Transferable Fishing Concessions (TFC): A pilot study on the applicability in the Mediterranean Sea

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A R T I C L E   I N F O

Article history:
Received 5 September 2013
Received in revised form 21 October 2013
Accepted 21 October 2013
Available online 11 November 2013

Keywords:
Rights-Based Management (RBM)
Fishery policy
Transferable Fishing Concessions (TFC)
Management measures
Mediterranean Sea

A B S T R A C T

Fisheries management systems based on Transferable Fishing Concessions (TFC) and similar rights-based systems have been developed during the last decades in some European countries. However, at present there is not a clear view on the possible effects caused by the application of this management systems in the Mediterranean Sea. The current study, involving nine Geographical Sub-Areas (GSAs) of the Mediterranean Sea, focuses on the appropriateness, transferability and modes of applicability of a TFC system in the Mediterranean area. Three different scenarios of quota allocation have been analyzed by taking into account biological, ecological, environmental, economic and social aspects: quota in terms of resource quantity, quota as a portion of the total fishing time, quota as a portion of the total fishing capacity. Results show that the transferability of a TFC-based system to the Mediterranean context appears to be low due to the characteristics of the Mediterranean fisheries (multiplicity of resources, fishing grounds shared among different countries, multigear, importance of small-scale fisheries) and to the general lack of sound and reliable individual historical data. The study also highlights rights-based systems such as Territorial Use Rights in Fisheries (TURF) might only be applied for the exploitation of sedentary resources, such as clams. A management system based on TFC could be theoretically reasonable for anchovy fishing, where a few species are caught, even if all countries and stakeholders should be involved in the decision making process.

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1. Introduction

The fishing sector gives an important contribution to food security and the global economy [1,2]. In the Mediterranean, the fishing products are an important component of human diet [3], and fishery has been one of the pillars of this area from a social and an economic point of view, especially in certain coastal communities where the fishing activity is the only opportunity to work and survive [4,5]. However, marine resources have been barely managed in the last twenty years, and they have been exploited under a free access regime, which has contributed to fleet overcapacity and has resulted in “too many fishers and vessels racing after too few fish” (definition of the OECD, [6]). Overall, the Scientific, Technical and Economic Committee for Fisheries (STECF) highlighted the recent status of resources in the Mediterranean: 32 out of 36 stocks were assessed as overfished (89%), while only 4 stocks were considered sustainably exploited consistent with high long term yields. All demersal fish stocks (100% of 18 stocks) were found overexploited [7,8].

Traditionally the measures taken by governments to solve the problem of declining fish stocks include different kinds of management tools that can be grouped into input and output controls [9]. Input or effort controls are measures restricting how much, how hard, and with what equipment fishing can be done. Therefore input controls involve restrictions on the number of fishing units (by limiting the number of licenses or permits issued), restrictions on the size and power of fishing vessels (capacity controls), measures relating to the technical characteristics of fishing gears that can be deployed (e.g. minimum mesh size, number of pots, length and drop of a passive nets, size of dredges, number of hooks in the longline), access to fishing grounds (e.g. closed areas, Marine Protected areas) and the time spent to fish (vessel usage...
controls, such as the interruption of trawling during the recruitment and reproduction season of commercial marine species). The output (catch) controls involve direct restrictions on the amount of marine organisms that can be taken in a certain fishery in a certain period of time, often equivalent to a year or fishing season (catch controls systems such as quotas). Output controls also involve the definition of a minimum size for the fish that can be landed (minimum landing size) and limits of the number of fish that may be landed in a day, generally used for the management of recreational fisheries.

In 2009 the European Commission identified in fleet overcapacity and inefficiency, associated to a general overfishing of stocks [10], two of the main issues threatening the EU fisheries sector. In such a context, in order to specifically tackle the problem of overcapacity and achieve an efficient management and use of resources, economists have suggested to create a property rights system for the access to resources (fishery Rights-Based Management, RBM; [11–15]). Property rights are defined as a package of entitlements defining the owner’s rights, privileges and limitations for use of the resource [16]. Property rights can be more or less effective for fisheries resource management as a function of four features [17]:

- Universality: how many of the resources are privately owned, and at what extent property rights are specified.
- Exclusivity: what level of benefits and costs deriving from resource property are referred exclusively to the rights owner.
- Transferability: at what extent are property rights transferable between owners in a voluntary exchange.
- Enforceability: how effective are controls on rights, aimed at avoiding involuntary appropriation or infractions.

RBM thus covers a wide range of systems: limited licensing, limited transferable licensing, individual non-transferable effort quotas, individual transferable effort quotas, individual non-transferable catch quotas (IQ), individual transferable quotas (ITQ), vessel catch limits, vessel transferable quotas (VTQ), community transferable quotas (CTQ), and Territorial Use Rights in fisheries (TURF) [15,18].

In 2011 the European Commission proposed a set of principles and regulations for the Reform of the Common Fisheries Policy [19,20]. In particular, a market-based system of Transferable Fishing Concessions (TFC) was proposed in order to contribute to achieving efficiency, reduce fleet overcapacity and increase economic viability of the fisheries sector. Transferable Fishing Concessions (TFC) can be defined as a form of rights-based fisheries management that entitle the holder to a specific proportion of its Member State's annual fishing quota or allowable fishing effort. Under the EC Proposal, these concessions should be transferable, but only within a Member State (vessels flying the same flag). Moreover the proposal stated that Member States may limit the period of validity of Transferable Fishing Concessions to a period of at least 15 years, for the purpose of reallocating such concessions.

Indeed, given the diversity of fisheries in Europe, Member States should be allowed to choose the management system which is most appropriate for the specific characteristics and requirements of the regional fisheries, based on a set of transparent criteria for economically viable, and environmentally and socially sustainable practices. During the following two years, the original EC Proposal has been extensively discussed and revised at all governance and stakeholder levels, until in January 2013, the Committee of Fisheries of the European Parliament has finally released the Report on the proposal for a regulation of the European Parliament and of the Council on the Common Fisheries Policy, where it was stated that “Member States will remain free to establish – or not to establish – a system of Transferable Fishing Concessions” [21]. Therefore a facultative application of TFCs was decided for the fisheries management system of each country.

