 mm mesh, 381 with the 65.2 mm mesh, 328 with the 67.8 mm mesh, 287 with the 70.2 mm mesh, and 235 with the 71.8 mm mesh. Similarly, the Catch Per Unit Effort decreased with the increment of the mesh size ranging from 14.2±1.8 ind. 400 and 1.2±0.1 kg 400 m^{-1} (64.2 mm mesh) to 8.4±0.8 ind. 400 m^{-1} and 0.8±0.1 kg 400 m^{-1} (71.8 mm mesh), but the differences were not statistically significant (number of individuals: $p = 0.085$; biomass: $p = 0.315$) (Figure 1).

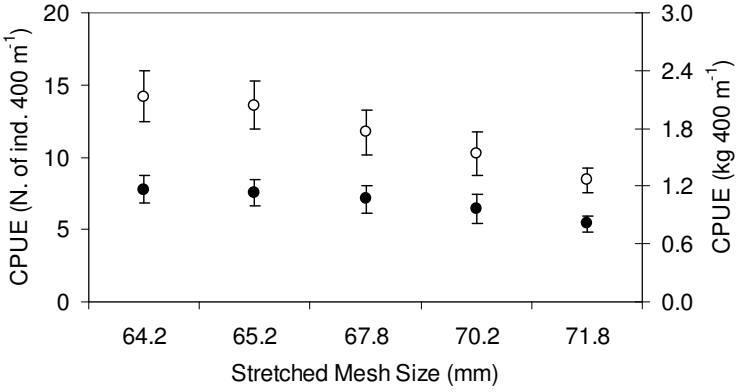

Figure 1 – Gillnet catches: Catch Per Unit Effort (± standard error) of *S. solea* in number of individuals (white dots) and weight (black dots) per 400 m of gillnet.

The mean TL significantly increased from 20.88±0.09 cm in the smallest mesh size (64.2 mm) to 21.88±0.15 cm in the largest one (71.8 mm). At the same time the fraction of specimens under the MLS decreased from 23-24% (64.2 and 65.2 mm meshes) to 16% (71.8 mm mesh), corresponding respectively to 16% and 9% in weight of the total sole catch.

The analysis of the way of capture evidenced that MC was the most important method of retention including from 74% (65.2 mm mesh) to 83% (70.2 mm mesh) of the total number of soles caught. GI was the second way of capture accounting for 14% (67.8 mm mesh) to 23% (65.2 mm mesh) of soles in catches, while the specimens retained as WE were very rare (2-3%).

The log-normal selection curves showed a low Coefficient of Variation (CV) for both parameters in respect to the other models, hence it was chosen for the subsequent between-set variation analysis. The mean log-normal selection curve estimated with the REML analysis showed a ratio between length of maximum retention and mesh size of 3.30. The TL with 50% retention probability on the left side of the curve ranged from 18.8 cm (64.2 mm mesh) to 21.1 cm (71.8 mm mesh), while on the right side it varied from 23.9 cm in the smallest mesh size to 26.8 cm in the largest one. The optimal retention size fell in the interval 21.2 cm (64.2 mm mesh) - 23.8 cm (71.8 mm mesh).

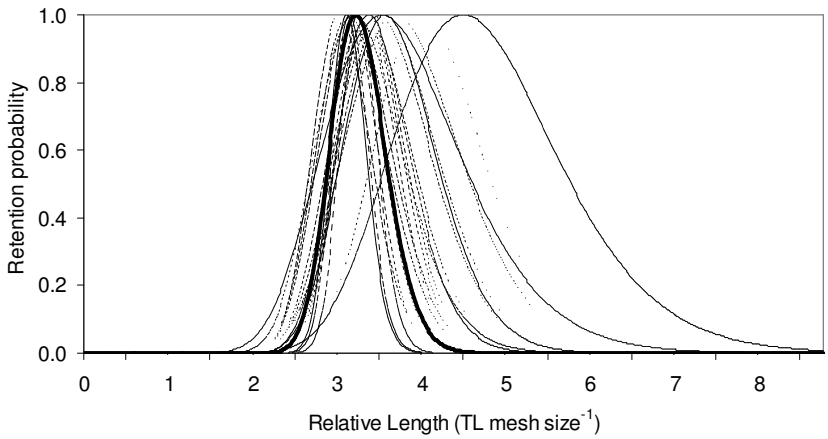

Figure 2 - Log-normal selection curves for individual sets (thin lines) and estimated mean selection curve given by REML analysis (thick line).

Results of the monofilament diameter comparison

Basing on the results obtained in the previous study it was decided to focus the analysis of monofilament diameter on the 71.8 mm mesh size, which showed the best compromise between

fishing yields and selection of undersized specimens.
The mean species richness of the 3 thinnest diameters (0.18, 0.20, and 0.22 mm) was significantly higher than that of the thickest one (0.30 mm).
Fishing yields gradually decreased with the increasing of monofilament diameter both in terms of number of individuals and in weight. Fishing yields (number of individuals and weight) of gillnets with monofilament diameter of 0.25 and 0.30 mm were significantly lower than these of the thinnest diameters.
Total catch was dominated by commercial fraction (C; from 54% in 0.20 mm to 66% in 0.30 mm in number of individuals; from 80% in 0.18 and 0.20 mm to 88% in 0.30 mm in weight). C fraction was dominated by the target species *S. solea*, *C. lucernus*, *Bolinus brandaris* and *S. mantis*.
Discard of no-commercial species (DNC) represented the second fraction of total catch both in term of abundance and biomass (from 27% in 0.30 mm to 41% in 0.20 mm in number of individuals; from 8% in 0.30 mm to 16% in 0.20 mm in weight), this category was dominated by *L. vernalis* and *Goneplax rhomboides*.
The discard of commercial species (DC) made up a fraction always smaller than 7% and was dominated by *Spicara maena* and *Engraulis encrasicholus*.
Fishing yields of C decreased with the increase of monofilament diameter, both in terms of abundance (minimum: 92.09±20.57 ind./500m/12h for 0.30 mm diameter; maximum: 317.33±42.91 ind./500m/12h for 0.18 mm diameter) and biomass (minimum: 4375.30±894.454 g/500m/12h for 0.30 mm diameter; maximum: 11868.02±1734.95 g/500m/12h for 0.18 mm diameter). Statistical analysis confirmed that fishing yields of C recorded with 0.30 mm diameter were significantly lower than these obtained with gillnets having thinner monofilaments. Fishing yields of *S. solea* caught with the 5 monofilament diameters were not statistical different.
Fishing yields of DNC decreased with the increase of monofilament diameter, both in number of individuals (minimum: 38.13±8.25 ind./500m/12h for 0.30 mm diameter; maximum: 220.20±60.21 ind./500m/12h for 0.18 mm diameter) and weight (minimum: 397.45±85.12 g/500m/12h for 0.30 mm diameter; maximum: 2355.54±522.35 g/500m/12h for 0.20 mm diameter). ANOVA evidenced that fishing yields obtained with 0.30 mm diameter were statistically lower than these recorded with the 3 thinnest diameters.
A slight decrease of fishing yields with the increase of monofilament diameter was observed for DC, both in terms of abundance (minimum: 10.04±2.67 ind./500m/12h for 0.30 mm diameter; maximum: 31.55±7.76 ind./500m/12h for 0.18 mm diameter) and biomass (minimum: 222.15±53.50 g/500m/12h for 0.30 mm diameter; maximum: 692.30±231.88 g/500m/12h for 0.18 mm diameter). Nevertheless, no statistical differences were evidenced among monofilament diameters.

Conclusion

Under the management point of view, the increment of the mesh size did not negatively affect the catch yields whilst the percentage of individuals under MLS in catches noticeably decreased from 16% down to 9% in terms of biomass in the largest mesh size. The estimated log-normal selectivity curves indicated that the retention probability for the 20 cm TL class decreased from 84% in the smallest mesh to 24% in the largest one. Such reduction assumes a relevant ecological importance in spring – early summer when this size class is the most abundant in the population at sea. On the contrary, the portion of individuals longer than MLS proportionally increased in the catches. For example, the retention probability for the 25 cm TL class (size at first sexual maturity; Fisher *et al.*, 1987) rose from 28% in the 64.2 mm mesh up to 89% in the 71.8 mm one, evidencing a greater efficiency of the latter mesh size towards adult individuals whose contribute to the catch biomass

shifted from 4% (64.2 mm mesh) to 21% (71.8 mm mesh). Taking into account that the small specimens have a lower economic value in respect to the largest ones, it can be concluded that the general adoption of the 72 mm mesh size (71.8 mm effective mesh opening) would represent a good compromise between the conservation of the resource at sea and the economic profit of the local small-scale fishermen.

Results obtained in the study of monofilament diameter evidenced that gillnets made with thin lines (0.18 – 0.20 mm) might have a negative impact on the ecosystem, and that a gillnet having a thicker diameter (0.25 mm) could represent a good compromise, because it showed suitable fishing yields of commercial species along with a low retention of discarded species.

The results obtained in the two studies evidenced that the technical features of sole gillnets normally used in the western Adriatic Sea (mesh size of 64-68 mm stretched and monofilament of 0.20-0.23 mm) could be improved by adopting a gillnet with a 72 mm mesh (stretched) made with a 0.25 mm monofilament.

CASE STUDY: BASKET TRAP FISHERY FOR *NASSARIUS MUTABILIS*[3]

Introduction

A recent census carried out in the western Adriatic Sea indicated that basket traps fishery is one of the most important small-scale fishing activity, accounting for more than 35% of total fishing effort (number of vessels x days at sea) and yielding from 2,000 to 3,000 t of landings each year. Landings include only the target species *N. mutabilis*, as the cogenus *Nassarius nitidus* is discarded alive at sea having no commercial value. Analysis of Catches Per Unit Effort (CPUEs) over the period 2000-2007 gave evidence of a decrease in catch rate of the target species and a stationary trend of the discarded one. The current legislation includes a Minimum Landing Size for *N. mutabilis* (MLS = 20 mm shell height, SH), daily quota (from 100 kg to 180 kg depending on crew size) and compulsory use of a sieve to select the commercial product. Nevertheless, the collapse of Landings Per Unit Effort (LPUEs) led fishermen to increase the fishing effort by using a greater number of traps and to commercialize undersized specimens. The mesh size of commercial traps is not regulated and no studies on size selectivity have ever been undertaken to identify the optimal mesh opening to prevent the retention of undersized specimens. Little information exists on the selectivity of traps for gastropods around the world. A few studies were carried out in 1990s on traps for the whelk (*Neptunea arthritica*) in Japan (Ram et al., 1993; Nashimoto et al., 1995), whilst Park et al. (2007) have recently investigated the selectivity of drum-net traps for *Buccinum opisoplectum* in the Korean coastal waters. A few studies on traps for whelk (*Buccinum undatum*) considering trap design, fishery management and whelk biology were carried out in Canada (Sainte-Marie, 1991; Himmelman and Hamel, 1993; Giguère et al., 2007).

Aims of the studies

The ultimate goal of these studies was to assess the selectivity of basket traps for *N. mutabilis* through comparative fishing trials with traps varying in mesh size and net colour, and, subsequently, to verify on field if the results obtained were satisfactory. The indirect SELECT (Millar 1992; Millar and Walsh, 1992) method was adopted to fit the retention curves. In addition, size selectivity of traps was evaluated using a modified version of the Sechin (1969) method, which allows the drawing of retention curves based on the girth measurements of the target species, hence requiring a very low sampling effort.

Materials and methods

The basket traps used in the experiments had the same structure as those employed by professional fishermen. They were made of a truncate-cone steel frame (Ø = 6 mm), with a cylindrical panel of poliamide knotless and braided net (PA; 210/18 Denier) hung both on the small hoop (upper base) and on the large hoop (lower base), and tied in the lower part creating a sort of codend (Fig. 3). The trap entrance is the upper base. Due to the particular shape of the frame, the Hanging Ratio (HR) gradually decreases from the large hoop (HR = 0.79-0.80) to the smaller one (HR = 0.42-0.43), and to the "codend" (HR = 0).

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[3] Fabi G, Grati F. 2004. Study of the selectivity of basket traps for *Nassarius mutabilis*. SFOP 2000-2006 N. 6 AI 28/05/02. Final Report for the Marche Region. 30 pp.
Grati F., Bolognini L., Polidori P., Fabi G. 2011. Management of the resource *Nassarius mutabilis*: adoption of basket traps with a mesh size optimised for the retention of legal sized specimens. PO FEP 2007-2013 N. 05ACO271109. Final Report for the Marche Region. 57 pp.

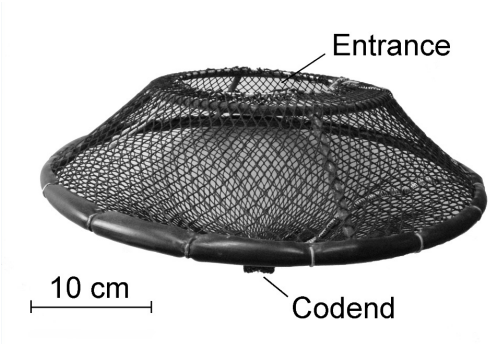

Figure 3 - Picture of a basket trap for *Nassarius mutabilis.*

Selectivity experiments were conducted in the western Adriatic Sea on a sandy-mud bottom, 13 m deep. Five different nets (test traps) were tested in comparison with a non-selective control net having a 5 mm mesh (stretched) and white twine (control trap). Four nets only differed in mesh size, having white twine and nominal mesh openings of 19 (commercial mesh size), 23, 26 and 28 mm, respectively. The remaining one had black twine and 19 mm mesh size. Comparison between traps with 19 mm mesh but twine of different colours was performed to evaluate if the changeable nassa is actually attracted by dark objects, as suggested by local fishermen. The effective mesh size of test traps was measured using an ICES Omega Mesh Gauge (force = 40 N), while a steel ruler was used for the small mesh of the control trap (force = 9.8 N). The obtained mean values were very close to the nominal mesh openings. Traps were baited with horse mackerel, which were replaced at each fishing operation. A total of 120 traps, 20 for each combination mesh size / twine colour, were randomly arranged in a single set and fished at each trip. The total number of fished traps was therefore 600 (20 traps x 6 types x 5 trips). All traps were fished with equal effort (24 h).

The particular shape of traps does not allow escape from the main entrance and, hence, the target species must escape almost exclusively through the trap mesh. Therefore, it was realistic to consider the retention curve to be similar to the symmetric logistic function used in trawl experiments and size selectivity was estimated by the SELECT method commonly used in trouser trawl experiments (Suuronen et al., 1991; Suuronen and Millar, 1992; Walsh et al., 1992). The parameters of five selectivity curves (logistic, probit, log-log, C-log-log and Richard's curve) generated by CC2000 software (Constat, 2000) were estimated in order to identify the curve that best fitted the catch data.

