



# Uses of ecosystem services provided by MPAs: How much do they impact the local economy? A southern Europe perspective

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## KEYWORDS

Activity-based user  
value;  
Diving;

## Summary

This paper addresses the problem of measuring the local economic impact of marine protected areas (MPAs). It relies on a broad socio-economic field survey covering 12 case studies in southern Europe, and focusing on two major uses of MPA ecosystem

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Local economic impact;  
Fisheries;  
Marine protected areas;  
Socio-economic field surveys;  
Southern Europe

services: fishing and scuba-diving. The impact of these uses on the local economic system is expressed in terms of incomes and jobs, and the methodology relies on a distinction between users transforming ecosystem services into commodities, and users consuming ecosystem services for recreational purposes. Assessment results show a variety of situations, from MPAs where commercial fishing is the major economic stake, to MPAs where recreational activities have a dominant economic role. However, available information concerning the number of recreational users and visitors, on one side, and the number and characteristics of commercial fishing boats, on the other side, suggest that the second situation is more representative of the area under study than the former one. Due to the lack of baseline, the question of sorting out the “reserve effect” from the “site effect” is addressed with the help of survey results concerning perceptions and attitudes of users. As regards divers and diving operators, answers to the survey suggest that the reserve effect plays an important role in the attractiveness of the area. Results are not so clear in the case of fishers, an ambiguity reflecting the uncertainty of the spill-over effects expected from marine reserves on fishing grounds.

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## Introduction

An increasing amount of literature has been devoted, during the last two decades, to the economic value of marine ecosystems conservation, and, more specifically, to the net benefits provided to society by marine protected areas (MPAs). Methodologies for assessing these benefits have been developed (see Hoagland et al., 1995 for a review), and various problems related to their nature and magnitude have been investigated (see Alban et al., 2006 for a review). Assessing the local economic impact of MPAs is a related but different topic; it does not address the question of their benefits to society as a whole, but the more matter-of-fact question of the economic consequences of their implementation for coastal communities. Even from a purely conservationist standpoint, there is a good case for not neglecting this topic. Although the basic purpose of MPAs (and, more generally, of nature reserves) is not economic development but ecosystem conservation, the question of their influence on the local economic system is critical because it governs their social acceptability (Carter, 2003; Pomeroy et al., 2004; Sanchirico, 2000). The explanation lies in a simple observation; in contrast to the broad scale of benefits expected from environment conservation measures (up to humankind as a whole in the case of existence values), most restrictions to human activities imposed by these measures have a local character (Lunney et al., 1997). This discrepancy is likely to undermine the support of neighbouring populations, unless they feel that the restrictions they are asked to accept for the sake of conservation are balanced by some tangible benefits to their

communities and livelihoods. Economic benefits obviously pertain to this category.

Nature reserves potentially affect two types of ecosystem services users: extractive and non-extractive users. In the case of MPAs, the first category is (in many circumstances) mainly represented by fishers, while the second category is largely composed of recreational users performing activities such as scuba-diving, snorkeling, whale watching, bathing, or sightseeing. MPAs are likely to affect differently each of these two categories.

As regards fishers, the impact of MPAs is two-sided. On the one hand, MPAs impose restrictions on fishing activities, particularly when they include a no-take zone (NTZ). Even if NTZs are not found in every MPA, specific fishing restrictions apply in most MPAs, which may be considered as a weakened version of the NTZ mechanism. On the other hand, MPAs are expected to benefit fishers by the alleged existence of spill-over effects from NTZs to fishing areas (biomass export, larval dispersal), and by their stabilising effect on overfished stocks dynamics (Clark, 1996; Lauck et al., 1998; Sumaila, 1998), provided the NTZ shelters a significant safe minimal biomass level (Anderson, 2002). However, these potential fishing benefits of MPAs are difficult to ascertain, first because fish mobility between NTZs and areas open to fishing is in most cases poorly documented (a topic addressed by Planes (2005), in the Mediterranean context), and also because potential benefits of MPAs to fishers are highly dependent on the level of fishing effort in areas open to fishing (Hannesson, 1998) – a factor that MPA managers usually try to control by creating a “buffer area” around the NTZ, where fishing is authorised but submitted to special regulations.