In the last decades, a number of European countries, both Member States and Third Countries [22], have developed fisheries management systems based on transferable concessions/quotas and similar rights-based systems. Such systems have been mainly applied in Northern European maritime areas, where fishery is usually characterized by simpler patterns than in Southern/Mediterranean areas. Experiences in Europe are: Netherlands [23,24], United Kingdom [25], Denmark [26], Spain [27,28], Estonia [29,30], Norway [31] and Iceland [32,33]. Overall, such systems have proved to be positive in improving management efficiency. However, at present, there is not a clear view on the effects caused by the application of this management systems both in the short and in the long term, and controversial results have been achieved in many cases [34,35].

In Mediterranean countries, fisheries management is mainly based on effort control and some other technical measures (e.g. minimum landing size and mesh size) and no TACs (Total Allowable Catches) are implemented, except for bluefin tuna [36]. Moreover, only Territorial Use Rights, have been introduced with success, in Adriatic clam fisheries [15,37].

Following the experiences reported in some EU countries and the considerations made for the Mediterranean, the present study, carried out in the framework of the EU Project MA.RE.MED. – Maritime Regions Cooperation for Mediterranean, whose fisheries theme was led by Marche Region (Italy), aimed at:

- increasing knowledge and competences on TFC in view of the next European Maritime and Fisheries Fund (EMFF), which will enter into force on 1st January, 2014 until 31st December, 2020;
- evaluating the appropriateness, transferability and modes of applicability of a fisheries management model based on a TFC system in the Mediterranean area, which is characterized by multispecific, multigear and small-scale fisheries.

2. Materials and methods

Data, information and opinions on the appropriateness and transferability of a fisheries management model based on a TFC system to the Mediterranean context, and on possible modes of applicability, were gathered through a comprehensive questionnaire that was submitted to the following partners (Table 1), representing 9 Geographical Sub-Areas of the Mediterranean Sea (Fig. 1). The questionnaire included a preliminary section with an introductory framework and general information, and was then subdivided into specific topics.

First of all partners were required to identify the options for quota determination and allocation criteria.

All project partners were required to complete a series of tables providing information on the identified options, as well as giving a list of advantages and disadvantages that are associated to each option from a biological/ecological/environmental and a social/economic/regulatory point of view.

To further investigate this topic and evaluate the applicability of a TFC system in the Mediterranean, partners were required to answer a series of closed and open questions, which were organized in two sections:

- biological, ecological and environmental issues and
- social, economic and regulatory issues.

Detailed and exhaustive data and information on the different issues were gathered by the partners through official documents
and gray literature. Information collected spanned from data on fisheries target species (catches, population dynamics and stock assessment), fish landing data, data related to fishing effort (fleet and fishing vessel characteristics, fishing gears and systems, fishing days), economic and social parameters.

3. Results

There are various possible options for quota determination, and different options may also be combined in order to make them more effective. When choosing among available options, it is important to identify the option that better allows to stay within the biological catch limits of the target species, keeping in mind that such limits are different among species.

Taking these premises into account the possible options selected by the partners for quota determination in the TFC framework were:

- Quota as a quantity of fish that can be caught by a fishing vessel identified as a portion of the national catch Quota for a TAC species (e.g. tons of red mullets, *Mullus barbatus*).
- Quota as a portion of the total fishing time allocated to the catch of one or more species, for instance fishing days for red mullets or fishing days for all species caught together.
- Quota as a portion of the total fishing capacity of the whole fleet calculated as fishing power by fishing time, for example fishing days by vessel horsepower in kW.

- Quota as a portion of the national catch Quota for each fishing system and fishing area, both for single species and for groups of species, for example tons of mullets caught by towed gear in FAO-GFCM GSA 17.

3.1. Options for quota determination and allocation criteria

Tables 2–4 present the various options for Quota determination and related allocation criteria for the Mediterranean that were identified by MAREMED project partners according to their Regional situation, together with a list of advantages and disadvantages related to each option based on National and Regional data (fleet, stock assessment, market).

4. Discussion

4.1. Multispeciﬁcity

The questionnaire analysis highlights that the main feature of the Mediterranean fisheries is the high multispeciﬁcity, since a wide variety of species of commercial interest are commonly caught. Most fishing operations, whether they employ towed or fixed gears, catch organisms that are not the primary target of the ﬁsher (bycatch). In addition to this, the Mediterranean region is subjected to a very high level of anthropic pressure since fishing vessels from more than 20 Mediterranean and other
Table 2
Options 1: Advantages and disadvantages of the quota in terms of resource quantity that can be caught by a fishing vessel (quota is calculated as a portion of the total allowed catches). A possible scenario for the quota allocation is also described.

**OPTION 1: Quota in terms of resource quantity that can be caught by a fishing vessel**

**ADVANTAGES**

**Biological, Ecological, Environmental aspects**
1. More control on the resource to be monitored/protected.
2. It could keep catches within safe biological limits.
3. It can be applied to single species fisheries and it has given good results with sedentary species. The maximum daily allowable catch per vessel has already been put in place for certain sedentary resources, such as clams in Italy.
4. Quotas would make more sense if they are applied to catches rather than to landings, in order to avoid an increase in discards which is very difficult to control.
5. Smaller vessels could sell their quotas to bigger ones and cease their activity. This could decrease fishing pressure on resources.
6. For strictly single-species fisheries (e.g., «rossetto», cuttlefish and octopus caught with traps, swordfish, bluefin tuna) it may be appropriate to set Quotas.