The probability that a gastropod of shell height l enters into the test trap depends on the following factors: a) the relative fishing effort, b) the relative sampling effort, and c) the relative fishing efficiency (Xu and Millar, 1993). Here, as fishing and sampling effort were the same for all tested traps, only the relative fishing efficiency was evaluated. Hence, all the above selection curves were computed both with p fixed (equal probability) and with p to be estimated. The shape of the selection curve that best fitted the catch data was chosen on the basis of the Akaike's Information Criterion (AIC) (Akaike, 1974).

In addition to SELECT method in this study selectivity of basket traps was also calculated using Sechin (1969) method, which allows the preliminary calculation of a bell-shaped selectivity curve of a gillnet from the girth measurement of the target fish. This method was adapted to study the selectivity of basket traps by using only the cumulative function describing the left portion of the

bell-shaped selection curve. This curve can be considered a theoretical size-selectivity curve as it is simply based on the shape of the target species.

Results

Catch composition was dominated by molluscs and crustaceans (7 species), followed by fish (2 species) and echinoderms (one species). *N. mutabilis* accounted for 50% (26 mm mesh) to 85% (19 mm black mesh) of catches obtained with the 5 mm control trap and the 19 (black and white), 23 and 26 mm test traps, followed by the gastropod *Nassarius nitidus* and the decapod *L. vernalis*. In constrast, the 28 mm test trap catches were mainly composed by *L. vernalis* (52%) and the black goby (*Gobius niger*) (17%).

Overall, 4,890 specimens of *N. mutabilis* were caught and measured. The highest catch was obtained with the control trap, and a gradual decrease occurred with the increment of mesh sizes.

Shell height-frequency distributions of *N. mutabilis* catches showed a gradual reduction in size range and a shift towards larger size classes with the increment of mesh size. The demography of control trap catches included a first cohort (mode at 8 mm SH) represented by young specimens that was completely absent in the test traps catches. The target species was found in 34% of control traps and the frequency of occurrence gradually declined with the increment of mesh size. The number of specimens inside each trap strongly fluctuated confirming a patchy distribution of *N. mutabilis*. However, the greatest mean CPUE was obtained with the control trap and the lowest one with the 28 mm test trap (Figure 4). Individuals smaller than MLS dominated the control trap catches (86%) and gradually decreased with the increment of mesh size. They accounted for 57% (white twine) and 68% (black twine) of the 19 mm mesh catches, whilst they made up only 11% of the 23 mm mesh ones. No undersized specimens were retained by the two larger mesh sizes. The mean number of individuals larger than MLS caught with the control, 19 mm black, 19 mm white, 23 mm and 26 mm mesh traps were not statistically different, while the 28 mm mesh size showed again a significant lower efficiency compared to all the other kinds of trap except for the 23 mm mesh one.

AIC values indicated that the logistic selection curve with unequal relative efficiencies (estimated p) was the best model. In fact, for sufficiently large specimens (100% retention probability), the ratio $n_T /(n_T + n_C)$, where n_T is the number of height l individuals in the test trap and n_C is the number in the control trap, was in most cases lower than the expected 0.5 value, showing that the test traps were less efficient than the control one and efficiency gradually decreased with the increase of mesh size. The Selection Range ($l75 – l25$) derived from the logistic selection curve was similar among the different test traps and very narrow, ranging from 1.034 mm (19 mm white) to 1.183 mm SH (26 mm white). The Selection Factor (ratio between $l50$ and the effective mesh size) was also comparable among the 5 test traps, being within the interval 0.841 (19 mm black) - 0.860 (28 mm white). Sechin method evidenced that SH with 50% of retention probability gradually increased from 17.142 mm (19 mm black and white) to 25.372 mm (28 mm white). The Selection Range (1.575 mm) was obviously the same for each mesh size, being the mean standard deviation of the maximum shell girth, the parameter accounting for the slope of the cumulative function. The Selection Factor slightly decreased from 0.912 (19 mm black and white) to 0.903 (28 mm white).

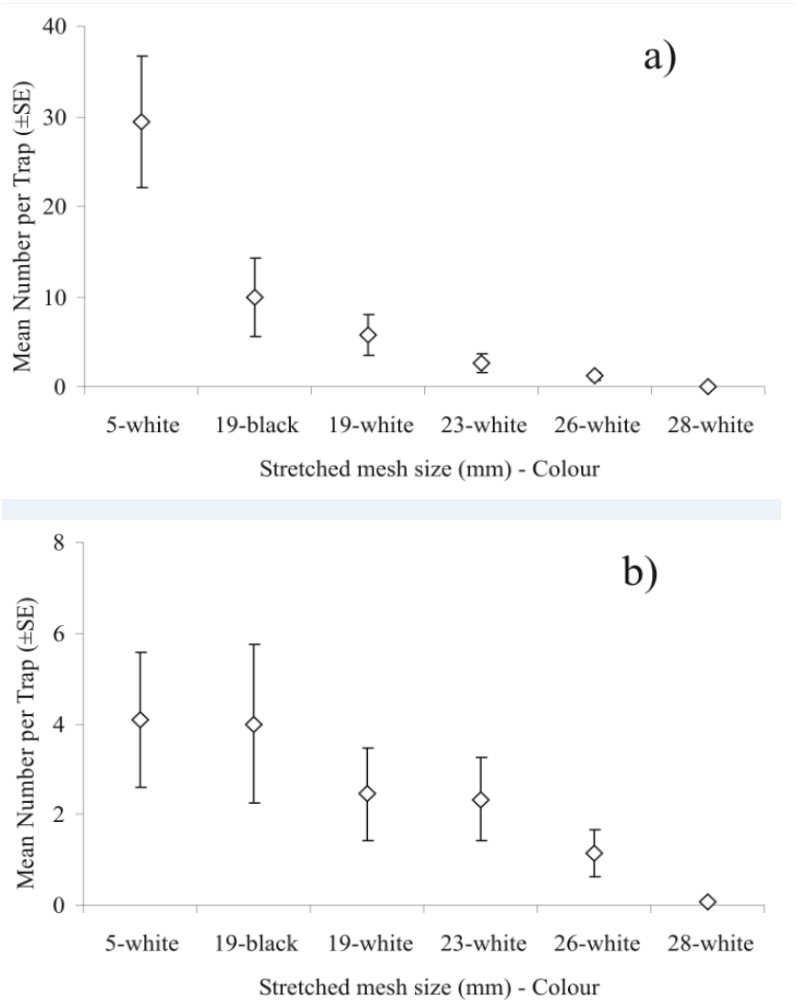

Figure 4 - Mean catch rates (mean number ± standard error) of *Nassarius mutabilis* obtained with the different kinds of net: a) total catch; b) specimens having SH≥20 mm.

Conclusion - The overall results obtained in the present study clearly indicate that the mesh size commonly used by fishermen along the coast of the central and northern Adriatic Sea is not adequate for the rational exploitation of *N. mutabilis* and the adoption of a larger mesh is needed. Taking into account both the fishing efficiency and the escape of small specimens, the use of 23 mm mesh size would be highly recommended because it represents a good compromise between the reduced occurrence of undersized specimens in the catches and satisfactory fishing yields of commercial product. On the other hand, the adoption of a very large mesh (26-28 mm) should be avoided because of very low fishing yields.

During the fishing season 2010-2011 seven local fishermen belonging to different fishing fleets of the Marche Region were asked to test basket traps having a 23 mm mesh in order to verify if what predicted in the study of selectivity was correct, and if the fishing yields of the larger mesh size would be satisfactory for the fishing activity. The results obtained in this subsequent experiment confirmed that the adoption of basket traps having a 23 mm mesh might have the following benefits: dramatic reduction of undersized specimens in catches, possibility to remove the hydraulic sieve from the deck with evident benefits in terms of onboard security, satisfactory fishing yields of legal sized specimens. Interviews to fishermen involved in the project evidenced an overall satisfaction in the use of a 23 mm mesh.

CASE STUDY: TRAMMEL NET, POT AND FYKE NET FISHERIES FOR CUTTLEFISH[4]

Introduction

The artisanal fishery of the cuttlefish *Sepia officinalis* has a very long tradition along the Italian coasts (Guerra, 1991) where it is especially carried out from late winter to early summer, when the adults of this cephalopod move inshore for spawning. Along the Adriatic coast the most used gears for the exploitation of this species are trammel nets, specific rectangular shaped pots and fyke nets. This last type of trap, traditionally employed in lagoons to catch mainly eels and other small fishes, such as gobids, is going to substitute the pots used for cuttlefish because of its efficiency, handiness and low cost.

Scarce and scattered information is available in Italy on cuttlefish fishery performed with set gears (Froglia, 1984) and there is also a lack of national measures aimed to manage the use of the different gears.

Aim of the study

The ultimate goal of the present study was to increase the knowledge on the set gears mostly used to exploit cuttlefish, investigating on an experimental basis their efficiency and catch yields. The assessment of importance of by-catch and discard also allowed to evaluate the impact of each gear on the target species and on the demersal community.

Materials and methods

The study was carried out through fishing trials at sea in the north-central Adriatic Sea during the period of maximum intensity of the professional cuttlefish fishery employing a trammel net, traditional pots and fyke nets commonly used by fishermen. Samplings were carried out either on a sandy and a sand-rocky bottom in order to investigate the influence of the type of bottom on the gear efficiency. Following the suggestions of the local fishermen, fyke nets and pots were previously adapted at sea for a few days to let them reach the highest catch efficiency. Pots were baited with laurel twigs while fyke nets were used without any bait. The gears were lowered into the water at dawn and pulled in at dawn of the subsequent day for about 24 h at sea. The catches obtained with the three different gears were subdivided into four categories (Alverson *et al*., 1994), according to the usual commercial procedures adopted by the fishermen of the two areas:

Target species: all the catch of *S. officinalis*;

Kept by-catch: portion of the catch retained and landed together with the target species. Discard of commercial species: specimens either damaged or smaller than the commercial size or unmarketable because caught in a very low amount.

Discard of no commercial species: non edible organisms or species which are unmarketable in the study area.

Investigations at field on the local fishing fleets, landings and activities were also performed to get a picture of the importance assumed by the cuttlefish fishery on the overall activity of the small-scale fishermen and to draft a cost/benefits ratio related to the use of the different gears in the two areas.

[4] Fabi G, Sartor P. 2001. *Sepia officinalis*: impact of three set gear fishing techniques in the Adriatic and the Ligurian Sea. Study Contract N. 98/069. Final Report for the EC. 119 pp.

Results and Discussion

The highest number of species and the highest yields in weight were recorded on the sand-rocky bottom, while more abundant catches in number of specimens were obtained at the sandy site for the great occurrence of the decapod *L. vernalis*. Cuttlefish made up most of fyke net and pot catches, while trammel net showed to be less selective because it generally caught high percentages of by-catch, which mainly consisted of discard of no commercial species. This category was dominated by benthic decapods, some of which belong to the food chains of the coastal zones. As crabs are generally dead when rejected at sea, this might alter the local macrozoobenthic communities, so creating an impact that is very difficult to quantify. A much lower importance was assumed by the discard of damaged or undersized individuals of commercials species. Also the occurrence of species which are endangered or need of a prudent management was occasional and very limited.

In agreement with what affirmed by the local fishermen, trammel net showed to be the most efficient gear for the catch of *S. officinalis* on the sand-rocky seabed, while no substantial differences were evidenced in the effectiveness of the three gears on the sandy bottom (Figure 5). A falling trend of the *S. officinalis* catches from late winter to early summer was observed for pots and trammel net. On the contrary, the fishing yields of fyke nets remained either constant or increased, according with the fact that a longer permanence at sea and siltation transform this type of trap in a suitable shelter for cuttlefish, so improving its catch efficiency. The yields obtained with the fyke nets and pots kept at sea for 48 h in both areas did not show appreciable differences with those of the correspondent gears soak for 24, demonstrating that a longer permanence at sea does not increase the efficiency of these traps. A general significant decrease of the mean mantle length of cuttlefish in catches was recorded from late winter to early summer everywhere. Cuttlefish caught on the sand-rocky bottom showed a higher mean mantle length and a wider size range in respect to the specimens caught on the sand.

Males were always more abundant than females and on the sand-rock also showed a higher mean size. Finally, comparison of the size-frequency distributions of catches obtained with the three gears evidenced that fyke nets collected the smallest individuals. All the specimens caught were bigger than the length of maturity and almost all of them had mature gonads, thus confirming that in the period late winter - early summer the exploitation of cuttlefish with set gears along the Italian coasts is mainly focused on adults which migrate inshore for spawning. Therefore, this fishing activity might affect the reproductive capacity of the population of *S. officinalis*, even though this impact is likely very scarce, considering that the species seems to spawn only once during its life cycle and that the traps act as suitable substrates for the egg attachment, as demonstrated by the massive presence of eggs attached on them.

An additional analysis based on the frequency of only male or only female catch as well as on the sex ratio of specimens inside each trap was conducted to clarify the catching mechanism of fyke nets and pots. The results showed that males were attracted by the presence of a female inside the pots, while the entry of females seemed to be accidental and probably related to spawning. No sexual attraction seemed to affect the entry of cuttlefish into the fyke nets.

The cost/benefits analysis based both on the information recorded on the fishing fleets and their activity and on the experimental data suggested that fyke net appears the most suitable gear for the artisanal fishery of cuttlefish independently from the type of bottom, because it represents a good compromise among different factors, such as purchase, maintenance and storage costs, handiness, yields and environmental impact.