As regards non-extractive users of marine ecosystem services, MPAs are expected to generate more straightforward effects. These effects directly stem from the fact that the marine environment within a MPA (particularly within its NTZ) is granted a certain level of protection against anthropogenic pressures, which is likely to improve the quality of some of its attributes that are valuable to visitors (e.g. [Alcala, 1988](#); [Rudd & Tupper, 2002](#)). However, the opposition between extractive and non-extractive uses should not be regarded as absolute; too many visitors will negatively affect the marine environment, particularly when their activity inside the MPA is not properly controlled ([Davis et al., 1995](#)). This phenomenon may generate a cycle in local economic benefits provided by the MPA; e.g. protection generates more visitors, who in turn damage the quality of the marine ecosystem, which after a while results in the decreased appeal of the area to visitors, and hence a diminishing number of visits ([Butler, 1980](#); [Davis & Tisdell, 1996](#); [Dixon et al., 1993](#)).

A majority of studies assessing the local economic impact of nature reserves, including MPAs, are concentrated in North America and Australia and mainly deal with recreational uses of these reserves (e.g. [Carlsen & Wood, 2004](#); [Driml & Common, 1995](#); [Kalter & Lord, 1968](#); [KPMG, 2000](#); [Leeworthy & Wiley, 2002](#); [Lindberg & Denstadli, 2004](#); [Stynes et al., 2002](#); [Tremblay & Carson, 2007](#)). Along with various monographic surveys, efforts have been made to develop generic methodologies ([Stynes & Propst, 1993](#)). In southern Europe, an important number of MPAs have been created, particularly in the Mediterranean ([Anon, 2006](#)). Compared to the Australian or North American context, these MPAs share two distinctive features: (i) their size is relatively small-112 km<sup>2</sup> on average, according to [IUCN \(2007\)](#); (ii) they are usually located in or close to zones highly influenced by human activity, including a considerable flow of tourists driven there by various factors of attractiveness (among which is an important cultural and historic heritage). Elements of information concerning their economic impact may be found in some monographic studies ([IRAP, 1999](#); [Musard, 2001](#); [Pérez-Ruzafa, 2003](#); [Ramos, 1992](#); [Ribera-Siguan, 1992](#); [Richez, 1992](#)). However, it was noticed at the beginning of the present decade that, on the whole, little attention had been paid to the necessity of analysing the economic dimension of Mediterranean MPAs ([Badalamenti et al., 2000](#)), a situation that has not dramatically changed since that time.

The purpose of this paper is to assess the local economic impact of MPAs in southern Europe, on

the basis of a standardised methodology and a broad socio-economic field survey covering 12 case studies. Due to material limitations, the analysis focuses on two major uses of marine ecosystem services provided by these MPAs: fishing and scuba-diving. The first part of the paper gives a synthetic view of the case studies, and presents the main features of the field survey. The second part describes the methodology that was used to assess the local economic impact of MPA ecosystem services uses, and displays the results of this assessment. These results are presented in the third part and discussed in the fourth part of the paper, with special attention to the problem of sorting out the “reserve effect” from the “site effect”. The conclusion sums up the main results and limits of the analysis.

## Case studies and field survey

The field survey forming the empirical basis of this paper was performed within the framework of an EU funded multidisciplinary research project, devoted to the study of European MPAs as a tool for fisheries management and conservation (EMPAFISH SSP8-006539). This project covered 20 MPAs in southern Europe, among which 12 are used as case studies for the present analysis. The sizes of these case studies are very heterogeneous, as shown by [Table 1](#); the largest one (Bonifacio) reaches 800 km<sup>2</sup>, while the smallest one (Monte da Guia) is only 4 km<sup>2</sup> in size. On average, 5% of the total surface of the MPAs is dedicated to an integral reserve, or NTZ. This proportion varies between 2% (Bonifacio, Monte da Guia) and 43% (Columbretes). The specificities of two cases studies have to be underlined:

- In Monte da Guia, part of the MPA is dedicated to an integral reserve, and the rest of the area is a buffer zone where only non-consumptive uses (e.g. diving) are authorised.
- In Columbretes, the whole MPA is a NTZ where commercial fishing is not allowed.