**Economic aspects**
1. Quotas put a limit on quantities that can be sold, and in certain periods quotas can cause an increase in market prices (if the same product is not brought to the market from other fishing areas, its economic value increases).
2. For some fishing systems, such as anchovies caught by light fishing and purse seine, fixing quotas could give a higher value to catches and more stable prices throughout the year.
3. Smaller vessels could decide to sell part of their quotas to bigger vessels, thus obtaining an economic gain.
4. Quotas may give a higher value to licenses and thus to fishing vessels. This may be relevant if the new EMF does not provide financial support for vessel scrapping and/or sets limits to supports for renewal. Quotas could therefore be an advantage for fishermen, in that they give an added value to their vessels and could allow to gain higher monetary reward to fishermen who cease their activity.
5. A TFC system based on catch quotas could give economic benefits if it is related to product quality policies aimed at increasing the price of fisheries products.

**Social aspects**
1. Fixing quotas could favor the aggregation of fishermen in consortia or producers associations in order to improve market relationships.
2. Fixing quotas could decrease the total amount of time spent out at sea, thus improving the quality of life and enhancing the possibility to develop secondary activities.

**DISADVANTAGES**
1. Necessity of very accurate studies on the resource quantity and status: introduction of a degree of uncertainty.
2. For most species, especially demersal ones, there are no exhaustive resource assessments for quota determination.
3. There are no exhaustive data which allow to assign quotas to the different GSA areas for each species.
4. Quotas assigned to each species could differ among areas, even if vessel characteristics are the same, due to differences in the ecological features of each area and in the species biology (e.g. distribution throughout the life cycle).
5. Several species of commercial interest are part of multispecific communities, and it is not possible to catch them as single species.
6. Discards tend to increase without biological benefits.
7. Due to the short life cycle of many Mediterranean species, quotas can include adults as well as juveniles according to the chosen fishing period.
8. Small fishing vessels may sell their TFCs to bigger vessels which concentrate their catches in restricted areas. This would determine an increase of the fishing effort in specific areas.

1. Quotas are usually reached in a short time, and this could cause long inactivity periods or the use of quotas allocated to other species, with a high probability of catching also species for which the quota has already been reached (in this case it is most likely that species for which the quota has been reached are discarded).
2. The quota will be reached trying to catch fish of the size/age class at higher market value. This means younger individuals for many Mediterranean commercial species (octopus, cuttlefish, squids, mullets, etc.). In other cases, such as anchovies, bigger size fish have a higher commercial value. In these cases the risk is that fishermen selectively keep on board bigger-size individuals and discard the residual catches (this is both an economic and a biological consideration).
3. The controls carried out to verify catch quantities on fishing vessels have high costs and are often ineffective, as demonstrated in Northern Europe. These costs would have to be heard by fishermen.
4. In the case of transnational resources, quotas should be shared between neighboring countries and respected also in neighboring areas, but this is difficult to apply and control.
5. There is the risk to concentrate quotas in a few hands, if small size vessels sell their quotas to big vessels that can more easily bear with market fluctuations.
6. Quotas for different species could be traded between vessels, for instance one could exchange a few “higher value” Norwegian prawn quotas and get a lot of mullet or anchovy quotas.
7. The distribution of national quotas among fishermen could lead to anomalies related to the different distribution of fish resources in the different areas. This could lead to the uneven distribution of quotas among fishing vessels with similar characteristics but operating in areas with different resource availability.
8. Fishermen that do not obtain quotas or have lower quota values are penalized from the economic point of view.
9. The operational and maintenance costs of fishing vessels are high. Allocating TFCs on the basis of catch quotas may lead to a further decrease in the profitability of fisheries, especially if quotas are assigned to species with low market value.
10. If the quota system caused a decrease of the total amount of fish that is caught, this could determine an increase in the price of fish, which might remain unsold. This would further decrease the fishermen’s gains, which are already low.
non-Mediterranean countries exploit the same natural resources, some of them shared between countries. Hence, managing Mediterranean fisheries is complicated by the presence of a great number of different fishing fleets in the same shared fishing areas using a diverse array of fishing gears. The peculiarities of Mediterranean fisheries can be briefly summarized as:

- high diversity in terms of catch composition: the commercial catches are composed of more than 50 species (multispecies fishery);
- a short average life span, permitting rapid renewal of resources;
- high diversity of the structure of the fisheries sector;
- a narrow continental shelf (excluding the Adriatic Sea);
- the absence of large single stocks, especially in the demersal regime, compared to those which inhabit other seas [38];
- the high marketability of small fish that in many countries encourages the targeting of the juvenile fraction of some species, often in violation of laws regarding minimum sizes;
- widespread coastal fisheries, with small-scale fishing vessels operating all along the coast at a shallow depth;
- seasonality of fishing practices and target species.

In this scenario (multispecific, multigear, small-scale fishery importance, high seasonal and spatial variability) partners agreed that a management system based on TFC is, in general, not suitable for the management of Mediterranean resources since it is not
Table 4
Options 3: Advantages and disadvantages of the quota as a portion of the total fishing capacity, considering the overall fishing time and the overall horsepower/size of fishing vessels (the quota is assigned to each vessel as a function of its horsepower/size and the maximum fishing time, and therefore it will vary according to a fishing vessel’s characteristics). A possible scenario for the quota allocation is also described.

**OPTION 3: Quota as a portion of the total fishing capacity, considering the overall fishing time and the overall horsepower/size of fishing vessels**