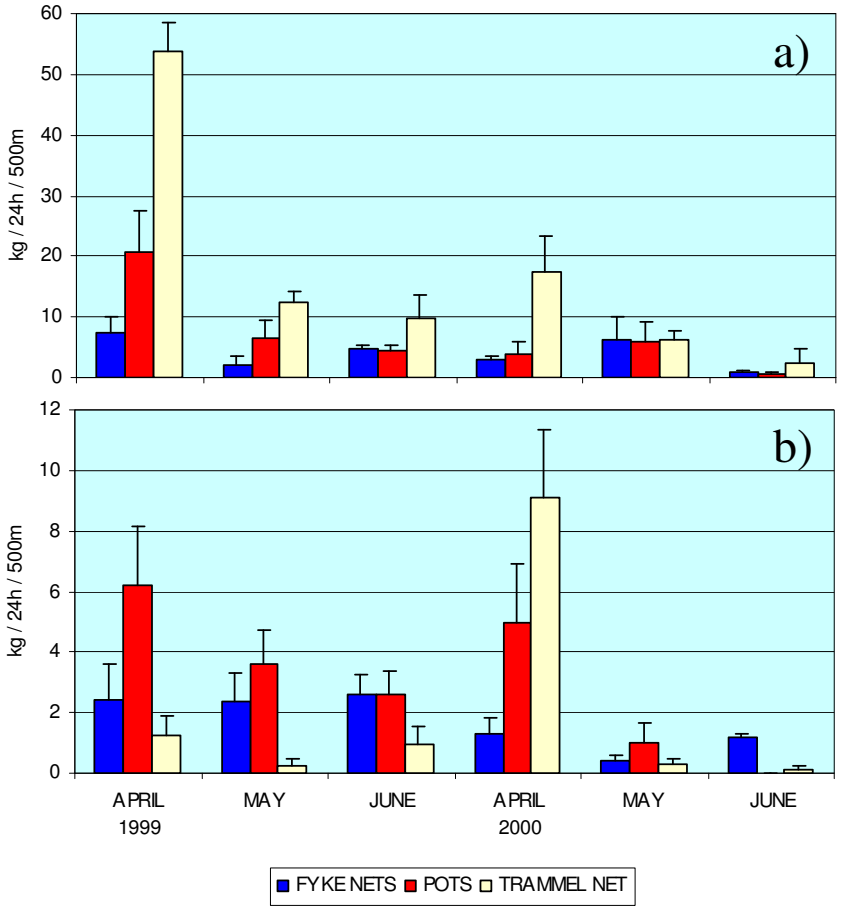

Figure 5 - Average monthly catches of *S. officinalis* in weight (with the respective standard errors) obtained with the three gears on the sand-rocky (a) and sandy (b) bottoms during the two sampling years.

CASE STUDY: STUDY OF SPATIAL INTERACTION USING GRID[5]

The present study has been developed inside the framework of the EU Project Coexist (FP7-KBBE-2009-3), a broad, multidisciplinary approach to evaluate the interactions of human activities with the goal to provide a roadmap for a better integration, sustainability and synergies between these activities in the coastal zone. Individual processes, as well as their interactions have been investigated in case studies. The north-central Adriatic Sea is the only Mediterranean case study inside the Coexist Project. The coastal strip of this basin is seat of several human activities, including commercial (small-scale fisheries, trawling, hydraulic dredges, etc.) and recreational fisheries, and intensive and extensive mussel culture. Among the other human activities, tourism, shipping, and gas extraction represent very relevant sectors. The combination of these driving forces inevitably results in spatial conflicts and requires an integrated approach to manage the interactions between these multiple pressures. Analysis of interactions have been accomplished by means of GRID (GeoReference Interactions Database), which is a web-based flexible database and tool to analyze conflicts and synergies, specifically developed inside Coexist Project by CNR-ISMAR of Ancona in collaboration with vTI of Hamburg.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27*
1. Mussel farms	0	0	0	0	3	5	5	5	5	5	5	5	5	5	2	0	3	6	0	0	4	0	5	5	5	5
2. Coastal protection		0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	3	3	3	0	3	0	3	0	3
3. Harbors			0	5	0	6	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0	5	0	0	3	3
4. Urban and rural residues				0	0	0	0	0	0	0	0	0	0	0	0	2	0	6	6	0	0	5	5	0	5	0
5. Urban development					0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0	5	0	5	0	0
6. Dumping						0	5	0	4	3	3	3	3	0	3	3	5	6	6	0	4	0	4	0	0	0
7. Cables and pipelines							3	6	6	6	6	6	6	6	6	6	6	6	6	0	6	4	6	6	6	0
8. Oil and gas extraction								5	5	5	5	5	5	5	5	0	0	6	6	0	0	5	5	0	5	0
9. Pots									4	4	4	4	4	4	4	0	3	0	0	0	5	0	5	0	5	5
10. Fyke nets										4	4	4	4	4	4	0	5	0	0	0	5	0	5	0	5	5
11. Gillnets											4	4	4	4	4	4	3	0	0	0	3	0	5	0	5	5
12. Trammel nets												4	4	4	4	4	3	0	0	0	3	0	5	0	5	5
13. Otter trawl													1	1	1	0	5	6	0	0	4	0	1	0	1	1
14. Pelagic trawl														1	1	0	5	6	0	0	4	0	1	0	1	1
15. Rapido trawl															1	0	5	6	0	0	4	0	1	0	1	1
16. Hydraulic dredges																0	5	6	0	0	4	0	1	0	1	2
17. Mussel harvesting																	3	0	0	0	3	0	4	0	4	2
18. Artificial reefs																		3	3	0	3	0	3	0	3	0
19. MPAs																			3	3	3	0	0	0	0	0
20. Natura 2000 sites																				3	0	0	3	3	0	0
21. Refurbish beaches																					0	3	0	0	0	0
22. Ship wrecks																						0	3	0	3	0
23. Beach tourism																							0	0	0	0
24. Recreational diving																								0	1	1
25. Marinas																									0	3
*27. Passengers and cargo ships																									26. Recreational fishing	1

Figure 6 – Interaction matrix reporting conflict scores (red), synergies (green) or no-interactions (white) between the main human activities carried out inside the coastal area of Marche Region (Adriatic Sea). Values of conflict score ranges from 1 to 6 and value of synergy is arbitrarily set to 3.

[5] Interaction in European coastal waters: a roadmap to sustainable integration of aquaculture and fisheries (COEXIST)

GRID allows four different spatial analyses: calculation of conflict scores, calculation of stress level, calculation of asymmetric spatial overlaps and plot of maps.
Interaction matrix evidenced that the most important human activities generate high level of conflicts inside the case study coastal area (Figure 6).

Small-scale fisheries are segregated inside the 3 nm by trawlers, as off this limit set gears can be damaged by towed gears. Inside the 3 nm limit artisanal vessels negatively interact with other human activities, such as hydraulic dredges, mussel farms, recreational fishing, and other man-made structures where fishing is prohibited (cable and pipelines, discharge areas, oil and gas extraction, etc.).
Map of interactions evidenced that the sum of conflict score is higher inside and around the limit of the 3 nm from the coast (Figure 7).

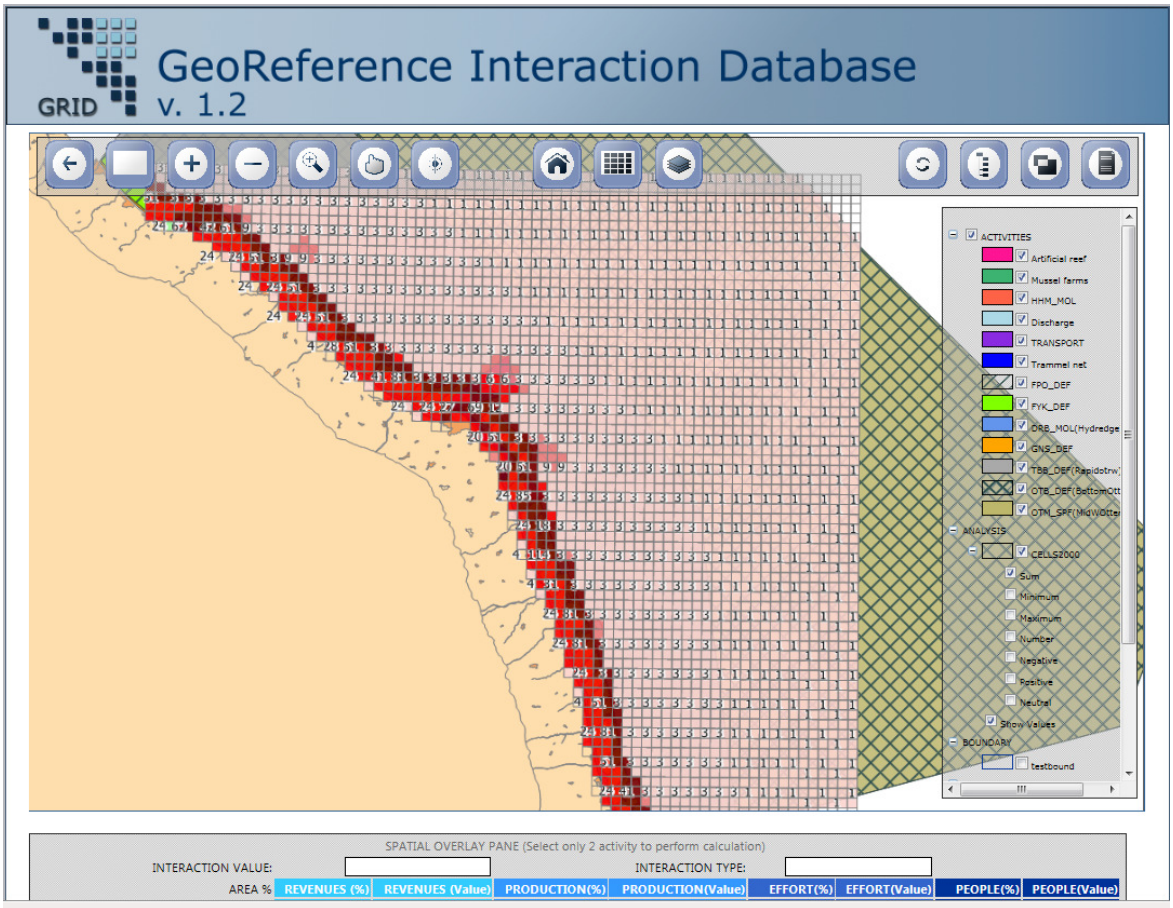

Figure 7 – Map of the actual situation in the Marche Region showing the grid (cells of 2 km) with the sum of conflict scores and synergies values.

Analysis of the key characteristics of the fishing activities carried out in the Marche Region (IREPA, 2010) showed that small-scale fishery was important in terms of number of vessels, number of fishermen and profit, but the fishing ground available for exploitation was very scarce in comparison with that of bottom and pelagic trawling (Figure 8).

On this basis, a possible future scenario could be to ban the bottom and pelagic trawling inside the 6 nm limit from the coast. This management measure could have the following benefits:

- great increase (105%) of the fishing ground for small-scale fishery;
- small decrease (6%) of the fishing ground for bottom and pelagic trawl;
- decrease of conflicts inside the 3 nm (Figure 9).

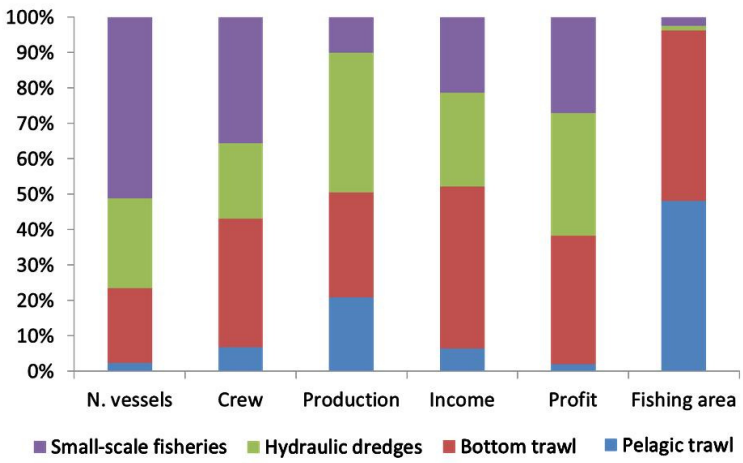

Figure 8. Main key characteristics of fishing activities carried out in the Marche Region in 2010 (IREPA, 2010). Fishing area was calculated on the basis of data collected by ISMAR-CNR of Ancona and mapped using GRID.

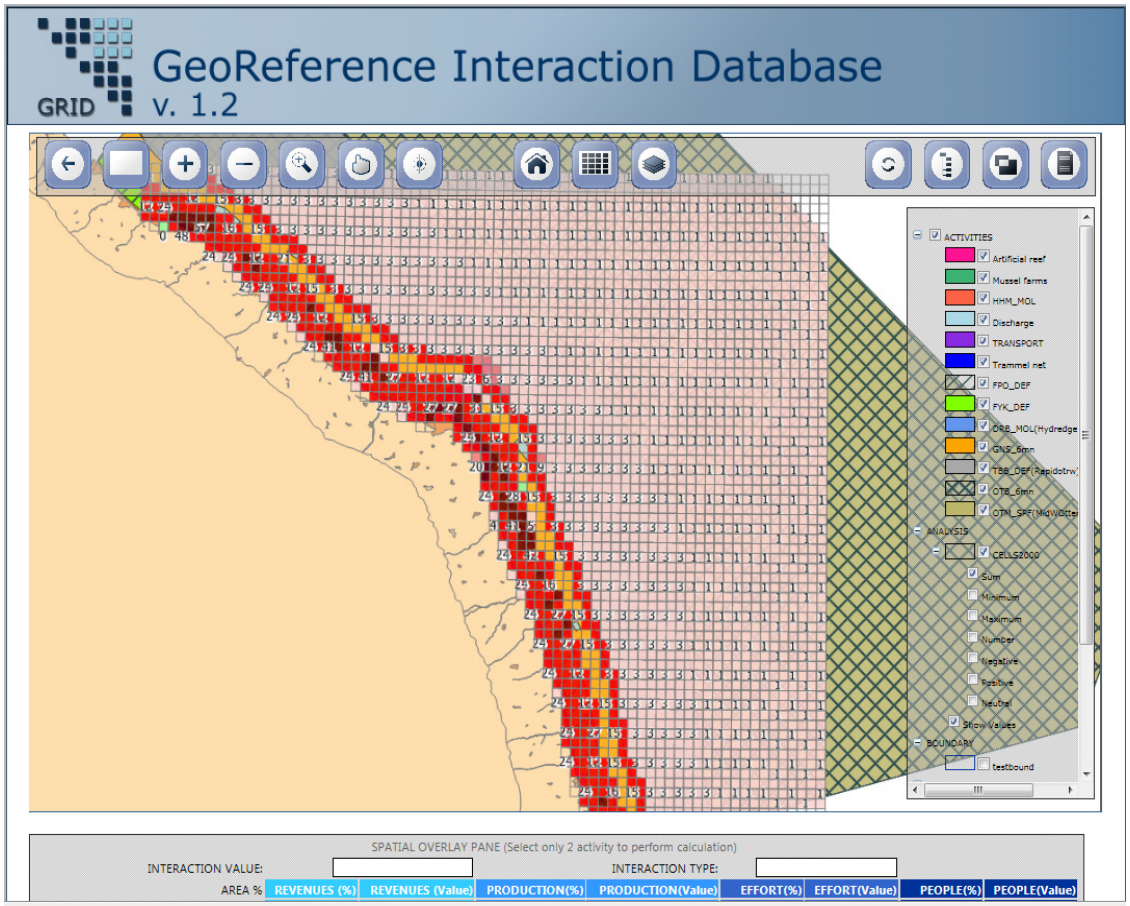

Figure 9. Map of the future scenario (trawling banned inside the 6 nm limit) in the Marche Region showing the grid (cells of 2 km) with the sum of conflict scores and synergies values.