For these two cases, an *ad hoc* zoning was adopted for the delimitation of the population of fishers covered by the field survey.

[Table 2](#) displays available information concerning the number of visitors of the MPAs under survey, and the number of users of their ecosystem services. According to case studies and uses, this information can be considered more or less accurate. This caveat applies particularly to

**Table 1.** MPAs used as case studies.

MPA	Country	Location	Area (ha)	
			Total	Integral reserve or NTZ
Banyuls	France	Mediterranean	715	65
Bonifacio	France	Mediterranean	80,000	1200
Cabo de Palos	Spain	Mediterranean	1898	270
Columbretes Islands	Spain	Mediterranean	4400	1893
Côte Bleue	France	Mediterranean	9873	295
La Graciosa	Spain	Atlantic <sup>a</sup>	70,700	1225
La Restinga	Spain	Atlantic <sup>a</sup>	750	180
Medes Islands	Spain	Mediterranean	511	93
Monte da Guia	Portugal	Atlantic <sup>b</sup>	443	10
Sinis	Italy	Mediterranean	25,673	529
Tabarca	Spain	Mediterranean	1400	100
Tuscany archipelago	Italy	Mediterranean	56,766	6147
<b>Mean</b>			<b>21,094</b>	<b>1001</b>
<b>Standard deviation</b>			<b>30,248</b>	<b>1727</b>

Data source: MPA managers.

<sup>a</sup>Canary Islands.

<sup>b</sup>Azore Islands.

**Table 2.** Estimations concerning populations of MPA ecosystem users and MPA visitors.

MPA	Commercial fishing boats		Recreational fishers	Scuba-divers	Visitors
	Yearly number	Average length <sup>a</sup>			
Banyuls	8	n.a.	1460	13,000	100,000
Bonifacio	30	n.a.	150	10,000	150,000
Cabo de Palos	7	8.8	n.a.	9000	17,400
Columbretes Islands	60	19.7	n.a.	3500	3000
Côte Bleue	40	n.a.	6870	16,000	n.a.
La Graciosa	30	10.6	1250	n.a.	75,000
La Restinga	33	7.9	1500	2700	n.a.
Medes Islands	21	6.6	n.a.	18,000	268,000
Monte da Guia	80	8.4	340	1300	4000
Sinis	124	8.6	n.a.	350	2500
Tabarca	n.a.	n.a.	2350	1000	80,000
Tuscany Archipelago	121	7.0	n.a.	3500	310,000
<b>Mean</b>	<b>50</b>	<b>10.7</b>	<b>1989</b>	<b>7123</b>	<b>100,990</b>
<b>Standard deviation</b>	<b>41</b>	<b>4.4</b>	<b>2277</b>	<b>6376</b>	<b>110,952</b>

Data source: EMPAFISH field survey 2005–2006 for boats average length. MPA managers for all other data.

<sup>a</sup>Unit: metre.

recreational fishing, which is totally informal in most cases (no operators, no permits). Nevertheless, in accordance with facts observed at a broader scale by the MedPAN network (Anon, 2006), estimations presented in Table 2 clearly suggest that, in our case studies, recreational uses play a major role in the pattern of use for MPA ecosystem services. According to these estimations, each MPA is visited each year by approximately 110,000 persons on average. More specifically, around 7000 scuba divers and 2000 recreational fishers (a figure

probably underscoring reality) make use of its ecosystem services on average. In comparison, commercial fishing seems rather limited, considering the fact that, in most cases, commercial fishing boats operating in the fishing zone of the MPA are small-sized (average length under 12 m, except in Columbretes).