| ADVANTAGES | DISADVANTAGES |
|------------|---------------|
| **Biological, Ecological, Environmental aspects** | 1. Catches are usually composed by a mixture of higher and lower value species; with a fixed quota, lower-value catches are discarded and the pressure on higher-value ones will increase. |
| 1. Each fishing vessel operates with quota restrictions which are mainly related to its horsepower/size, and it can catch a certain amount of fish (of whatever species) during a specific fishing time. | 2. There is no connection between quotas of allowed catches and levels of resource exploitation for each species, and thus the benefits on the status of specific stocks cannot be evaluated. |
| 2. Small vessels could sell their quotas and the fleet could be restructured, causing a reduction in fishing effort and a lower pressure on fish stocks. | 3. With two limits, total catches allowed and fishing time, it is not possible to calibrate quotas on the available resources (fluctuations in abundance). |
| **Economic aspects** | 4. The decrease in fishing effort is not targeted on specific species, and thus it is not possible to control pressure levels on specific species (especially those that should be more safeguarded). |
| 1. Bigger vessels will get more quotas. | 5. If a specific reduction in fishing time or allowed catches is not put in place, there will be no benefits in terms of levels of resource exploitation, and thus in expected future catches (this has also socio-economic implications). |
| 2. Smaller vessels could sell their quotas to bigger ones thus obtaining a direct monetary reward. | 1. Only the declared (registered) horsepower can be considered for quota allocation, but the real horsepower of fishing vessels is often higher than the registered one. |
| **Social aspects** | 2. The controls should be doubled, on quantities of catches and on fishing times. |
| 1. Fishing habits will not vary much, apart from a stricter control on catch quantities and fishing times. | 3. The quota allocated to same-horsepower fishing vessels will not have the same value for each one of them, since the real value depends on the species composition of catches, which varies according to fishing areas (for instance it is different in coastal and deep sea areas). |
| 2. If the days to go fishing can be freely chosen by fishermen throughout the year, only respecting the maximum fishing time allowed, some restrictions are avoided (saturdays and sundays can become fishing days, etc.). | 4. Smaller vessels (lower horsepower) would get very small quotas and thus would not obtain sufficient economic gains from their fishing activity anymore. |
| 3. Job contracts can be fairer because the maximum fishing time is clearly stated. | **Allocation criteria** |
| **The total fishing capacity for each GSA is determined and then subdivided among fishing systems. Within each fishing system, the parameter on which to calculate the fishing capacity is determined (length, horsepower, tonnage, etc) and the quota for each fishing vessel is allocated in a proportional way (tons of catches allowed according to a vessel’s characteristics). Such a quota will indicate the maximum quantity of fish that can be caught in a maximum number of days (freely chosen by fishermen throughout the year). This quota would assign a specific “value” to each fishing vessel. For instance, bigger vessels that can operate even with very bad weather conditions could get a higher time-quota. In the long run smaller vessels could be “forced” to sell their quotas since economic gains are too low, thus reducing fleet consistency.** | **In the Mediterranean sea a management system similar to Individual Transferable Quotas (ITQs) is only applied for bluefin tuna (Thunnus thynnus) management, even if an heterogeneous approach to quota management and subdivision among gears and vessels is commonly applied in the different countries. The International Commission for the Conservation of Atlantic Tuna (ICCAT) assigns to each Mediterranean country the yearly quota (an inclusive quota is fixed for the EU Member States). The historical series of catches is the criteria used to fix the tuna quota (TAC) among 27 EU countries. Each country can freely determine how to catch its quota and how to subdivide this quota among vessel and fishing practice (longlining, purse seining, trapping, leisure fishing). In this context Regional Administrations are usually excluded from the decision making process. The definition of national quotas for swordfish (Xiphias gladius) is under study and still far from complete achievement. Each individual quota is a portion of the total quota (Total Allowable Catches, TAC) that can be caught each year according to the state of a stock. However, also in this case, the partners complained that small-scale fishermen are facing several difficulties in the access to these quotas: 90% of bluefin tuna national quota is hold by just a few big vessels, and the small-scale fisheries segment has access to just 10% of the** |
authorized catches. Corsica Region adds that no fishing vessels in their fleet would be eligible for a TFC system.

In certain European areas (e.g. Scotland, Iceland) ITQs are mainly assigned on the basis of fishing vessels’ catch histories (species and quantities caught in recent years by each vessel); when it comes to new entries, quotas should be assigned taking into account the amounts that are allocated to vessels with similar characteristics. TACs are calculated for each target species on the basis of biological indices. Landings should be constantly monitored so that the fishing season can be terminated as soon as the TAC value is reached. Through this measure, the management authority can fix lower catch levels if the resource is overexploited, so that stocks can progressively recover. Once a stock has reached sustainable levels again, TAC can be raised to the initial or even higher values.

However, two basic requirements must be satisfied for the measure to be effective: on the one hand, catches should be constantly monitored (resource state assessment), on the other hand, fishermen should be constantly monitored too (compliance with the rules). The TAC to be distributed among individual quota owners can only be determined if the state of stocks is known.

None of the partners reckons that a system based on catch histories would be appropriate and feasible for the Mediterranean. The main reason is a general lack of sound and reliable individual historical data.

The assessment of the status of resources is considered as a key factor for the introduction of management systems based on TFC. In particular TACs can only be determined on the basis of stock assessment data and models, but these are available only for a limited number of species in the Mediterranean Sea. In the Mediterranean Sea the use of TACs is no guarantee of success and of optimal management, since the two requirements mentioned above (resource assessment and compliance control) are not always completely satisfied.

4.3. Shared stocks

In the Mediterranean Sea a further criticality is related to the fact that demersal and pelagic stocks are shared among different States and this should be taken into account when assigning TFCs. The Adriatic Sea is probably the largest and best-defined area of occurrence of shared stocks in the Mediterranean. Due to the semi-enclosed nature of the basin and the presence of many different countries along its coasts (Italy, Slovenia, Croatia, Montenegro, Albania, Bosnia-Herzegovina), Adriatic can be considered a kind of small Mediterranean. Evidence of the transboundary and straddling nature of some important stocks may be drawn from the geographical occurrence pattern in late spring and early summer, e.g. for the European hake (Merluccius merluccius) and Norway lobster (Nephrops norvegicus), which are high-value stocks targeted by the Adriatic demersal fishery. The shared character of Adriatic fishery resources makes it necessary to take in full consideration the cooperation among states as an essential and unavoidable requirement to pursue a responsible exploitation of such resources. Considering that six countries fish in the same basin, caution needs to be exerted when assessing trends in fisheries landing. Underestimation of landed quantities is a common problem that affects available statistics to an often unknown extent. Therefore the application of a system based on TFCs should carefully take into account all these factors.