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Artisanal fishery in Puglia (Italy, GSA 18): a comparison between passive gears less than 12 metres and bottom trawlers less than 12 metres, illustrating the main characteristics of the small scale fisheries in Puglia (Italy)

Monica Gambino[6]

Introduction

The Puglia region has a very long coast, about 800 kilometres. It falls in two different GSAs: the eastern Adriatic side in GSA 18 while the western Ionian side falls into the GSA 19. Puglia has a very important fishing fleet if considered in the context of the Italian fishery. 11% of the Italian vessels are registered in Puglia (the second region after Sicily), 2/3 of which fishing on the Adriatic side. If taking into account only the Italian Adriatic fishery (GSA 17 and 18), Puglia accounts for 24% of the total number of vessel.

The analysis carried out in the present case-study is focused only on the fishery along the Adriatic coast of Puglia (GSA 18) and refers to all vessels with a LOA lower than 12 metres: passive gears using mainly fixed nets and small demersal trawlers.

The analysis has been focused on the main socio-economic trends that have characterised these two fleet segment over the last four years. In the second part of the report, a list of six "balance" indicators have been applied to these fisheries with the aim to produce an overall picture of the capacity status of passive gears and demersal trawlers less than 12 metres. Such analysis confirmed the general decreasing trend of all indicators of profitability and productivity, which was undoubtedly due to the increase in fuel price and to new restrictions enforced with the entering into force of the Council Regulation (EC) n. 1967/2006.

1. Artisanal fleet (passive gears and demersal trawlers less than 12 metres) in Puglia (GSA 18) : structure and economic performance

1.1 Fleet description

Vessels lower than 12 metres represent the largest segment within the Puglia fleet: 510 vessels, amounting to 49% of the whole fleet. The second important segment is the one made up of demersal trawlers with a LOA between 12 to 18 (28% of the total) – table 1. In terms of capacity, they represent 6% and 10% of the regional GT and kW respectively. Indeed, these vessels are very low dimensioned: if considered together they have an average tonnage of 2 GT and an average installed power of 19 kW while the average figures for the overall regional fleets are 16 GT and 100 kW.

Vessels lower than 12 metres are older than other segments of the fleet, 33 and 34 years on average for demersal trawlers and passive gears, respectively, while the regional average is 26. In 2011, they show the highest number of average days at sea: 171 if considered together vs. 160 of the overall fleet. The more active vessels are the ones using passive gears with a LOA lower than 6 metres: 203 days on average in 2011

In 2011, people working on board of vessel <12m. were 959 (34% of total employment of the area). On average there are 2 persons on-board of each vessel: the vessel owner usually works on board with an additional person.

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Table 1 Fishing fleet by segment and length, Puglia GSA 18, 2011

Fishing technique	Vessel lenght	No. Vessel	GT	kW	Average days at sea	Age	Crew member
Dredges	VL1218	76	819	7,544	78	22	152
Demersal trawlers	***VL0612***	***36***	***231***	***2,028***	**106**	**34**	**81**
	VL1218	294	5,534	38,281	160	20	785
	VL1824	78	4,153	21,052	168	21	319
	VL2440	20	1,948	7,362	179	29	103
Longlines	VL1218	32	546	5,488	151	19	171
Polyvalent passive gears	***VL0006***	***173***	***173***	***626***	***203***	***37***	***233***
	VL0612	***301***	***645***	***7,309***	***161***	***30***	***644***
Purse seines	VL2440	5	608	2,561	116	22	80
Pelagic trawlers	VL2440	30	2,354	12,444	158	22	205
Total fleet		**1,045**	**17,011**	**104,695**	**160**	**26**	**2,774**

Source: Mipaaf-Irepa

Table 2 gives an overview of the distribution of small vessels by type of gears used (passive or trawlers) and by main administrative geographical area (*compartimento di iscrizione*), also representing the most important ports.

The Adriatic coast of Puglia has 4 compartments: Manfredonia, Molfetta, Bari and Brindisi. The most important port, in terms of operating vessels, is Manfredonia, having the highest number of both passive and demersal small vessels.

Having a look at average values, it can be observed the small vessels have quite different features according to the gear used (if passive or trawlers). First of all the average size: vessel less than 12 metres are, on average, 2 GT and 17 kW sized and have a LOA of 7 metres. The bigger passive vessels are operating in Brindisi. On the other side small trawlers are, on average, 6 GT and 56 kW sized and have a LOA of 11 metres. The bigger demersal trawlers are those operating in Molfetta. In general, Brindisi has the less obsolete vessels: average age of 23 years s. a regional average of 31.

Table 2- Passive gears and demersal trawlers less than 12 metres by main administrative geographical area, Puglia GSA 18, 2011

	Passive gears				Demersal trawlers		
	Manfredonia	Molfetta	Bari	Brindisi	Manfredonia	Molfetta	Bari
	Absolute values						
Number of vessels	219	38	125	92	29	4	3
Total GT	314	61	207	236	179	35	17
Total kW	2,179	733	1,954	3,070	1,545	285	198
	Average values						
GT	1	2	2	3	6	9	6
kW	10	19	16	33	53	71	66
LOA	7	7	6	7	11	11	10
Age	33	35	36	24	36	30	22

Source Mipaaf-Irepa

Figure 1 shows the trend of the average days at sea and the volume of landings over the period 2008-2011. For passive gears it can be observed that while the activity level is almost stable (slight increasing), the volume of landings shows, on the overall period a decrease of 20%. On the other side, the graphs highlights for small demersal trawlers a consistent decrease on both the level of activity and the volume of landings, respectively equal to -28% and -60%.
The reduction in the fishing effort in 2010 and 2011 is clearly related to the rise in production costs caused by the increase in the cost of fuel.
As in 2008, fuel cost significantly reduced the income, also causing lower fishing activity. Given the narrowing of the margins between revenue and costs, many vessels tended to reduce their number of active days when weather conditions were not ideal and could therefore have undermined the catch. This cautious behaviour was a feature of both smaller and larger demersal trawlers.

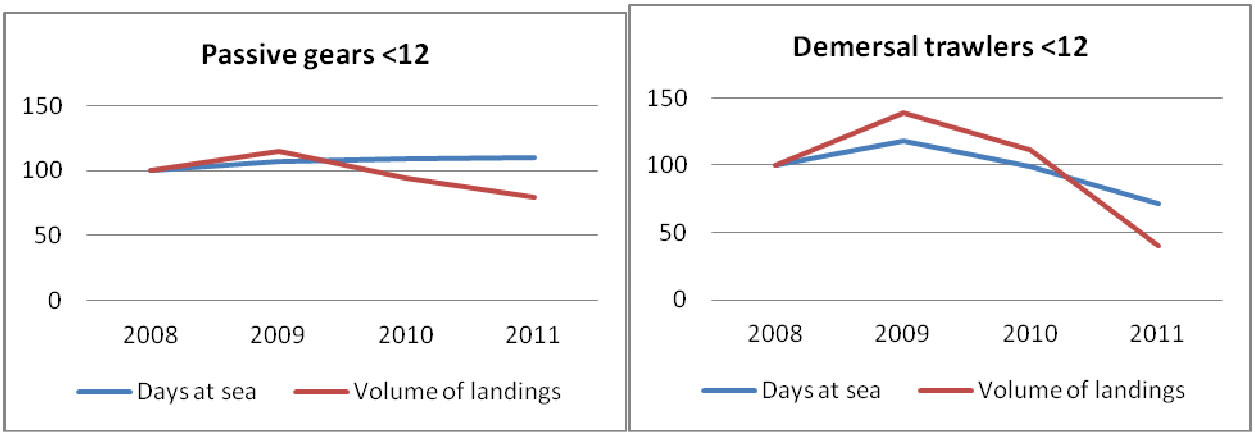

Figure 2 - Trend in fishing activity and landings in volume of passive gears <12 m and demersal trawler <12m, Puglia GSA 18, index numbers 2008-2011 (base=2008). Source: Mipaaf-Irepa

1.2 Production and main species fished

The main target species for small passive gears vessels and small demersal trawlers are reported in table 3. The share of each species is estimated on the volume of landings over the period are 2008-2011 (average percentage). Table 3 also reports the total amount of the volume of landings for the two fleet segments <12 m.

The most important target species is cuttlefish (*Sepia officinalis*), representing 21% and 13% on the total volume of landings for passive gears and demersal trawlers, respectively. Another important species for both the fleet segments is European hake (*Merluccius merluccius*), representing 8% and 13% for the two fleets. Common octopus (*Octopus vulgaris*) is an important target species (13%) for passive gears but not for demersal trawlers (1%).

Table 3- Main target species of passive gears <12 m and demersal trawlers <12m, Puglia GSA 18, 2008-2011

Species	***Passive Gear <12m***	***Demersal trawlers<12 m***
Common cuttlefish	21%	13%
European hake	8%	13%
Common octopus	13%	1%
Spottail mantis squillid	3%	11%
Red mullet	3%	10%
Atlantic bonito	5%	1%
Surmullet	5%	1%
Bogue	3%	1%
European squid	1%	4%
Norway lobster	0.5%	2%
Horned octopus	-	6%
Musky octopus	-	5%
Mediterranean horse mackerel	-	3%
Deep-water rose shrimp	-	2%
Total volume of landings 2011	**1,656 tons**	**247 tons**

Source: Mipaaf-Irepa

Red mullet (*Mullus barbatus*) is mainly targeted by trawlers (10%) and at much lesser extent by small scale fisheries using gillnets and trammel nets (3%). Fishing grounds are located along the coasts of the whole GSA 18. Red mullet usually co-occurs with other important commercial species as *Pagellus sp., Eledone sp., Octopus sp., M. merluccius*. (STECF EWG 12-10). Estimation from STECF EWG 12-10 on stock of *Mullus barbatus* in GSA 18 made on results obtained by the XSA analysis (current F is around 1.50), highlight that the stock of this species in the Adriatic waters of Puglia is considered exploited unsustainably (Abella *et al*., 2012).

Squilla mantis does not represent a target species in the fisheries carried out in the GSA 18 but it is part of the mixed species representing the by-catch of otter trawlers and set netters using gill net and trammel net. Indeed table 3 shows that the share of spottail mantis squillid on the total volume of landings is 10% for demersal trawlers and 3% for passive gears. Taking into account the results obtained by the VIT analysis carried out on the most updated data (current F is around 1.04), STECF EWG 12-10 concluded that the stock is considered exploited unsustainably (*Abella et al*., 2012).

There are, moreover, some species on which the two fleet segments are not conflicting so much: Atlantic bonito (*Sarda sarda*), surmullet (*Mullus surmuletus*) and bogue (*Boops boops*) are important species for the passive gears <12 (from 3% to 5%) while other species are almost caught only by demersal trawlers as horned octopus (*Eledone cirrhosa*), European squid (*Loligo vulgaris*), musky octopus (*Eledone moschata*), Mediterranean horse mackerel (*Trachurus mediterraneus*).

Deep-water rose shrimp (*Parapenaeus longirostris*) and Norway lobster (*Nephrops norvegicus*) are only targeted by trawlers (2% of total volume of landings over the period 2008-2011.

Fishing grounds of deep-water rose shrimp are located along the coasts of the whole GSA 18 (catches from trawlers are from a depth range between 50 and 500 m) while Norway lobster is only targeted by trawlers on offshore fishing grounds. Usually catches of both species co-occurs with

other important commercial species as *M. merluccius, Illex coindetii, Eledone cirrhosa, Lophius spp.* and *Lepidorhombus boscii*.
Taking into account the results of analysis carried out during STECF EWG 12-10, the stocks of both species are considered exploited unsustainably (Abella *et al*., 2012).

1.3 Profitability of fishing enterprises

Figure 2 shows the trend of the main economic variables of the two fishing segment analysed within the present case study for the period 2008-2011. The fishing sector of both the segments in 2011 continued to record considerably negative performances: the revenue produced by the fishing sector has consistently declined since 2008, a particularly negative year for the industry. The added value produced by the two segments in the last year (2011) was equal to 14,498 and to 1,777 thousand euro for passive gears and demersal trawlers respectively. Table 4 shows very different figures for the two segments. First of all income, costs and value added figures per vessel are completely different: on average a passive vessel in 2011 had an income of 30 thousand euro vs. 46 thousand euro for the small trawlers.

Table 4- Income statement of passive gears <12 m and demersal trawler <12m, Puglia GSA 18, 2011

Fleet segments	**Indicators**	**Income**	**Intermediate costs**	**Gross value added**
Passive gears <12	absolute value ('000 €)	14,498	5,970	8,528
	average by vessel (€)	29,708	12,233	17,476
	% on income	100	41	59
Demersal trawlers <12	absolute value ('000 €)	1,777	1,567	210
	average by vessel (€)	45,944	40,525	5,419
	% on income	100	88	12

Source: Mipaaf-Irepa

The greater difference is for the intermediate costs level, equal to about 12 thousand euro for a passive vessel and to 40 thousand euro for a small trawler. Indeed, small trawlers, as the bigger ones, show a high incidence of intermediate costs on income (88% for small trawlers fishing in the Adriatic waters of Puglia Vs. 41% of passive vessels – table 4). On average, in 2011, vessel costs for fuel were equal to 26 thousand euro for small trawlers vs. 6 thousand euro for passive vessels.

Taking into account the consistent decrease of the value of landings of small trawlers (-65% since 2009), caused by a decrease in catches due to different behaviour of fishermen as a reply to the increase in fuel price and to the restriction carried on by the Council Regulation (EC) n. 1967, the value added produced by small trawlers appears to be the lowest of the period (-88% since 2008) – Figure 2.