The socio-economic survey of these MPAs was performed in 2005 and 2006. It covered a range of MPA ecosystem uses, with a focus on fishing and scuba-diving. Its main purpose was to provide

**Table 3.** Socio-economic field survey: number of answers concerning fishing and scuba diving.

Types of uses MPA	Fishing		Scuba-diving	
	Professional	Recreational	Operators	Divers
Banyuls			11	82
Bonifacio		10	6	108
Cabo de Palos	4		4	132
Columbretes Islands	20		8	257
Côte Bleue		262	17	689
La Graciosa	14	184		
La Restinga	28	142		159
Medes Islands	16		6	147
Monte da Guia	51	76	3	57
Sinis	36	25	3	34
Tabarca			1	108
Tuscany Archipelago	1		1	63
<b>Total</b>	<b>170</b>	<b>699</b>	<b>60</b>	<b>1836</b>

Data source: EMPAFISH field survey 2005–2006.

information on the identity of users, on their MPA-related activity, and on their attitude towards the MPA. The scope of the survey was normally limited to persons with an activity inside the MPA. As regards fishing, this implies that only fishers operating (at least part-time) inside the fishing zone of the MPA were interviewed. This approach may be considered as excessively restrictive, since the NTZ is liable to generate spill-over effects beyond the administrative limits of the MPA. However, information concerning the range of these spill-over effects was not available in most cases, and therefore it was decided to take the fishing zone of the MPA as a proxy.

In total, 1836 questionnaires concerning fishing or scuba-diving were completed within the 12 case studies (Table 3). There are important differences between case studies concerning sampling rates, as may be seen by comparing Tables 2 and 3. These differences are due to the fact that implementing the survey was under the responsibility of each local project partner, who faced specific constraints and sometimes had specific priorities within the project.

## Methodology

Anthropic uses of the services provided by a MPA ecosystem have a local economic impact, in so far as they generate incomes in the neighbouring coastal zone.

The category of “neighbouring zone” cannot be defined generically, because it depends on the

individual characteristics (e.g. size) of the MPA. For instance, in the case of the Great Barrier Reef Marine Park (GBRMP) in Australia, economic impacts were assessed at the scale of the whole State of Queensland (KPMG, 2000), a choice which is consistent with the characteristics of the GBRMP (350,000 km<sup>2</sup>, 3.8 million visitors in 1990). In southern Europe, MPAs are much smaller (see Table 1), and the most appropriate definition of “neighbouring zone” probably corresponds to the concept of “employment zone”, i.e. a zone encompassing the majority of everyday commuting trips between home and workplace. However, information concerning such zones was not available for the whole set of case studies, and the following approximations were adopted:

1. All commercial fishers were considered as “local” (an assumption based on consideration of the home port and size of commercial fishing boats operating within the fishing zone or the vicinity of the MPA); and
2. Recreational users were considered as “local”, or “resident”, if the distance between the MPA and their permanent home was less than 50 km (according to survey results, most people living beyond this limit have to spend at least one night out of their home to partake in recreational activity within the MPA).

Incomes that are locally generated by the uses of MPA ecosystem services may be of two types: cash or non-cash. Non-cash incomes correspond to the non-market benefits that the MPA ecosystem provides to the local population, and cash incomes



are generated by the market-oriented private activities induced by the MPA ecosystem uses.

In this analysis, non-cash incomes are not considered. This restrictive choice certainly results in underscoring the local benefits generated by MPA ecosystem services, since it amounts to excluding the consumer's surplus of local recreational users from the assessment. Underscoring may vary according to the type of activity and case study considered; if, in all case studies, a large majority of divers are non-resident (88% for the whole survey sample), in some MPAs the majority of recreational fishers are resident (up to 77% in Côte Bleue, a MPA in the vicinity of the highly populated city of Marseille).

In the case of market-oriented productive activities, the only incomes that should be taken into account, from a theoretical point of view, are the net resource rents generated by these activities (e.g. fishery rent), since other incomes are supposed to be the opportunity costs of scarce production factors that could have been employed in other activities, or in other places. However, this view implies that markets are fully competitive and full employment prevails, an assumption which is frequently at odds with real-world circumstances. This provision fully applies in the case studies considered here, where coastal zones neighbouring MPAs frequently face fairly high rates of unemployment. As a result, it seems more appropriate to assume that providing jobs, wages and other activity incomes in these zones is a positive contribution to the welfare of coastal communities. In line with this assumption, we base our assessment on the following two indicators: (i) added value (i.e. value of production, minus consumption of intermediate goods and services), which represents the direct contribution of the considered activity to the local GDP; (ii) local jobs that are required to run this activity. Indirect and induced incomes and jobs (Lindberg, 2001) are not considered, which is another aspect of the conservative standpoint characterising our assessment. The reason for this restrictive choice is the difficulty to use reliable multipliers, due to the lack of input-output tables at the local scale.