4.4. Maximum Sustainable Yield

With regard to the Maximum Sustainable Yield (MSY) concept, partners believe that this index does not seem appropriate and exhaustive for the development of a sustainable fisheries management model in the Mediterranean. All partners see the MSY concept as too theoretical, and not applicable to resources which are highly interrelated and variable over time. The current determination of stock status is based on scientific assessments which do not take into account all factors that have an influence on resource fluctuations (climate change impacts, maritime pollution, natural predation, recruitment variation). The MSY definition is relatively easier for single or monospecific stocks, but it is very difficult in case of mixed species catches, as it is the case for Mediterranean fisheries. Indeed, in the Mediterranean the MSY should be determined for groups of species (mixed-species MSY) according to fishing systems, seasons and areas, also considering that MSY for mixed species should have a margin of flexibility. But it is difficult to develop a method to calculate the MSY for multispecies fisheries, since there are not enough biological and life history data to determine the MSY for most Mediterranean species. There have been many objections to the EC proposal of calibrating multispecies MSY on the most threatened species, since this would cause an unnecessary ban on species with stocks in good status. Calculations could be based on the mortality rate for each target species, but this type of data may not be available. For instance, in the Adriatic Sea the state of certain populations is determined by recruitment rather than by fishing mortality, since most species have a short life cycle. In GSA 8, for example, it seems that the state of spiny lobster population does also fluctuate according to recruitment, a complex process governed by a 5-month pelagic larval phase. Another criticism to MSY is that the concept is very restrictive and it takes into account only a few environmental aspects, whereas social and economic issues should also be added to the equation.

More in general, it would be good to develop specific management tools at the Regional level and, at the same time, to enhance a dialog with non-European countries in order to set specific MSY goals within multiannual management plans calibrated on each target species and for each Region in the framework of more general MSY guidelines. But this is difficult to achieve, due to the lack of sufficient scientific data and to the difficult dialog with non-EU third countries. Project partners identify direct resource assessment methods as the most suitable alternative to MSY. Partners stress the importance to constantly monitor the state of resources at the local level, identifying specific indicators that can be used to assess resource state and trends and thus modulate fishing effort. The quota would be proportionally fixed on the trend taken by the resource.

4.5. TFC and discards

Overall, in consideration of the multispecificity of the Mediterranean, discards seems to be especially associated to bottom trawling, where non-commercial species, damaged species or individuals below legal size are typically thrown back in the sea. Pelagic trawling may also favor discards as a consequence of economic considerations: if daily quota is over crossed, fishermen tend to keep the best fish (bigger anchovies) and discard the other one (with lower commercial value).

In general it is thought that a TFC system could increase the practice of discards, as reported also by some authors [40,41]. If a non-sellable species is caught with the target species, the “best” choice for a fisherman will be to discard it, unless forced by law to land it. The only effective solution would be to apply TFC to catches rather than to landings, but this would imply much stricter control and surveillance activities on board fishing vessels through an observers program, something which is in general not feasible at the moment in the Mediterranean. In this regard some proposals of setting up a supply chain to transform discards into fish flour were not approved at Regional level; this was mainly because the use of marine species for the production of fish flour could strongly encourage fishermen to catch as much fish as possible.
4.6. TFC and fishery rights

In the Mediterranean EU countries fisheries rights are usually regulated through a system of licenses released by the State. The overall fishing effort is regulated by reducing the number of licenses through vessel scrapping without allowing new entries. A license authorizes a fishing vessel to catch fish with a specific fishing system (which can include one or more fishing gears). It can be related to the concept of “concession”, but it is not transferable (licenses can only be sold with a fishing vessel or a portion of it) and it is not associated to a quota. In Italy in order to enter the fleet, a license should be purchased. Licenses cannot be “created” and they are assigned on the basis of a fishing vessel’s size/horsepower. Hence, licenses are associated with a specific fishing vessel and gear, and “transferable” only when the fishing vessel is sold: for each fishing vessel which is scrapped, a corresponding amount of kW is made available for new entries. While in France a license can only be transferred when a fishing vessel is sold, in Italy the “transferability” of licenses is done with a sell/purchase process on either the whole fishing vessel or portions of it (carats). The owners could trade some of their “quotas” (vessel carats), thus keeping their names on the license but sharing their property on one or more vessels. Similarly, a legal entity may own carats of one or more vessels without having its name on the license. In general partners recognize that fishing concessions are very similar to licenses. But the latter do not penalize fishermen by setting restrictions on catch quotas or on fishing days. Bringing such factors into the equation would decrease the license value.

At the moment, fisheries rights are in general not assigned according to territorial, biological or economic criteria, although there are exceptions in the case of species under special management regimes. In Liguria Region, a specificity is related to “rossetto” (Aphia minuta) fishing. Catches for this species are regulated through a Management Plan, and fisheries rights are assigned on the basis of territorial, biological and socio-economic criteria. Number of fishing vessels which are allowed to operate, maximum quota that can be caught and total fishing days at sea are all strictly defined. Taking this experience into account, partners agreed that “Fishing concession” could only make sense if related to a spatial concept, that is to the exclusive rights to catch resources located in a specific maritime area.

Also, the process of selling and acquiring TFCs should not be merely regulated by the operators’ individual interests, especially considering the weaker position of small and medium enterprises, the pressures that could be made on the fisheries market, and the difficulties created by the general economic crisis. The problems related to speculations, to the excessive concentration of TFCs in a few hands (stronger economic groups/bigger enterprises), to the safeguard of small-scale coastal fisheries have not been exhaustively tackled and solved yet.

4.7. TFC duration

The initial Common Fisheries Policy (CFP) reform proposal indicated that TFCs should be allocated for a period of 15 years. However, all partners agree that there is not an optimal duration for TFCs. If the limits in duration and validity are associated to mortgage duration for new vessels, the maximum duration will be 15 years. But this is not long enough for making long term investments in a fishing activity. If a fisherman invests his capital in a fishing vessel, he does not think that he will lose it after 15 years. Indeed, the average age of the Mediterranean fleet is much higher. It is likely that after 15 years a TFC will have to be renewed, and this means that there will be no room for new entries, unless some fishermen leave the sector and sell their TFCs. Moreover, without a certainty of renewal the TFC value will decrease year by year as the TFC deadline approaches.