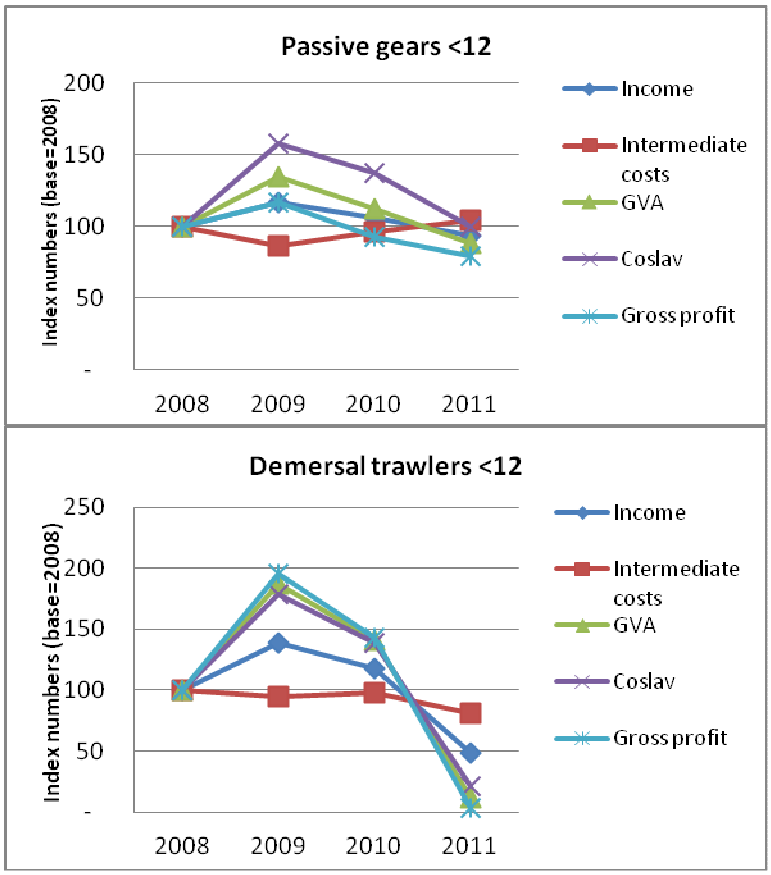

Figure 3 - Trend of the main economic indicators of passive gears <12 m and demersal trawler <12m, Puglia GSA 18, index numbers 2008-2011 (base=2008). Source: Mipaaf-Irepa

Table 5 shows the trend of the main economic performance indicators (% on income level of the main economic indicators) for passive gears <12 metres and demersal trawler <12 metres fishing in Adriatic waters of Puglia (GSA 18) for the period 2008-2011. It is interesting to see the complete fall of most economic performance indicators for the small trawlers over the observed period. From 24% to 10% for labour costs/income, from 47% to 12% for gross value added/income and from 23% to 2% for gross profit/income. In 2011, the increase in the cost of fuel on the levels of 2008 has heavily affected the profitability of the demersal trawl system, placing operators in a situation of uncertainty for the future. In addition, the stagnation of the demand associated with a fall in producer prices has further deteriorated the profitability of the entire sector. Finally, in the second quarter of 2010, the restrictions introduced by the Mediterranean Regulation EC) n.1967/2006 came fully into force. Some measures concerning mesh size, distance from the coast, minimum size of several species have been implemented on 1st June 2010 and restrictions were applied fully for the first time. These - especially the ban on bottom trawling activities within 3 miles from the coast – has largely impacted the fishing activity of several fishing fleets of the Adriatic sea.

Table 5 - Economic performance indicators of passive gears <12 m and demersal trawler <12m, Puglia GSA 18, 2008-2011, %

Fleet segments	Indicators	2008	2009	2010	2011
Passive gears <12	Intermediate costs/income	37	28	34	41
	Labour costs/income	27	36	35	29
	Gross value added/income	63	72	66	59
	Gross profit/income	36	36	32	30
Demersal trawlers <12	Intermediate costs/income	53	36	44	88
	Labour costs/income	24	31	28	10
	Gross value added/income	47	64	56	12
	Gross profit/income	23	33	28	2

Source: Mipaaf-Irepa

1.4 Fleet adjustment plans

The economic crisis within the fishing industry in Puglia over the past four years has encouraged many owners of fishing vessels to apply assistance of the European Fisheries Fund for decommissioning scheme. In accordance with the state of the biological resources, the national adjustment plan foresees a reduction in the capacity of 21% for bottom trawling and 8% for small scale vessels included in "Other systems" for the period 2008-2015 (Table 6). For this latter group of vessels the planned reductions refer both to the Adriatic and Ionian fleets registered in Puglia. The reduction planned for the Apulian fleet segments are quite above the national averages, which correspond to 13% for the Italian bottom trawling fleet and to 5% for the Italian small scale segment.

Table 6 - Fleet capacity adjustment plan for years 2008-2015

Fishing fleet's segment	% Reduction in GT and kW	GT planned to be scraped	kW planned to be scraped
Bottom trawling GSA 18 (Southern Adriatic)	21	2991	16134
Pelagic GSAs 18 & 19 (Ionian)	2	86	423
Other systems GSA 18 & 19	8	334	3331

Source:Mipaaf

2 Balance between the fleet and the available fishing opportunities for artisanal fleet (passive gears and demersal trawlers less than 12 metres) in Puglia (GSA 18)

As evidenced by a vast literature (FAO, 1999; OECD, 2003) and projects (e.g. CopeMed and AdriaMed projects), the importance attached to social and economic indicators and reference points in order to assist fishery policy and management have greatly increased over the last twenty years. Taking into consideration the conclusions reached by previous studies and reports, the present study is aimed to produce an overall picture of the capacity status of small scale fishery in Puglia from a socio-economic point of view through the calculation of some balance indicators. Such indicators are set according the EU Commission "Guidelines for an improved analysis of the balance between fishing capacity and fishing opportunities" (STECF, 2007). These indicators have been developed with the purpose to assist EU Member States in describing the balance between fishing fleets and their resources. They have been classified according to four dimensions or areas (Economic, Biological, Social and Technical) and reflect the CFP objectives of ensuring an exploitation that provides sustainable economic environmental and social condition.
In this context a list of six socio-economic indicators have been applied to small scale fishery and demersal trawl less than 12 metres. Data are based on the economic information collected in the context of EU Data Collection Framework (DCF). Indicators related to the most recent year are also organized according to a traffic light system.

2.1 Technical indicators

The ratio between days at sea and maximum days at sea for each gear type and length group are presented in table 7 and 8. By taking the ratio between average and maximum number of sea days, an expression for technical capacity utilisation is calculated. The maximum number of sea days within a fleet segment has been set equal to the most active year within the time period considered.
In the Commission guidelines a value below 0.7 is considered to indicate the presence of technical overcapacity, and if this is applied to the figures below, technical overcapacity is present in the demersal fleet segments. By the contrast, the small scale segment shows a largely homogeneous level of activity.

Table 7 - Technical indicators: capacity utilization for passive gears <12m

Year	Effort(average)		Maximum effort		Capacity utilization	
	days	*Gtdays*	*days*	*Gtdays*	*days*	*Gtdays*
2008	156	271	171	305	0.91	0.89
2009	167	282	171	305	0.98	0.92
2010	170	292	171	305	1.00	0.96
2011	171	305	171	305	1.00	1.00

Source: Irepa

Table 8 - Technical indicators: capacity utilization for demersal trawlers <12m

Year	Effort (average)		Maximum effort		Capacity utilization	
	days	Gtdays	days	Gtdays	days	Gtdays
2008	137	903	162	1039	0.85	0.87
2009	162	1039	162	1039	1.00	1.00
2010	136	889	162	1039	0.84	0.86
2011	99	639	162	1039	0.61	0.61

Source: Irepa

2.2 *Economic indicators*

With reference to the Economic dimension it primary refers to the criteria of profitability. Low or negative profitability usually indicates that fish stocks are exploited in an economic wasteful manner and fishing capacity and effort are excessive on both economic and biological grounds. The two indicators recommended in the EC guidelines are Return on investment (ROI) per fleet segment and the current revenue in proportion to the break-even revenue per fleet segment.

The most common indicator to measure the economic performance of a fleet segment is the Return on Investment (ROI), which indicates the percentage ratio of net profit (Income – crew costs - fuel costs – repair costs – variable costs – fixed costs – capital costs) in relation to the investment. The economic sustainability is calculated by comparing the investment profitability rate with the theoretical risk free rate, usually the long term bonds rate (around 5%). A ROI value varying around zero indicates neither economic over- nor under-capitalisation.

In 2011, the two fleet segments are seen to consistently have negative ROIs thus indicating economic over-capitalisation.

Table 9. Return on investment (%)

Gear type and length	2008	2009	2010	2011
PGP 00-12 m	57%	66%	-7%	-11%
DTS 06-12m	58%	126%	79%	-29%

Source: Irepa

The ratio between the current revenue and the break-even revenue gives an indication of the economic sustainability of the fishing fleet in the short term. This break even revenue point is defined as the revenue point at which the gross cash flow (= Income-all operational costs excluding capital costs) equals the fixed costs. Hence, if the ratio is greater than 1, then enough cash flow is generated to cover fixed costs, indicating that the segment is economically viable in the short term. Conversely, if the ratio is less than 1, insufficient cash flow is generated to cover fixed costs, indicating that the segment is economically unviable in the short term. It is a good measure of economic sustainability, although not linked to investments cost.

In 2011, both fisheries have ratios below 1, thus indicating the activity is not economic in balance and sustainable. These trends should mainly be linked to the reduction in revenues and producer prices which have led to large losses for the entire sector.

Table 10 - Ratio between current revenue and break-even revenue

Gear type and length	2008		2009		2010		2011	
	BER (EUR)	CR/BER	BER (EUR)	CR/BER	BER (EUR)	CR/BER	BER (EUR)	CR/BER
PGP 00-12 m	7,464,232	2.07	7,952,543	2.26	20,663,704	0.79	21,370,650	0.68
DTS 06-12m	1,801,203	2.03	1,530,535	3.30	1,779,422	2.43	3,753,386	0.47

Source: Irepa

2.3 Social indicator

Social criteria primary refer to employment, which is the most used indicator of the condition of a fishery. For this reason the indicators recommended in the EC guidelines are gross values added per Full-employment, gross values added per vessel and average crew share per Full-employment.
Total Gross Added Value is applied to estimate the remuneration of capital and labour. It is calculated as income minus operative costs (all variable and fixed costs) and expresses the Added Value that a fishery contributes to the National Economy. This indicator also provides information on the socio-economic importance of the fishery, as economically important stocks are represented by high revenues. Setting target values for this indicator is very complicated. A value above zero means the fishery has a value for society. As shown in table 11, the gross value added for the two fleet segments are all positive even if they show a decreasing trend. In 2011, the small scale fishery gave a contribution of over 8 million EUR, showing a decrease of 14%. to 2008. In the last year, the Gross Valued Added generated by small trawlers corresponded to 12% of GVA generated in 2010.
Gross value added per employee and per vessel are also important indicator of social sustainability. As for Total Gross Added Value both ratios highlight decreasing trend for both fleet segments. In particular, the demersal trawl segment showed clear signs of crisis: GVA per employee and GVA per vessel have fallen of around 90% in three years.

Table 11 - Gross Value Added

Year	Indicator	PGP 00-12 m	DTS 06-12 m
2008	GVA	9,711,600	1,717,763
2009	GVA	13,041,872	3,214,140
2010	GVA	10,880,097	2,417,729
2011	GVA	8,528,151	209,522
2008	GVA/No Employees	10,943	23,371
2009	GVA/No Employees	14,845	43,725
2010	GVA/No Employees	12,209	33,156
2011	GVA/No Employees	9,715	2,587
2008	GVA/No Vessels	19,860	49,790
2009	GVA/No Vessels	26,849	90,752
2010	GVA/No Vessels	22,150	63,837
2011	GVA/No Vessels	17,476	5,419

Source: Irepa

The Average Wage per employee gives a reference based on the salary that the crew receives. This indicator is compared with the minimum or the average salary. General speaking a reduction in wage could imply a reduction in the purchasing power and so a worse situation, even though the indicator could be higher than the minimum wage.
For both fleet segments general trend of decreasing average wages per FE is observed, and this is especially pronounced for small demersal trawlers.

Table 12 - Average crew wage per number of employees, PGP 00-12m

Year	**No employees**	**Crew Cost** (EUR)	**Crew wages per No employees (EUR)**
2008	887	4,145,822	4,672
2009	879	6,528,796	7,431
2010	891	5,703,888	6,401
2011	878	4,132,561	4,708

Source: Irepa

Table 13 - Average crew wage per number of employees, DTS 06-12

Year	**No employees**	**Crew Cost** (EUR)	**Crew wages per No employees (EUR)**
2008	74	863,851	11,753
2009	74	1,545,958	21,031
2010	73	1,199,638	16,451
2011	81	180,961	2,235

Source: Irepa

2.4 Biological indicator

Regarding the biological indicator, catches per unit effort (CPUE) have been considered in order to evaluate productivity tendency both for temporal analysis and for horizontal comparisons among the fishing segments. The catches per effort unit ratio compares the variation in production with the effort unit variations, and are based on the assumption that technological progress is expected to bring about increases in fishing mortality rates. Nevertheless, the catches per unit effort (CPUE) trend requires correct and careful interpretation and should be analyzed as part of a long and homogeneous historical dataset. For this reason in the Commission guidelines it is it defined as a "third-best" biological indicator where the other two recommended indicators (Ratio between F estimated and F target and Ratio between current catch weight and stock biomass) cannot be calculated as in this case.
With regard to the present analysis the total catches and effort were calculated for the main target species (*Sepia officinalis, Octopus vulgaris, Merluccius merluccius, Mullus barbatus*) shared by the small scale s and by the trawl segment under 12 metres in Puglia, which in 2011 accounted for a 51% of total landings for the small scale segment and for a 36% of total landings the small demersal trawl segment .
The CPUE indicator showed signs of reduction for both fleet segments. For the small scale segment, the largest reduction of less 26% is calculated only for Red mullet. For the mall demersal trawl segment, CPUE of Red mullet reduced by more than 90% between 2008 and 2011. Over the same period CPUE of European hake decreased by 49%.

Table 14 - Catches per unit effort (CPUE) of PGP 0012m, 2008-11

Species	2008	2009	2010	2011
Common cuttlefish	4.16	5.53	6.55	4.32
Common octopus	3.46	2.95	3.54	3.20
European hake	1.54	2.76	1.92	2.10
Red mullet	0.61	0.95	0.54	0.45

Source: Irepa

Table 15 - Catches per unit effort (CPUE) of DTS 0612m , 2008-11

Species	2008	2009	2010	2011
Common cuttlefish	10.12	11.45	9.56	10.07
Common octopus	0.70	1.17	1.45	0.61
European hake	21.07	16.84	16.43	10.67
Red mullet	20.63	16.02	7.11	2.00

Source: Irepa

3. Conclusions

The aim of the indicators proposed in the European Commission's guidelines for calculating the biological, economic, social and technical indicators is to establish whether a balance has been achieved between these fleets and the available fishing opportunities. Although the indicators show extreme variations among the two fishing segments, the analysis confirmed a significant deterioration in the biological, economic, social indicators and a largely unchanged situation for the technical indicator. For the Apulian fishing sector, 2008 was a particularly bad year because of the increase in operating costs resulting from the sharp rise in fuel prices; 2009 saw a recovery in vessels' average activity and, thanks to a reduction in intermediate consumption, there was a general improvement in the social and economic indicators. However, this was transitory, and the performance of the sector declined again in 2010 and 2011. The biological indicator showed signs of a slight reduction. The CPUE indicators recorded in 2011 were greatly lower than in the previous year for almost all species considered.