The methodology we use for assessing incomes and related jobs is based on a distinction between users transforming ecosystem services into commodities (commercial fishers), and users consuming ecosystem services for recreational purposes (recreational fishers and scuba divers).

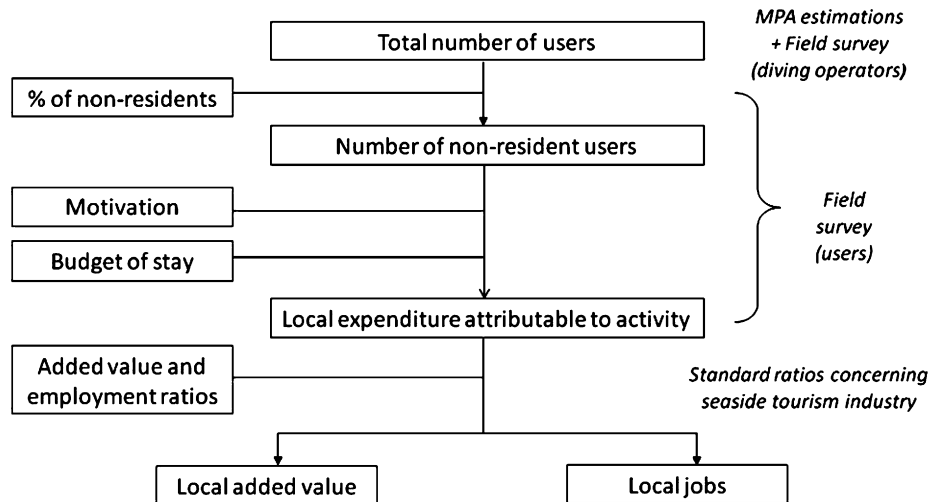
In the first case, incomes and jobs that are taken into account correspond to commercial fishing within the fishing zone of the MPA, and considered as a proxy for the zone where spill-over effects from

the NTZ are significant. Assessing these incomes and jobs relies on the following methodology:

1. Information concerning the number of commercial fishing boats with an activity inside the MPA comes from MPA authorities (see above, Table 2);
2. For each case, the share of their annual turnover provided by their activity within the fishing zone of the MPA is derived from fishers' answers to the field survey;
3. The corresponding added value is estimated by applying the following standard ratios of added value to turnover; 70% for boats under 12 m, and 50% for boats between 12 and 24 m. Estimated by the French marine research institute Ifremer, these ratios correspond to the average values for the French commercial fishing fleet of the Mediterranean (Daurès, pers. com.); and,
4. Answers to the survey concerning the share of boat turnover provided by the fishing zone of the MPA are also used for allocating manpower (e.g. a boat with a crew of three persons, including skipper, deriving half of its annual landings from the fishing zone of the MPA is taken to account for 1.5 jobs).

In the case of recreational fishing and scuba-diving, incomes and jobs that are taken into account are those that various local businesses (e.g. hotels, restaurants, diving or charter-fishing operators) derive from the expenditures of non-resident recreational users of the MPA during their stay. In order to avoid over rating the impact of the MPA, we use a filter ("attribution factor") based on the motivation of these non-resident users (Johnson & Moore, 1993). The methodology for estimating the local incomes and jobs generated by the expenditures of these users is summed up in Figure 1 and comprises five steps:

1. The total yearly number of users is estimated on the basis of information provided by MPA authorities, and complemented by diving operators;
2. For each use and each case study, the number of non-resident users is estimated by applying a ratio derived from the field survey to the total population;
3. Among this estimated population of non-resident users, only those whose stay in the area is motivated mainly by diving or fishing are retained at the third step (this category is hereafter called "class a" recreational users). The information concerning main trip motivation is also provided by answers to the field survey;