Theoretically, the market value of a TFC is proportional to the potential profits that it will allow to obtain. At the moment the fisheries sector is in strong crisis and there are no buyers, and only vessel scrapping allows to exit the sector without losing too much. If quantities of fish that can be caught and fishing times were limited by assigning TFCs and thus setting quotas, the economic situation would become even more critical. Concessions would also lose their transferability power, since there would be no significant potential gains in acquiring a TFC.

4.8. TFC transferability

With regard to setting specific restrictions to TFC transferability, almost none of the partners would set territorial restrictions, since this would further decrease the possibility to develop the fisheries activity, further decreasing also the TFC value. On the other hand the approach of limiting the transferability at the Regional level could be justified in order to avoid the risk that big industrial vessels, which are not part of a specific fleet, acquire concessions to exploit certain areas, thus putting at risk the local small-scale artisanal fishery sector. Considering fishing vessel characteristics, fishing gears and systems, all partners suggested that TFC should not be transferred from fixed (gillnetting) to trawling gears. This measure would protect in particular artisanal small-scale coastal fisheries, an important sector of the economy in Mediterranean coastal countries. Similarly, all partners believe that some restrictions in transferability should be set on fish categories. For example, TFCs for demersal fish should not be transferred to pelagic fishing, and TFCs for small-size pelagic should not be transferred to big pelagic fishing. This is important in order to avoid transferring fishing pressure from one resource to another, and thus maintain a good control on the status of each stock and a good balance between the different fish resources. More in general, transferability should be regulated by the releasing authority, so that catches can be orientated on the resources that are environmentally and economically more sustainable.

4.9. TFC and competitiveness

Overall, TFCs are not seen as an appropriate tool to increase competitiveness in the fisheries sector. It is likely that TFCs neither improve the socio-economic situation of the fisheries sector nor increase production. On the contrary, TFCs bring restrictions that are often set without a thorough knowledge of the local requirements, with a tendency to standardize too much and oversimplify a highly complex issue. In terms of competition, the only likely effect is that many small enterprises cease the activity by selling their TFC to bigger and more competitive enterprises. The TFC system is based too strongly on market and economic considerations and does not take into account social factors. In several EU countries, this has helped to rationalize the fleet (usually decreasing the number of vessels). But this type of economic speculations would be detrimental for the Mediterranean Regions, which are characterized by a huge number of vessels (and fishermen) belonging to the artisanal small-scale fisheries.

TFCs would also increase job entry barriers for new generations. In order to enter the profession, TFCs or licenses must be purchased, and this has a cost which is proportional to the potential incomes. Building or buying a fishing vessel in order to get a TFC is very expensive, usually too expensive compared to potential incomes, considering the current crisis of the sector.

In addition one of the criticalities of TFCs is the concentration of TFCs in the hands of a few vessel owners (the risk for bigger fishing enterprises to absorb smaller ones is high) could cause an
exit of small fishing vessels, thus making new entries to the profession even more difficult.

All partners considered that the adoption of a TFC system would lead to a fleet reduction. Introducing new restrictions (quota and/or fishing days), the potential income for each enterprise is reduced. Some of the fishermen will therefore have to exit the sector because staying in is not remunerative anymore.

It is however difficult to foresee TFC markets and prices. In certain cases the monopoly can be obtained through a concentration of licenses rather than the organization of fishermen in Consortia or Producers’ Organizations. The best way to avoid excessive concentration would be to exclude small-scale fisheries, as well as species which do not have a quota.

According to the MAREMED partners, throughout the Mediterranean fishermen and category associations are mainly worried about a potential TFC introduction. One of the reasons is related to what has happened with the introduction of quotas for tuna: this type of fisheries has almost disappeared as a consequence.

Overall, actors and stakeholders in the fisheries sector have however not a clear vision of how a TFC system could actually work, since this issue is managed with a top-down approach, including the setting of quotas and fishing times. Fishermen of the small pelagic fisheries sector in the Adriatic Sea showed a direct interest in developing management schemes based on quotas directly managed by the fishermen themselves; however the recent GFCM (General Fisheries Commission for the Mediterranean) Recommendation [42] excluded fishermen and Member States from the definition of quotas and fishing period in the Adriatic Sea.

5. Conclusion

The state of heavy exploitation of Mediterranean fishery resources is apparent, and for some stocks it has reached critical levels. Several different factors, often interacting simultaneously, have affected Mediterranean fisheries, and fishery production dynamics are based not only on resource availability but are also strongly driven by market demand and prices. Socio-economic forces have been observed to be determinant in shaping fishery exploitation patterns and management. Stepping from these premises, the current study has reviewed the applicability of a management system based on TFC in the Mediterranean.

Most options for quota determination and allocation criteria highlighted in the study can be considered as “pure options”, but several other options could be considered by combining a number of different factors, for instance setting a catch quota for a group of species rather than a single species, and taking into account combinations of catch quotas and other parameters such as fishing areas, fishing systems, fishing times. A good example is the combination of a catch quota (e.g. tons of red mullets) caught by a specific fishing system (bottom trawling) in a specific fishing area (GSA 17). Such a mixed-criteria option would have all the advantages of the «pure option» n.1 (catch quota), and in general it would allow to better manage a specific fisheries segment from both the resource and the socio-economic point of view. In addition, linking catch quotas to specific fishing areas and systems would allow to better implement the interventions included in local management plans. The adoption of measures developed at the local scale would allow to fine tuning of the socio-economic interventions aimed at compensating income losses due to fishing effort restrictions. One of the main disadvantages of this mixed criteria is the risk of “freezing” the system since fishing vessels would be forced to operate only in specific areas (e.g. only in GSA 17). But this is the real situation for most of the fleet.

In the case of catch quotas set for groups of species, if the target is to have a direct connection with a species’ level of exploitation (fishing pressure on each species), the only solution is to determine the combined quota as the weighted sum of quantities that can be caught for each species, but this could be very difficult to determine. If an overall catch quota is set with no limits assigned to each single species, the risk is to have a more intense fishing pressure on higher-value species, so that these will tend to be overexploited, and the lower-value species will tend to be discarded. In all cases and whatever the option chosen, control and surveillance activities will have to be stricter, both on landings and out at sea, with higher costs and obligations. Ideally, a TFC system based on quantities would be more meaningful if applied to catches rather than to landings, but this would imply the implementation of complex control systems on board fishing vessels.