To conclude, the balance between the fleet and the available fishing opportunities deteriorated in 2011, particularly for the bottom trawler segment less than 12 m. By contrast, small-scale fishing showed a more stable situation.

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Artisanal fishery in Veneto (Italy, GSA 17): a comparison between passive gears less than 12 metres and bottom trawlers less than 12 metres, illustrating the main characteristics of the small scale fisheries in Veneto (Italy)

Loretta Malvarosa[1],

Abstract

The Veneto region has a coast coinciding in the southern part with the "laguna Veneta" and to the North with the strip of coast between the "laguna" and the maritime place of Bibione. In length it is about 140 kilometres. The Veneto waters fall exclusively in GSA 17. 5% of the Italian vessels are registered in Veneto. If taking into account only the Italian Adriatic fishery (GSA 17 and 18), Veneto accounts for 16% of the total number of vessel. The main fishing port of the area are: Caorle and Chioggia. In this case study the analysis is carried out on all the vessels with a LOA lower than 12 metres: passive gears using mainly fixed nets and small demersal trawlers. The analysis show the main differences between the two different type of vessels. These differences constitutes the main reason why in Italy small demersal trawlers are not considered within the "small scale" segment.

Introduction

The Veneto region has a coast coinciding in the southern part with the "laguna Veneta" and to the North with the strip of coast between the "laguna" and the maritime place of Bibione. In length it is about 140 kilometres. The Veneto waters fall exclusively in GSA 17.

5% of the Italian vessels are registered in Veneto. If taking into account only the Italian Adriatic fishery (GSA 17 and 18), Veneto accounts for 16% of the total number of vessel. The main fishing port of the area are: Caorle and Chioggia.

In the present case study the analysis is carried out on all the vessels with a LOA lower than 12 metres: passive gears using mainly fixed nets and small demersal trawlers. The analysis will show the main differences between the two different type of vessels. These differences constitutes the main reason why in Italy small demersal trawlers are not considered within the "small scale" segment.

1. Artisanal fleet (passive gears and demersal trawlers less than 12 metres) in Veneto: structure and economic performance

1.1 Fleet description

Vessels lower than 12 metres represent the largest segment within the Veneto fleet: 357 vessels, amounting to 49% of the whole fleet. The second most important segment is the one made up of dredges, one of the most important fishery in this area (23% of the total) – table 1.

In terms of capacity vessel lower than 12 metres represents 8% and 19% of the regional GT and kW respectively. Indeed, these vessel are very low dimensioned: if considered together they have an average tonnage of 3 GT and an average installed power of 45 kW while the average figures for the overall regional fleets are 17 GT and 114 kW.

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Vessel lower than 12 metres are older than other segments of the fleet, 36 and 35 years on average for demersal trawlers and passive gears (average between the two length classes) respectively, while the regional average is 30 years.
Vessel lower than 12 metres show, for 2011 – table 1 –average days at sea equal to 103 if considered together, almost in line with the average indicator for the overall fleet for 2011 (101 days). The less active vessels are the ones using passive gears with a LOA lower than 6 metres: 54 days on average in 2011.
In 2011, people working on board of vessel <12 metres were 627. On average there are 2 person on-board of each vessel: the vessel owner usually works on board with an additional person. Only the owner is usually working on board of very small vessels (LOA less than 6 metres, 1 average crew member employed in 2011).

Table 16 – Veneto fishing fleet parameters by segment and length, 2011

Fishing technique	Vessel lenght	No. Vessel	GT	kW	Average days at sea	Age	Crew member
Dredges	VL1218	163	1.836	17.915	62	25	328
Demersal trawlers	***VL0612***	***33***	***197***	***3.255***	***108***	***36***	***65***
	VL1218	102	1.730	13.959	117	26	250
	VL1824	28	2.238	10.657	158	28	142
Polivalent passive gears	***VL0006***	***94***	***94***	***1.304***	***54***	***38***	***100***
	VL0612	***230***	***714***	***11.334***	***123***	***33***	***462***
Beam trawlers	VL1824	27	1.579	8.655	127	31	108
	VL2440	9	1.106	4.703	122	23	49
Pelagic trawlers	VL1218	19	620	3.332	145	14	68
	VL1824	5	301	881	61	17	11
	VL2440	12	1.608	5.983	155	14	74
Total fleet		**722**	**12.023**	**81.980**	**101**	**30**	**1.658**

Source: Mipaaf-Irepa

Table 2 gives an overview of the distribution of small vessels by type of gears used (passive or trawlers) and by "compartimento di iscrizione", the main administrative geographical area where vessels are registered. While Chioggia is both a compartment an important port (the most important port of Veneto), Caorle is the main port of the Venezia compartment. Vessels, both those using passive or trawlers, are almost equally distributed between the two compartments.
Having a look at average values, it can be observed the small vessels have quite different features according to the gear used (if passive or trawlers) and to the area they operate in. First of all the average size: vessel using passive gears are, on average, 2 and 3 GT, 35 and 44 kW depending if they operate in Chioggia or in Venezia area, respectively. LOA is 7 and 8 metres respectively.

Demersal trawlers show to have a bigger size and, again, the area where they are operating influences the main technical characteristics: 4 and 7 GT, 104 and 95 kW depending if they operate in Chioggia or in Venezia area, respectively. LOA is 10 and 11 metres respectively. Average age is ranging between 33 and 36 years.

Table 17- Passive gears and demersal trawlers less than 12 metres by "compartimento di iscrizione", Veneto GSA 17, 2011

	Passive gears		Demersal trawlers	
	Chioggia	Venezia	Chioggia	Venezia
	Absolute values			
Number of vessels	168	156	13	20
Total GT	317	491	56	141
Total kW	5.834	6.805	1.355	1.900
	Average values			
GT	2	3	4	7
kW	35	44	104	95
LOA	7	8	10	11
Age	36	33	35	36

Source: Mipaaf Irepa-

Figure 1 shows the trend of the average days at sea and the volume of landings over the period 2008-2011. For passive gears it can be observed that both the activity level and the volume of landings show an increase on the overall period (24% and 8% respectively), especially in 2011 compared to 2010.

On the other side, for small demersal trawlers the graphs highlights a decrease on both the level of activity and the volume of landings, respectively equal to -14% and -50%; again, 2011 shows an increase if compared to 2010 (around 44% for both variables).

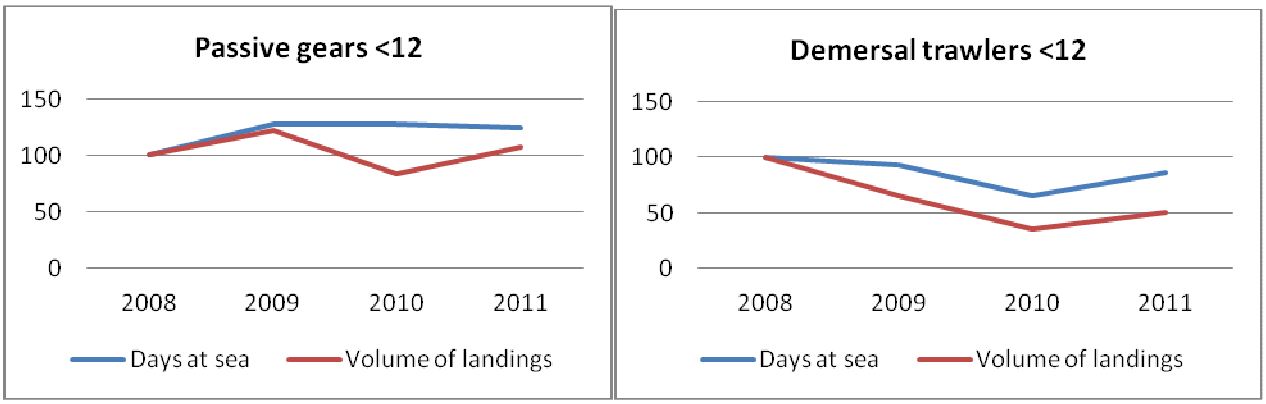

Figure 4 - Trend in fishing activity and landings in volume of passive gears <12 m and demersal trawler <12m, Veneto GSA 17, index numbers 2008-2011 (base=2008). Source: Mipaaf-Irepa.

The decreasing trend of the demersal trawlers is undoubtedly due to the increase in fuel price, considering the large impact of fuel consumption on the economic performance of demersal trawlers.

Furthermore, it must be said that the new restrictions enforced with the entering into force of the Council Regulation (EC) n. 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, fully entered into force only in 2010 (second half of the year) has heavily affected the activity of the two fleet segments. The lowest level of days at sea and volume of landings for small trawlers registered in 2010 is the result of a change

in the behaviour of fishermen as a reply to the main restriction carried on by the new rules (in particular the ban on bottom trawling activities within 3 miles from the coast) that, together with the high level of fuel price, created an important element of crisis for the sector.
The increase registered in both the variables for small trawlers in 2011 can be explained as a way to answer to the crisis: higher costs should be compensated with a higher level of production being obtainable only with a higher level of activity (taking into account the number of restrictions in place for trawlers).

1.2 Production and main species fished

The main target species for small passive gears vessels and small demersal trawlers are reported in table 3. The share of each species is estimated on the volume of landings over the period are 2008-2011 (average percentage). Table 3 also reports the total amount of the volume of landings for the two fleet segments <12 metres in 2011.
The most important target species are Sand smelts (*Atherinidae)*, representing 30% and 12% on the total volume of landings for passive gears and demersal trawlers, respectively (even if, following the restrictions implemented by the new Mediterranean regulation, the landings of this species are expected to decrease in the next future). Another important species for both the fleet segments is Common cuttlefish (*Sepia officinalis*), representing 16% and 20% for the two fleets. Musky octopus (*Eledone moschata)* is the most important target species (31%) for demersal trawlers but not for passive gears (less than 1%).

Table 18- Main target species of passive gears <12 m and demersal trawlers <12m, Veneto GSA 17, 2008-2011

Species	***Passive Gear <12m***	***Demersal trawlers<12 m***
Sand smelts	30%	12%
Common cuttlefish	16%	20%
Musky octopus	0.03%	31%
Mantis shrimp	1%%	10%
Red mullet	0%	5%
Common shrimp	4%	0.3%
Whiting	0.1%	5%
Blackspotted smooth-hound	4%	1%
Common sole	3%	1%
Total volume of landings 2011	**1,629 tons**	**292 tons**

Source: Mipaaf-Irepa

Red mullet (*Mullus barbatus*) is mainly targeted by trawlers (5%). Estimations from STECF EWG 12-10 on stock of Mullus barbatus in GSA 17 made on results obtained by the XSA analysis (current F is around 0.71), highlight that the stock of this species in GSA 17 is considered exploited unsustainably (Abella *et al.*, 2012).
Although in the Italian landings of GSA 17, *Squilla mantis* ranks first among the crustacean landed in most of the Adriatic ports (except the Gulf of Trieste), mantis shrimp is not the target of a specialised fishery, but it is only an important component of local multispecies trawl and gill net fishery. In the Italian side of the GSA 17, the species is exploited by different types of gears, the majority of the landing comes from trawling. Indeed it represents 10% of landings on average on the period 2008-2011. Taking into account the results obtained by the analysis (VIT) carried out on

the most updated data (current F is around 1.00), STECF EWG 12-10 concluded that the stock is considered exploited unsustainably (Abella *et al.*, 2012).

1.3 Profitability of fishing enterprises

Figure 2 shows the trend of the main economic variables of the two fishing segments analysed within the present case study for the period 2008-2011.
The fishing sector of both the segments in 2011 shows a recovery if compared with 2010. However, the two fleet segments show a completely different trend over the entire period 2008-2011. Passive gears registered an increase in almost all the indicators in 2009 then decreasing in 2010 but almost recovering in 2011.
For demersal trawlers the trend is more or less the same but the difference is that 2010 represents the worst year of the series (2010 was the year when the Council Regulation (EC) n. 1967/2006 fully entered into force) and even if recovering in 2011, figures of the last year of the series (2011) are under the 2008 level.

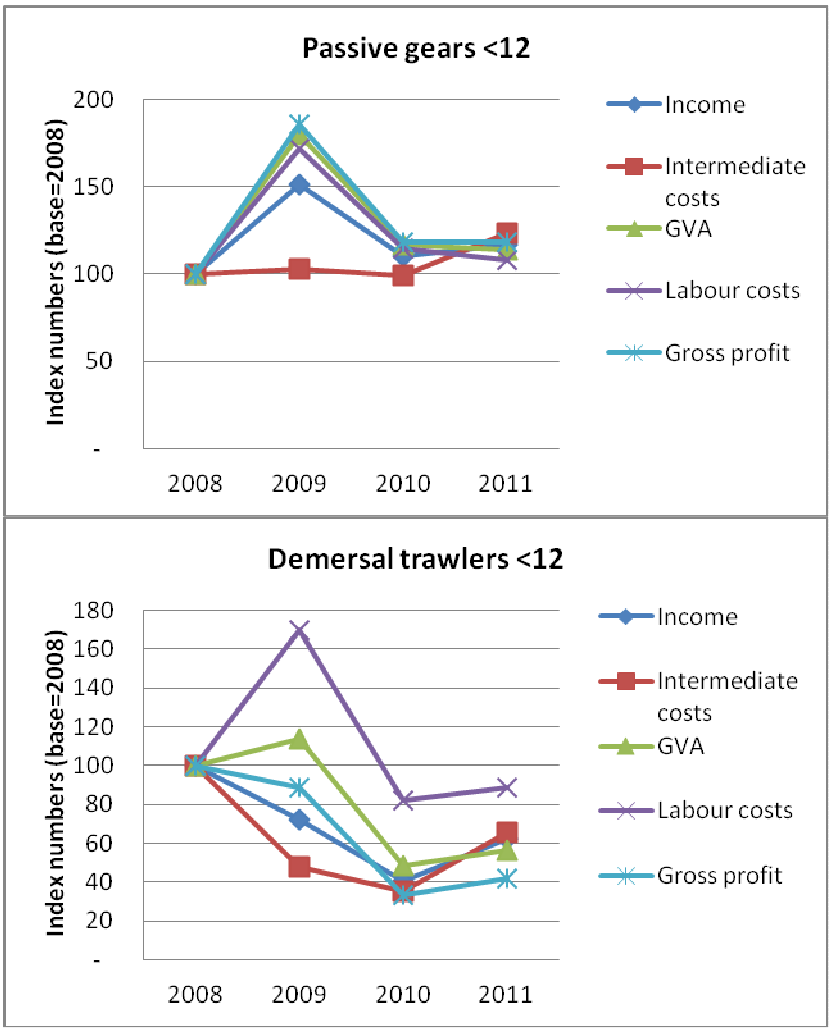

Figure 5 - Trend of the main economic indicators of passive gears <12 m and demersal trawler <12m, Veneto GSA 17, index numbers 2008-2011 (base=2008). Source:Mipaaf-Irepa.