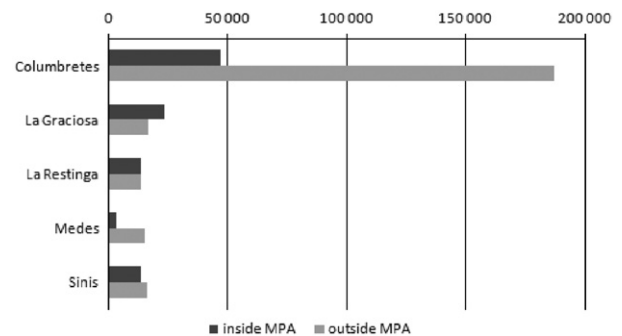
**Figure 1.** Methodology for estimating the local impact of expenditures of non-resident MPA recreational users (scuba-divers, recreational fishers).

4. The local expenditure of these persons is estimated from the field survey; and
5. The amount of local added value and the number of local jobs generated by this expenditure are estimated on the basis of standard ratios derived from statistical data concerning the French seaside tourism industry (Kalaydjian, 2006). According to these data, 1 million € spent by tourists visiting the seaside generate locally, on average, 0.42 million € of added value, and 9.89 jobs (full-time yearly equivalent units).

## Results

The whole set of data required by the estimation process was not available for every case study. Moreover, in some cases, the sampling rate was too low for drawing significant conclusions. As a result, the estimation could be carried out in 11 cases concerning scuba-diving, but only in five cases for professional fishing, and in four cases for recreational fishing. Figures 2–4 display major features of the assessment process, and Table 4 presents its overall results.

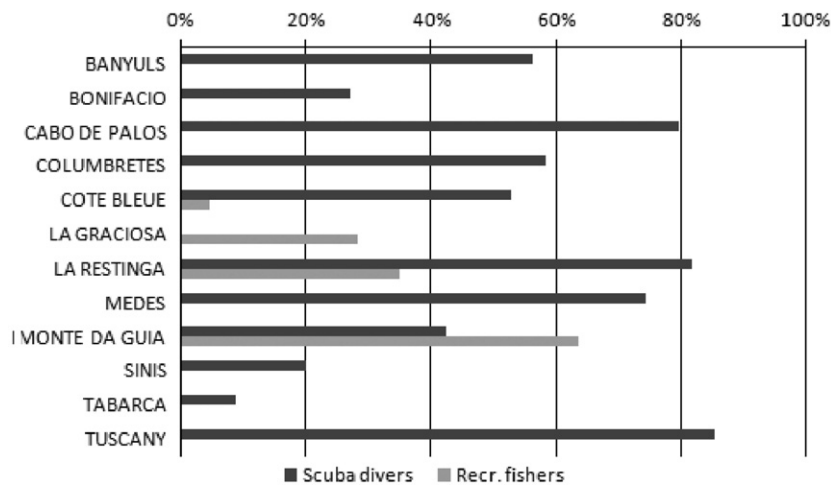
Figure 2 is dedicated to commercial fishing. For each documented case study, it describes the estimated average yearly value landed by commercial fishing boats with an activity inside the MPA, and the distribution of this value according to the origin of catches (inside/outside MPA). In four out of five cases (Medes, La Restinga, Sinis, La Graciosa), the average yearly landed value ranged from €18,000–40,000 per boat. It is much more important in the remaining fifth case (Colum-



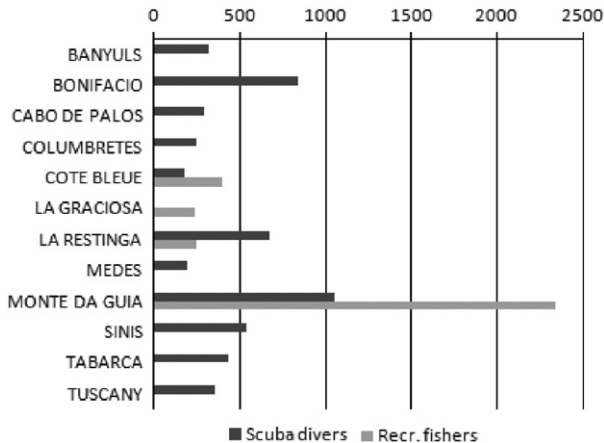
**Figure 2.** Commercial fishing: estimated value of average annual landings per boat (in €), according to origin of catches. Data source: EMPAFISH field survey 2005–2006.