It must also be considered that for most Mediterranean species and GSAs there are no exhaustive data on the overall state of exploitation of resources and on the status of stocks, and quotas could only be assigned adopting a precautionary approach (which is very restrictive).

Finally, if small-scale fishing is kept out of the TFC system (as stressed above), a thorough control on the overall catches cannot be carried out, especially in a context such as the Mediterranean one, where small-scale fisheries has a very significant incidence on the overall catches.

In the Mediterranean, a TFC system based on quotas of caught fish, with all the limitations discussed above, could be appropriate only if applied to single-species fisheries, such as clam fishing, with direct management of TFCs by Fishermen Consortia or Producers’ Organizations, which have the responsibility to determine quotas within the overall limits (TAC and contingencies) defined by Member States. It is worth pointing out that a type of RBM management that can be associated to the TURF (Territorial Use Rights in Fisheries) concept has been put in place for clam (Chionea labronica) fisheries in the North Adriatic Sea. In this area Fishermen Consortia are directly responsible for the management of clam fishing; within National and European legal framework (daily catches per fishing vessel are fixed by Ministerial Decree [43]), stakeholders are allowed to determine daily quotas, fishing time, seeding, time closures, according to the state of resources and the commercial situation. This is a typical example of bottom-up management, where stakeholders are directly involved in the decision making process. On the other hand, when stakeholders are not involved in the decision making process, any change to the rules is considered as a top down imposition and often this is not the most effective solution. This is the case of quotas fixed by International bodies (ICCAT, CGPM) or by the National and EU Administration, that are usually perceived by fishermen as an imposition. The top down approach commonly raises noncompliance decisions and illegal activities, enhancing the need for enforcement effort. The principle is that it is better to have a plan that has been widely discussed and shared, rather than a plan developed by managers and ignored by the majority of stakeholders. However, Territorial Use Rights are only appropriate for the exploitation of sedentary resources, such as clams, where there is no competition between territorial rights owners and fishermen exploiting the resources out of the TURF area.

A management system based on TFC could be theoretically reasonable also for anchovy fishing (pelagic trawling or purse seineing), where a few species are caught. However, all countries and stakeholders of a basin where resources are shared (e.g. on all Adriatic fleets) should be involved assessing the appropriateness of such an approach for the improvement of overall fisheries sector and the state of resources.

In general terms, in the Mediterranean the disadvantages of developing fisheries management systems based on TFC seem always to be higher than the advantages.

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In conclusion none of the partners reckoned that a TFC system would be appropriate for their Regional context and, more in general, for the Mediterranean. The main reasons are:

- it would introduce stricter limits in terms of catches (through quotas) and in terms of fishing time;
- it would make it more difficult for new entries to enter the fisheries sector;
- it would cause the disappearance of a number of fishermen from the sector without real benefits in terms of production (their concessions would simply be acquired by bigger enterprises);
- the assessment of the status of each species is presently not feasible in the Mediterranean considering the multiplicity of this basin and the presence of different fleets and gears in the same shared areas;
- small-scale fisheries should disappear in favor of larger, economically stronger companies;
- TFCs would be misunderstood and not well accepted by fishermen, and to be effective, this management policy would require monitoring and control operations that are present to be difficult to be implemented.

Following these considerations, MAREMED project partners agreed that Mediterranean fishermen should not be forced into a TFC system, but rather be directly involved in fisheries management at the local level, and made more responsible through the participation in the development and implementation of specific management plans.

Acknowledgments

This study was conducted with the financial support of the Commission of the European Communities within the MAREMED Project – Maritime Regions Cooperation for Mediterranean (www.maremmed.eu – MED Transnational Cooperation Program financed by the European Regional Development Fund). It does not necessarily reflect the European Commission’s views and in no way anticipates its future policy. This support is gratefully acknowledged.