The added value produced by the two segments in the last year (2011) was equal to 7,014 and to 615 thousand euro for passive gears and demersal trawlers respectively. Table 4 shows very different figures for the two segments. First of all income, costs and value added figures per vessel are completely different: on average a passive vessel in 2011 had an income of 33 thousand euro vs. 55 thousand euro for the small trawlers.

Table 19- Income statement of passive gears <12 m and demersal trawler <12m, Veneto GSA 17, 2011

Fleet segments	**Indicators**	**Income**	**Intermediate costs**	**Gross value added**
Passive gears <12	absolute value ('000 €)	11,408	4,394	7,014
	average by vessel (€)	33,685	12,975	20,710
	% on income	100	39	61
Demersal trawlers <12	absolute value ('000 €)	1,818	1,203	615
	average by vessel (€)	55,084	36,442	18,642
	% on income	100	66	34

Source:Mipaaf-Irepa

The major difference can be detected for the intermediate costs level, equal to about 13 thousand euro for a passive vessel and to 36 thousand euro for a small trawler. Indeed, small trawlers, as the bigger ones, show a very high incidence of intermediate costs on income (66% for small trawlers vs. 39% of passive vessels – table 4). On average, in 2011, vessel costs for fuel were equal to 23 thousand euro for small trawlers vs. 6 thousand euro for passive vessels.

Table 5 shows the trend of the main economic performance indicators (% on income level of the main economic indicators) for passive gears <12 m and demersal trawler <12m fishing in Veneto (GSA 17) for the period 2008-2011. It is interesting to see that 2011 is the year registering the higher incidence of intermediate costs on income and the year with the lowest incidence of labour costs on total income.
Actually, the price in 2011 has been higher than in 2008 (0.74 vs. 0.69 per litre) and this has been the main cause of the increase in the level of intermediate costs in 2011 with respect to 2010 (+24% for passive gears and +85% for small trawlers). Fuel cost per vessel registered in 2011 is almost twice the value registered in 2010 (23 thousand euro vs. 9.5 thousand euro, respectively, +139%). For passive gears the increase in fuel costs was about +50% in 2011 compared to 2010.

Table 20 - Economic performance indicators of passive gears <12 m and demersal trawler <12m, Veneto GSA 18, 2008-2011, %

Fleet segments	**Indicators**	**2008**	**2009**	**2010**	**2011**
Passive gears <12	Intermediate costs/income	37	25	33	39
	Labour costs/income	26	30	27	24
	Gross value added/income	63	75	67	61
	Gross profit/income	37	45	40	37
Demersal trawlers <12	Intermediate costs/income	63	41	55	66
	Labour costs/income	12	27	24	17
	Gross value added/income	37	59	45	34
	Gross profit/income	26	31	21	17

Source:Mipaaf-Irepa.

Both the situations (high level of intermediate costs/income and low level of labour costs/income) represent a sign of crisis: the first impacting on the capacity of the sector to produce value added, the first impacting the income of fishermen. Indeed the value of the average wage of 2011 is the lowest for passive gears and more or less the same for the small trawlers (the very lowest being that registered for 2010) – see tables 12 and 13.

1.4 Fleet adjustment plans

Fishing capacity reduction scheme, which applies to the whole GSA 17 fishing fleet, is represented by fishing vessels decommissioning (scraping) programme financed by national and public support provided through means of the European Fisheries Fund for years 2008-2015. With reference to the state of the biological resources and based on estimates of the biological parameters, the decommissioning plan of GSA 17 should bring about a reduction in the capacity varying from 6% for bottom trawling down to 3% for small scale vessels included in "Other systems". At Italian level, the national Adjustment plan foresees a reduction in the Italian fleet capacity of 10%.

Table 21 -. Fleet capacity adjustment plan for GSA 17, 2008-2015

Fishing fleet segments	**% Reduction in GT and kW**	**GT planned to be scraped**	**kW planned to be scraped**
Bottom trawling GSA 17 (Northern and Central Adriatic)	6	1939	9917
Pelagic GSA 17	2	215	967
Other systems GSA 17	3	424	5000

Source:Mipaaf.

2 Balance between the fleet and the available fishing opportunities for artisanal fleet (passive gears and demersal trawlers less than 12 metres) in Veneto (GSA 17)

Following the approach suggested by the the Scientific, Technical and Economic Committee for Fisheries (STECF) working groups in the "Guidelines for an improved analysis of the balance between fishing capacity and fishing opportunities", (Version 1, March 2008 - 10.06.2008 D 06724), six technical, economic, social and biological indicators have been applied for describing the balance between the fishing fleets under analysis and resources. The so called "balance" indicators have been developed in order to assist EU Member States for the compilation of their annual reports containing information concerning the efforts undertaken in order to achieve a *stable and enduring balance balance between fishing fleets and the available resources* as estabilished by the Council Regulation 2371/2002.
In the guideline a common approach based on different typologies of indicators and corresponding reference points was recommended in order to ensure homogenous assessments among Member States. The guidelines contain two technical indicators, three biological indicators, two economic indicators and two social indicators. They are relatively easy to calculate because are sourced on accessible information, in particular data that is being collected according to Data Collection Framework (DCF) and are presented in the form of a "traffic light" system, which shows whether each indicator value is considered satisfactory (green), somewhat unsatisfactory (yellow) or very

unsatisfactory (red). However, indicators are subject to interpretation in order to take into account the reliability of data underlying the calculation and expert knowledge.

2.1 Technical indicators

The technical indicator has been calculated as the ratio between the average effort per vessel in a fleet segment and the observed maximum effort. The calculation of the effort is in days and GT-days in order to take account of different vessel characteristics. As for the other indicators a trend of four years hase been considered in order to consider i fluctuations in economic parameters.
Technical indicators estimated for small vessels, passive and demersal, are reported in table 7 and 8. For the "traffic light system", the margin between the calculated value and 1 indicates the technical overcapacity. An indicator of more than 0.9 will only be observed in fleet segments showing a largely homogeneous level of activity, which could be classed as a green light in practice. Values below 0.7 could be considered as showing a distinct structural overcapacity (red light).
For the passive gears <12 capacity utilization indicators in terms in fishing days fluctuated around high values over years 2008-2011. The same indicator calculated on the basis of GT- days indicates some overcapacity for this segment in 2008. However, for this ratio an increasing trend during the period 2008-2011 is registered – table 7.

Table 22 - Technical indicators: capacity utilization for passive gears <12m, Veneto, 2008-2011

Year	Effort (average)		Maximum effort		Capacity utilization	
	days	Gtdays	days	Gtdays	days	Gt days
2008	83	165	106	265	0.78	0.62
2009	106	209	106	265	1.00	0.79
2010	106	210	106	265	1.00	0.79
2011	104	265	106	265	0.97	1.00

Source:Mipaaf-Irepa.

For trawlers <12 metres both capacity utilization indicators show a decreasing trend. According to the suggested definitions, the capacity of this segment is somewhat in excess of opportunity – table 8.

Table 23 - Technical indicators: capacity utilization for demersal trawlers <12m, Veneto, 2008-2011

Year	Effort (average)		Maximum effort		Capacity utilization	
	days	Gtdays	days	Gtdays	days	Gtdays
2008	125	741	125	741	1.00	1.00
2009	117	706	125	741	0.93	0.95
2010	81	493	125	741	0.65	0.67
2011	108	640	125	741	0.86	0.86

Source:Mipaaf-Irepa.

2.2 Economic indicators

The economic indicator gives account of the economic performance of fleet segments without having an evident correlation with the stock developments. Following the methodology proposed in the above mentioned guidelines, two economic indicators have been calculated: the return on investment (ROI)[2] and the ratio between break-even revenue and current revenue.
The first indicator is the ratio between net profit and gross capital invested, which was calculated by applying the perpetual inventory method (PIM). It shows investment profitability.
In the case of the small scale fishery segment, the ROI figures do not show a realistic situation in fishery (table 9): Indeed, the high values of ROI in this case mostly depend on the very low level of investment that occur in this segment: very small vessels with a low technological level of on-board equipment. For demersal trawlers<12 segment ROI figures reported in table 9 highlight a very consistent decreasing tend, mostly due to the decrease in the level of profit (-88%) while the level of investment is almost stable (-1%).

Table 24 - Return on investment (%), Veneto, 2008-2011

Gear type and length	2008	2009	2010	2011
Passive gears <12	50%	126%	62%	66%
Demersal trawlers <12	64%	38%	2%	7%

Source:Mipaaf-Irepa.

The second proposed economic indicator is the ratio between current revenue and break-even revenue (CR/BER). A ratio of less than one indicates economic difficulty, as current cash flow in the short term is not sufficient to cover current costs, meaning that the activity is not economically sustainable. An indicator of more than one means that cash flow is greater than or equal to fixed costs, meaning that the fishery is profitable in the short term and the segment is thus able to continue its fishing activity.
The value of the CR/BER indicator was at its maximum level for passive gears <12 2009 (3.76) comparatively to 2008 (2.10) - table 10 - and being more than "1" indicates a profitable fishery in the short - term period. On the other hand, an indicator close to 1 is a sign of weakness in fishing as a whole .
For the small demersal trawlers operating in Veneto CR/BER indicator demonstrates a decreasing trend from 2008 (2.24) to 2011 (1.14) as a consequences of the fuel increase of 2011.

Table 25 - Ratio between current revenue and break-even revenue, Veneto, 2008-2011

Gear type and length	2008		2009		2010		2011	
	BER (EUR)	CR/BER	BER (EUR)	CR/BER	BER (EUR)	CR/BER	BER (EUR)	CR/BER
Passive gears <12	4,630,280	2.10	3,927,395	3.76	4,441,077	2.42	4,807,078	2.37
Demersal trawlers <12	1,301,614	2.24	1,168,120	1.80	1,127,946	1.04	1,594,237	1.14

Source:Mipaaf-Irepa.

[2] ROI = (net profit - depreciation & amortisation)/capital invested.

2.3 Social indicator

The social indicators are intended to assess the social benefit of the fishing activity. These indicators are gross value added (GVA), gross values added per employment and gross values added per vessel and average crew share per employment.
Total GVA by fleet segment has been calculated as the difference between total revenues and all variable and fixed costs (labour costs exluded). This indicator gives the average contribution of each fishing segment to the fishing sector's total value added. However, it can be interpreted not only as positive/negative value but also as the proportional contribution of the segment to the GVA of the national fleet (the weight of that segment in the national fishing sector). As these segments differ widely in terms of numbers, also GVA per employment, or per vessel are considered making it easier to interpret whether capital costs, labour costs and the company's profit are covered at company (vessel) level for each segment.

Table 26 - Gross value added indicators for passive gears and demersal trawlers <12 in Veneto, 2008-2011.

Year	Indicator	Passive gears <12	Demersal trawlers <12
2008	GVA	6,170,048	1,087,641
2009		11,093,334	1,236,940
2010		7,209,514	525,880
2011		7,013,787	615,183
2008	GVA/ Employee	15,198	16,356
2009		28,434	19,222
2010		15,741	8,540
2011		12,475	9,511
2008	GVA/ Vessel	18,237	31,075
2009		33,804	38,454
2010		22,473	17,471
2011		20,710	18,642

Source:Mipaaf-Irepa.

In 2011, the small scale fishery gave a contribution of over 7 million EUR, showing a decreasing trend respect to 2009. Over the same period , the demersal trawl segment showed clear signs of decline. The sustained growth of intermediary costs, set against a fall in production and revenue, entailed a fall in value added and consequently in GVA per employee and GVA per vessel of around 50% in two years.
With reference to the average crew share per employee, both segments of small boats and trawlers less than 12 metres, show a significant decrease between 2009 and 2011. Such reduction reflects the

decrease in profitability of the sector between 2009 and 2011, resulting in -23% in revenues for small scale fishery and – 14% for demersal trawlers.

Table 27 - Crew wage indicators for passive gears <12, Veneto, 2008-2011

Year	No employees	Crew Cost (EUR)	Crew wages/No employees (EUR)
2008	406	2,563,397	6,314
2009	390	4,399,587	11,277
2010	458	2,933,607	6,405
2011	562	2,760,818	4,910

Source:Mipaaf-Irepa

Table 28 - Crew wage indicators for demersal trawlers <12, Veneto, 2008-2011

Year	No employees	Crew Cost (EUR)	Crew wages per No employees (EUR)
2008	67	338,561	5,091
2009	64	575,232	8,939
2010	62	278,821	4,528
2011	65	300,069	4,639

Source:Mipaaf-Irepa

2.4 Biological indicator

The biological indicator calculated for this report is the catch per unit effort (CPUE) measured in catch weight per days at sea, which has been calculated with reference to four of the main target species shared among small-scale fishing and bottom trawling less than 12 metres in Veneto. For the calculation of this ratio days at sea was used as a proxy for effort. The other two proposed indicators, ratio $F_{estimated}$ and F_{target} and ratio current catch weight and stock biomass have not been considered due to data limitations (Abella *et al.*, 2012).

CPUE estimates can be interpreted as a relative index of stock abundance and only provide a trend over time. It does not indicate the level at which exploitation becomes unsustainable. Furthermore, changes in stock abundance can be due to other effects than changes in fishing pressures, e.g. changes in fleet behaviour rather than species abundance. However for species representing the majority of fleet catches, consideration of CPUE trends for each species could give important information. The target species considered, Common cuttlefish (*Sepia officinalis*), Musky octopus (*Eledone moschata*), Red mullet (*Mullus barbatus*) and Common sole (*Solea solea*), on average account for 19% of catches for passive gears and for 52% for demersal trawlers <12.