bretes), where it reaches €234,000. This gap may be explained by a difference in boat size; while the average boat length is between 6.6 and 10.6 m in the first four cases, it is up to 19.7 m in the case of Columbretes (see above, Table 2). The estimated proportion of landings due to catches within the MPA lies between 45% and 58% in three out of four cases (Sinis, La Restinga, La Graciosa); and it is only 20% in the two remaining cases (Columbretes and Medes), a fact that may be explained either by the exiguity of the MPA (e.g. Medes) or by boat characteristics (e.g. Columbretes, where 70% of the boats operating near the MPA are trawlers with a length over 20 m).

Figures 3 and 4 are dedicated to recreational fishing and scuba-diving. Figure 3 displays the proportion of “class a” recreational users, i.e. those recreational fishers and divers who are non-resident, and whose stay in the area is mainly motivated by fishing or diving. The number of documented case studies is much smaller in the



**Figure 3.** Proportion of “class a” recreational users\* (\*non-residents mainly driven to the area by the motivation of fishing or diving). *Data source:* EMPAFISH field survey 2005–2006.



**Figure 4.** Average local expenditure (€/person) of “class a” recreational users\* (\*non-residents mainly driven to the area by the motivation of fishing or diving). *Data source:* EMPAFISH field survey 2005–2006.

case of recreational fishing than in the case of scuba-diving (4 versus 11), which complicates comparisons between these two uses. However, it is noticeable that the overall proportion of “class a” users is considerably higher for scuba-diving than for recreational fishing (60% versus 14%, for the whole sample). In seven of the 11 documented case studies “class a” divers form the majority of all divers frequenting the MPAs. However, for recreational fishing this trend features in only one of four documented case studies; unlike the other three, this case-study (Monte da Guia) is characterised by a high proportion of sport fishers making use of charter-fishing boats. In the other documented cases, the low proportion of “class a” recreational fishers is due to one of the following two

factors, or to their combination: (i) a high proportion of residents (Côte Bleue); and, (ii) a relatively low motivation for the activity in the case of non-residents (Côte Bleue, La Graciosa, La Restinga), a situation which is often encountered when fishers are on holiday with their family in the area.

Figure 4 displays the average local expenditure of “class a” recreational fishers and scuba divers during their stay. In the case of scuba-diving, this expenditure ranges from less than €300 per person in Cabo de Palos, Columbretes, Côte Bleue and Medes, to more than €800 in Bonifacio and Monte da Guia. The heterogeneity is more substantial with recreational fishing; in this case, the average expenditure is around €300 per person in Côte Bleue, La Graciosa and La Restinga, but it reaches €2300 in Monte da Guia (a peculiarity which is related to the importance of customers of charter-fishing operators in this case).

Table 4 presents the results of the estimation process concerning the local economic impact of fishing and diving in the MPA. According to this estimation, yearly local incomes generated by the use of MPA ecosystem services amount approximately to €720,000 per MPA in the commercial fishing industry, and to €640,000 per MPA in the various activities providing services to non-resident recreational users. As regards jobs, according to our assessment, commercial fishing generates approximately 54 jobs per MPA on average, and local expenditures of non-resident recreational users generates approximately 15 jobs (expressed in terms of yearly full-time equivalent units). However, the situation varies considerably according to each MPA, and, for extractive uses, the estimation could be completed for only a few case