References

[1] RQ Grafton, Hilbronn, Squires D, Tait M, MJ Williams editors. Handbook of marine fisheries conservation and management. New York: Oxford University Press 2010, p. 770.
[2] FAO. The state of world fisheries and aquaculture. Rome; 2012. 209 p.
[3] Reguant-Aleix J. The Mediterranean diet: designed for the future. CIHEAM, Mediterra. Presses de Sciences Po – Annuels 2012, p. 29–50 (chapter 1).
[4] Papaconstantinou C, Furgiolo H. Fisheries in the Mediterranean. Mediter Mar Sci 2000;1:5–18.
[5] Battaglia P, Romeo T, Consoli P, Scotti G, Andaloro F. Characterization of the artisanal fishery and its socio-economic aspects in the central Mediterranean Sea (Aeolian Islands, Italy). Fish Res 2012;102(1–2):87–97.
[6] OECD. Report on sustainable fisheries—economics aspects of management of living marine resources. Organization for Economic Cooperation and Development. Paris, France: OECD Publishing; 1996.
[7] Cardinale M, Abella A, Bellido J, Biteto I, Colloca F, Fiorentino F, et al. Assessment of Mediterranean Stocks Part I. Scientific, Technical and Economic Committee for Fisheries. Report of the SGMED-10-02 working group on the Mediterranean part I. Luxembourg: Publications Office of the European Union; 2010. 1077 p.
[8] Colloca F, Cardinale M, Maynou F, Giannoulaki M, Scarcella G, Jenko K, et al. Rebuilding Mediterranean fisheries: a new paradigm for ecological sustainability. Fish Fish 2013;14:89–109.
[9] Spagnolo M. Elements of economy and governance of the pesca. Franco Angeli. (editor), Milan, Italy; 2006. p. 288.
[10] FAO. Review of the state of world marine fishery resources. FAO Fisheries and Aquaculture Technical Paper; 2011. p. 569.
[11] Scott A. Introducing property in fisheries management. FAO Fisheries Technical Paper, 404/1; 2000. p. 1–13.
[12] Hentrich S, Salomon M. Flexible management of fishing rights and a sustainable fisheries industry in Europe. Mar Policy 2006;30:712–20.
[13] M.P. Coelho, J.A. Filipe, Ferreira MA. Rights based management and the reform of the common fisheries policy: the debate. Int J Latest Trends Finance Econ Sci 2011:16–22.
[14] Arnsen R. Property rights in fisheries: how much can individual transferable quotas accomplish? Rev Environ Econ Policy 2012;6(2):217–36.
[15] Spagnolo M. What kind of management for Mediterranean fisheries?: Directorate – General for International Policies, Policy Department, Structural and Cohesion Policies Note; 2012. 52 pp.
[16] Bromley DW. Property relations and economic development: the other land reform. World Dev. 1989;17(6):867–77.
[17] Stokes A. Property Rights on the High Seas: Issues for High Seas Fisheries. FAO Fisheries Technical paper, 1968; 404/2.
[18] MRAC, BPM, CEIPAS, AZTI Tecnalia & PoEM. An analysis of existing Rights Based Management (RBM) instruments in Member States and on setting up best practices in the EU. Final Report. London: MRAC Ltd; 2009; 117.
[19] EU COM 417 Final. Communication from the commission to the European Parliament, the council, the European Economic and Social Committee and the Committee of the Regions, Reform of the Common Fisheries Policy; 2011a.
[20] EU COM 425 Final. Proposal for a regulation of the European Parliament and of the Council on the common fisheries policy (SEC(2011) 891 final) (SEC(2011) 892 final); 2011b.
[21] EU Parliament. Position of the European Parliament adopted at first reading on 6 February 2013 with a view to the adoption of regulation (EU) No. 2013 of the European Parliament and of the Council on the common fisheries policy, amending Council Regulations (EC) No. 1954/2003 and (EC) No 768/2005 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. EP-PE, TC1-0CD, 2013 03195; 2013. 229 p.
[22] Hersoug B. Rights-Based Fisheries Management in some Non-EU Countries. Discussion and Recommendations – Rights Based Management in Fisheries, European Parliament; PE389.601; 2007.
[23] Dalsøe WP. ITQs in The Netherlands: the quota market and its consequences in industry- and on firm levels, Workshop on property rights, Reykjavik; 1995.
[24] Salz P. ITQs in The Netherlands: twenty years of experience. CM 1996P/18, Theme session on Management faced with Multiple Objectives; 1996. p. 17.
[25] Hatcher AC, Read A. The allocation of Fishing Rights in UK Fisheries, Shotton R. (editor). Case studies on the allocation of transferable quota rights in fisheries. FAO Fisheries and Aquaculture Technical Paper; 2001; 411.
[26] Andersen P, JL Andersen, Frost H. ITQs in Denmark and resource rent gains. Mar Resource Econ 2010;25:11–22.
[27] Garza-Gil D, Iglesias-Malvido C, JC Suris-Regueiro, Varela-Lafuente MV. The Spanish case regarding fishing regulation, Mar Policy 1996;20(3):249–59.
[28] Løse FG. Transferability of fishing rights: The Spanish case. Mar Policy 2006;30(3):779–88.
[29] Ulmas H. The cost of fishery management in Estonia. UNIU Fisheries Training Program, Final Report; 2003. 38 p.
[30] Frey M. Sustainable fisheries management plan for the Estonian fisheries in the Baltic Sea, Final Report; 2003. 24 p.
[31] Trondsen T. Quota Prices and the Economic Performance of the Fishing Fleet in Norway. In: Hersoug B, van Hoof L, Evrard M, Trondsen T, Matthiasson T (editors). Discussion and Recommendations – Rights Based Management in Fisheries, European Parliament PE389:601; 2007.
[32] Xinhlan L. Implementation of individual transferable quota system in fisheries management: the case of the icelandic fisheries. UNIU Fisheries Training Program Final Report, 2000. 30 p.
[33] Eythorsson E. A decade of ITQ-management in Icelandic fisheries: consolidation without consensus. Mar Policy 2000;24(6):483–92.
[34] Arnsen R. A review of international experiences with ITQs. Annex to Future Guidance for UK Fish Quota Management. Report to the Department for the Environment, Food and Rural Affairs. CEMARE: University of Portsmouth; 2002; 64.
[35] Copes P, Charles A. Socioeconomics of individual transferable quotas and community-based fisheries management. Agric Resource Econ Rev 2004;33(2):171–81.
[36] Lleonart J, Maynou F. Fish stock assessments in the Mediterranean: state of the art. Sci Marina 2003;67(Suppl. 1):37–49.
[37] Sasson另行在Marine Policy 2000;30(3):779–88.
[38] Farrugio H, Oliver P, Biagi F. An overview of the history, knowledge, recent and future research trends in the Mediterranean fisheries. Sci Marina 2000;64.
[39] Thomas B. Economic performance of the fleet slips in 2011, Italy: Eurofish Magazine. ISSN 1868-5943; 2013. 48 p.
[40] TA Branch, Hilborn R. Matching catches to quotas in a multispecies trawl fishery: targeting and avoidance behavior under individual transferable quotas. Can J Fish Aquat Sci 2008;65:1435–46.
[41] J.J. Poos, J.A. Bogaards, F.J. Quirijns, D.M. Gillis, Rijnsdorp AD. Individual quotas, fishing effort allocation, and over-quota discarding in mixed fisheries. ICES J Mar Sci 2010;67(2):323–33.
[42] Recommendation RFMC/37.2013/1 on a multiannual management plan for fisheries on small pelagic stocks in the GFCM-GSA 17 (Northern Adriatic Sea) and on transitional conservation measures for fisheries on small pelagic stocks in GSA 18 (Southern Adriatic Sea); 2013. 10 p.
[43] Italian Ministry for Agricultural, Food and Forestry Policies of 22/12/2000 on the Bivalves Fishing. Published on the Official Journal; 4th April 2001. 14 p.