Table 29 - Catches per unit effort (CPUE) of passive gears <12, Veneto, 2008-2011

	2008	2009	2010	2011
Common cuttlefish	10.78	12.24	4.16	3.94
Musky octopus	0.000	0.007	0.029	0.010
Red mullet	0.004	0.002	0.002	0.0003
Common sole	0.53	1.09	2.06	1.57

Source:Mipaaf-Irepa.

During the time period considered total days at sea were stable for both fleet segments, in contrast catches of common cuttlefish, musky octopus and red mullet were largely decreased. As a consequence, for both fleet segments common species highlight a decreasing (red) or constant (yellow) trend in CPUE with the exception of Common sole (green) which registered significant increase in catch per unit of effort.

Table 30 - Catches per unit effort (CPUE) of DTS 0612m , 2008-11

	2008	2009	2010	2011
Common cuttlefish	34.12	18.43	11.64	12.09
Musky octopus	50.65	44.07	17.01	7.79
Red mullet	5.47	3.89	3.09	5.74
Common sole	1.17	0.48	0.70	1.33

Source:Mipaaf-Irepa.

3. Conclusions

The aim of the present case study was, by mean of a comparison between vessels with a length lower that 12 metres using passive gears, on one side, and demersal trawlers, on the other side, to demonstrate that the definition of small scale fishery only based on the length (all the vessels < 12 metres) does not define an homogenous fishery. Indeed, In Italy the small scale fishery definition only refers, by law, to vessels < 12 using passive gears.

Actually, as highlighted by the case study, the two group of small vessels operating in Veneto have completely different features in terms of technical characteristics, in terms of target species, in terms of costs structure and profitability. Furthermore, the analysis of the balance between capacity and fishing opportunities carried out by mean of different type of indicators, evidenced completely different situation in terms of degree of overcapacity. This happens also when using biological indicators (CPUE) related to the those species shared by the two group of vessel.

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Long-term trends in the structure of eastern Adriatic coastal resources: Consequences for fisheries management)

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SUMMARY ONLY

The Adriatic Sea, as part of the Mediterranean Sea, shares with that region all common characteristics in terms of geographical features, available marine resources, their type and intensity of exploitation. Moreover, those fisheries functioned in the very specific socio-economical and historical contexts. Since ancient times fishing has played an important role in life of Mediterranean inhabitants, becoming more and more crucial at present times as the booming growth of human populations along Mediterranean coasts necessitates ever larger harvests of marine resources. The very characteristics of such fishery, i.e. numerous fleet using diverse fishing gears, multi species catches and extremely heterogeneous landing sites and marketing, put scientific research in a particularly complex context. In that manner Croatian artisanal fishery is without exception a typical Mediterranean example.

Issuing of new licenses stopped in 2008 and o*fficial* statistics of Fisheries Directorate (FD) for period 2009-2010 counted around 4,000 vessels (app. number of vessels corresponds to number of licenses) in professional fishery sector of which 3,360 vessels are less than 12 m indicating their artisanal character and 12,000 vessels registered under subsistence category. However, official statistics of Fisheries Directorate (FD) for period 2008-2010 shows the annual landing is stable at about 50,000 t of which 90% are landing of small pelagic while artisanal landings contribute by only 1%. This contribution is for sure underestimated since the majority of artisanal landings go unreported. It is important to point out that exploration of coastal ichthyocommunities in the eastern Adriatic Sea goes as far back as the last 65 years. Data were collected through direct sampling using IOR RV "Bios" (now "Bios II") or speed boat "Navicula" or through analysis of commercial landings in collaboration with numerous fishermen and also through their logbooks and numerous questionnaires. Sampling locations of analyzed experimental and commercial catches representatively cover all of the eastern Adriatic coastal waters. Those activities are supported through various projects, mostly financed by Ministry of science, education and sports and Ministry of agriculture, fisheries and rural development. Thus, extensive monitoring programme of coastal fisheries were initiated in 2008 and is still unroll but now according to DCF proposed by EU. Since monitoring of status and changes of coastal ichthyo-communities and artisanal fisheries management effects are a complex issue, the scope of our work encompasses as many different aspects as possible to get an accurate insight from systematic research of fish biology, coastal fish community composition, biological characteristics and distribution of species, population dynamics and stock assessment of characteristic, commercially important coastal fish species, qualitative and quantitative catch structure, demographic structure of the most important stocks, exploitation level, by-catch and discard composition, evaluation of selectivity properties and destructiveness of majorities of totally more than 55 fishing gears, estimating potential impact of global climate change on fish biodiversity and other sea living resources in the Adriatic Sea, collection of new ichthyological data and finally as a result of

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all the before mentioned activities preparing recommendations for conservation, sustainable use and management of Croatian coastal living resources. Fisheries management throughout the Mediterranean region is conventional in nature, meaning that it is almost only based on gear specific management provisions. Baseline regulation governing fisheries issues in Croatia is Marine Fisheries Act together with its subordinate acts. In the last 10 years type and quantity of fishing gear with which commercial and subsistence artisanal fishing can be undertaken has been the subject of fisheries management changes. Although legislative changes in fishery sector are numerous, they are usually more "cosmetic" in nature. But two years can be highlighted. Specifically, legislative changes of artisanal fishing regulations have mostly been aimed at trammel nets and encompass the increase in minimum inner layer mesh size of trammel net from 28 to 40 mm in 1999 and excluding the trammel net from subsistence artisanal fishing in 2002. Additionally, in 2002 for artisanal subsistence fishing legal provisions proclaimed a daily catch limit of 5 kg and reduced the allowed quantity of most types of gillnets, orienting it thus much more to trap and line fishing. Evidently, through Marine Fisheries Act and Ordinates for trammel nets are regulated: spatial and temporal fishing restrictions; minimal landing size of commercial fish species and construction properties of fishing gear and application of fishing techniques. Currently, we are trying to adopt integrated approach of investigations, both fisheries and ecological, in the eastern Adriatic to investigate the state and perspective of our artisanal fisheries and the health of our coastal communities in term that we really have in the future so called ecology based management. Results of almost a two decades monitoring programme of coastal fish resources were presented in terms of littoral communities' state and future management actions. In last five years, we investigated state of littoral fish assemblages on a wider spatial scale. Results showed that littoral fish assemblages along the eastern Adriatic coast are characterized by continuous change throughout the last 16 years evidenced patently through positive trends in abundance, biomass, diversity and structure which all indicate that fish assemblages are going through a strong process of change. A common pattern among time trajectories of studied areas implies that the factor affecting the littoral fish assemblages is not localized but regional in nature. Since positive effects are seen at multiple levels and are so consistent and widespread we suggest that the most plausible causative factor can be a stricter fisheries management, implementation of which coincided with the study period. But we have to be careful in interpreting these positive effects because, if you look at species that mostly contributed to this positive effect, in general we are talking about mid trophic species that obviously take advantage of the top predator species lack in the community. Moreover, for some species like *Mullus surmuletus*, we for sure have to take in the consideration oceanographic changes that apparently serve it in term of better spawning and recruitment success. To confirm that legislative changes have the potential to shift artisanal fishery towards sustainability as we has been already concluded, we made investigation in an offshore Adriatic region, island Vis area. As a result, significant increases over time were observed in most of the community indices analyzed as well as a directional change in abundance and biomass catch composition of littoral fish resources. Comparison of catch structure of trammel nets with minimal inner mash size of 28 mm and those that are now in use of 40 mm shows that positive responses were, however, primarily related with a recovery of *Mullus surmuletus* stock. Moreover, we are in process of testing this species as potential indicator species of costal communities' health. Regarding the state of two target species of Croatian coastal fisheries we analize destructiveness of trammel nets for *Mulus surmuletus*

and *Scorpaena scrofa*. Taking into account minimal landing size of *M. surmuletus* (11 cm; although it has to be mentioned that this size is given for both Mullidae species inhabiting the Adriatic – *M. surmuletus* and *M. barbatus*, and it is not biologically justified for *M. surmuletus*) no undersized specimens were present in the overall catch. Even when "poponica" destructiveness is assessed considering biologically justified size at first sexual maturity (18 cm), the catches contained a rather low, satisfying 1.2% of immature specimens. On the other side, results indicate a rather alarming status of *Scorpaena scrofa* populations. It can be seen that the overall catch is dominated by undersized specimens (62.5%). Situation is even more troublesome if biologically justified size at first sexual maturity is applied (TL 30 cm) since the proportion of immature specimens is in that case as high as 90%. In the same context, after *Mullus surmuletus*, the species that mostly contributed to the positive effect in abundance and biomass of catches in coastal area in last 20 years is small scorpaenid, *Scorpaena porcus* that probably occupy vacate niche of *Scorpaena scrofa* in the community. But, positive trends of abundance and biomass of this species in the catches were not accompanied with positive changes in main characteristics. Just opposite, today black scorpionfish have smaller TL and TW than before 20 years showing that this species is still suffers and that it's response on changes in community is not so fast and obvious that this species could serve as indicator species. Without doubt only more restrictive management regime can lead to further restoring littoral fish resources. The seasonal closing of fishing grounds and proclamation of marine protected areas in the Adriatic can be a strong management tool for further restoration, conservation and ensuring fisheries existence and the sustainability of marine resources exploitation in the future.

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Small-scale fisheries of Marine Protected Areas in the Croatian Adriatic

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SUMMARY ONLY

The base line regulation governing nature protection in Croatia is the Nature Protection Act. According to the Croatian Nature Protection Act, protected areas are classified in 9 categories which easily translate into the corresponding internationally determined IUCN protection categories. Currently, there are 432 protected nature areas designated in various categories, covering 8,5% of total area of Croatia, 12,1% mainland area and a little less than 2% of marine area. Obviously, as Croatia is a marine oriented country with nearly half of the territory on the sea, marine environment is not proportionally and sufficiently represented in protection categories. Marine area is almost entirely protected in the nature park and national park categories. All of the parks are insular and protect near shore ecosystems while still no open waters have been put under protection. The criteria for selection and management objectives, of any given marine protected area (MPA) in Croatian part of eastern Adriatic Sea, are often vague and lack a proper scientific backup. Croatia's MPAs have mostly been designated on *ad hoc* basis by extending the boundaries of previously established terrestrial counterparts or the area was closed for military purposes prior to MPA establishment.

Regulation of fishing activities in each of the MPAs is variable, but there is a major distinction between national and nature parks. National parks afford greater protection since by definition they exclude all commercial activities and thus much of the fishing is automatically prohibited – all the large-scale industrial fishing as well as professional small-scale. However, engaging in traditional agriculture and fisheries for subsistence needs is allowed since parks are at least seasonally inhabited. Considering the critical socio-economic importance of small-scale artisanal fisheries a compromise solution between the need of local people and protection of biological resources has been made. On the other hand, nature parks do allow for commercial use of resources but provided that it is organized in a sustainable way. Two of three Croatian national parks – NP Mljet and Kornati – are quite similar regarding their fisheries regulation. Subsistence small-scale fishing for local residents includes a range of fishing practices, but again in a more limited way compared to regular fisheries regulations outside the protected area. Recreationl fishing for visitors is allowed using only fishing line tools and imposing also a limit on daily catch. Each of the national parks also has no-take zones where all extractive uses are prohibited. Still, the zones are not that numerous (1 in NP Mljet, 4 in NP Kornati) and their size is relatively small compared to total park area. Contrary, National Park Brijuni, which is not inhabited and it is also a presidential residence and military point, is a no-take zone for most part of the aquatorium. Only in a small border area very restrictive recreational fishing has been allowed to nearby residents. Nature Park Telascica has not allowed any kind of professional fishing, and

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similarly to Kornati and Mljet owing to socio-economic reasons the local residents are allowed some types of small scale fishing for subsistence and visitors can engage in recreational fishing but only with hook and line and respecting the catch limit. Nature park Lastovo adopted a highly specific rotational fisheries management. The park aquatorium is divided into 4 fishing zones which are protected and fished in pairs with temporal rotation of 3 years. What is allowed in each of the zones at each level of protection is quite elaborated – in short recreational and subsistence fishing are allowed throughout the park basically in the same way the national fisheries legislation allows, while professional fishing is subject to rotation and controlled by a system of permit limitations since only 45 fishermen can be authorized to fish in the park waters and also there are some limitations on the fishing gears used.

The question is now whether this kind of protection in our MPAs actually manages and regulates small-scale fisheries in a way compatible with the sustainable use and conservation. Of course to be able to answer this continuous assessments are essential to identify fish resources, their abundance and location and to indicate which level of use is optimal to guarantee their renewal. Up to now there hasn't been a systematic monitoring program set up in our MPAs. Rather, the research that has been done is more a result of sporadic individual efforts, so parks now have initial data and need to put the effort to turn these base line researches into on-going programs. Results indicate that reserve effect is clearly witnessed in the Brijuni National Park while all the other Parks that offer some kind of partial protection have very limited is any success in achieving the recovery of resources.

What are the challenges and issues that lie behind the lack of significant protection effects in most of Croatia's MPAs? First of all in our MPAs one can really not be sure whether the fishing effort is kept within the regulation limits, so as the level and dynamics of fishing effort are unknown it is very difficult to say what exactly needs to be changed in order to optimize exploitation. So some research has been done on the status of the resources but another part of the picture is still missing since in none of the MPAs a characterization of the fisheries itself still hasn't been done. Partially this is also because MPAs are in constant lack of finances, technical resources and trained personnel to conduct the needed studies. Lack of resources is also hindering enforcement activities. Surveillance is sporadic and parks have problems with uncontrolled and illegal fishing. The problem is further exacerbated since rangers have not been given full police powers so they are not in a position to identify the poachers of force them to stop their activities if they decline. And even if they manage penalty fees are so low that people are simply willing to risk. Weak compliance and support is even common among local people who generally do not feel as they are active part of the Park. This is a consequence of establishing the parks through a top down approach - imposing the restriction on the use of fishing gears instead of involving the stakeholders in the decision making process. Additionally, there is also insufficient intersectoral (MPA, conservation, fisheries) collaboration and cooperation on fisheries issues.

What are the potential solutions to MPAs' fisheries issues? First of all, funding opportunities need to be increased and diversified to support the actions needed for effective and adaptive MPA management. Setting up systematic monitoring of artisanal fisheries resources and the

fisheries itself is a priority. Ensure strict implementation of regulations through effective surveillance, giving the rangers adequate powers, increasing fines for illegal fishing and remedying critical gaps regarding intersectoral cooperation in marine conservation-fisheries legislation. Full participation of fishing communities in decisions on the sustainable use of natural resources should be facilitated as well as monitoring and surveillance through innovative approaches to marine conservation (co-management). Scientific knowledge and research needs to be integrated with traditional knowledge of fishermen as participation and involvement of the local fishermen is really the key to a successful protected area.

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