**Table 4.** Estimated local yearly incomes and jobs generated by MPA ecosystem services uses.

MPA	Professional fishing <sup>a</sup>		Recreational fishing <sup>b</sup>		Scuba-diving <sup>b</sup>	
	Added value <sup>c</sup>	Jobs <sup>d</sup>	Added value <sup>c</sup>	Jobs <sup>d</sup>	Added value <sup>c</sup>	Jobs <sup>d</sup>
Banyuls					973	22.9
Bonifacio					948	22.3
Cabo de Palos					868	20.4
Columbretes	1573	50.4			211	5.0
Côte Bleue			52	1.8	632	14.9
La Graciosa	482	50.0	35	1.1		
La Restinga	306	31.4	55	1.7	616	14.5
Medes	48	4.2			1099	25.9
Monte da Guia			211	5.0	241	5.7
Sinis	1140	133.9			16	0.4
Tabarca					16	0.4
Tuscany					446	10.5
<b>Mean</b>	<b>710</b>	<b>54.0</b>	<b>88</b>	<b>2.1</b>	<b>551</b>	<b>13.0</b>
<b>Standard deviation</b>	<b>563</b>	<b>43.4</b>	<b>71</b>	<b>1.7</b>	<b>374</b>	<b>8.8</b>

Data source: EMPAFISH field survey 2005–2006.

<sup>a</sup>Added value and jobs due to fishing within MPA.

<sup>b</sup>Added value and jobs related to expenditures of non-resident recreational users of MPA.

<sup>c</sup>Unit: 1000 €.

<sup>d</sup>Yearly full-time equivalents.

studies. As regards recreational fishing, an activity fully documented in four case studies only, it appears that few jobs are generated by local expenditures of non-resident users (2.1 per MPA on average). This situation may be explained by the fact that an important proportion of recreational fishers are resident, or are motivated to pay a visit to the area for reasons other than fishing (family vacation for instance). In the case of scuba-diving, the number of yearly full time-equivalent jobs, though substantially higher (13 per MPA on average), is limited by the seasonal character of the activity.

Due to available information, the relative importance of professional fishing and recreational activities may be compared for only a few case studies. Figure 4 presents the prevailing situation in three Spanish MPAs: Columbretes; La Restinga; and, Medes. Columbretes provides an example of an MPA where professional fishing is dominant, in terms of economic impact (88% of total income locally generated by fishing and diving). The situation is completely opposite in Medes where, according to our assessment, incomes generated by commercial fishing amount to approximately 5% of the incomes generated by scuba-diving. In La Restinga, recreational activities are also dominant, though to a lesser degree than in Medes; their economic weight, in terms of income, is approximately 2.2 times that of commercial fishing. Considering the

number and size of commercial fishing boats operating in the various MPAs under survey (see above, Table 2) would suggest that most of these MPAs are closer to the Medes-La Restinga model than to the Columbretes model. At a much smaller scale, the pattern of uses exhibited by Medes and La Restinga is similar to the one characterising the Great Barrier Reef Marine Park in Australia, where the estimated distribution of economic weights between recreational uses and commercial fishing is approximately 4 to 1 (KPMG, 2000).

Another useful approach for benchmarking consists in comparing the incomes generated by the uses of the MPA ecosystem services to the costs induced by the management of the MPA (Table 5). This comparison leads to the conclusion that, generally, these incomes are high enough to cover MPA management costs (though cost-recovery is not implemented in any of the MPAs under survey). On average, according to our assessment, the amount of locally generated income by fishing and diving in the MPA represents 2.3 times the management costs of the MPA. A more comprehensive approach to the benefits generated by the MPA ecosystem could considerably raise this ratio; in the case of the Florida Keys National Marine Sanctuary (USA), it was estimated that management costs of the conservation programme represented only 2% of the total benefits generated by the MPA ecosystem (Bhat, 2003).

**Table 5.** MPA yearly management costs<sup>a</sup>.

MPA	Labour costs	Other costs	Total costs
Banyuls	162	353	515
Bonifacio	1100	1300	2400
Cabo de Palos	231	15	246
Columbretes	455	286	742
Islands			
Côte Bleue	179	109	287
La Graciosa	314	68	382
La Restinga	368	57	424
Medes Islands	156	240	397
Monte da Guia	96	214	310
Sinis	239	50	289
Tabarca	365	110	475
Tuscany	n.a.	n.a.	n.a.
Archipelago			
<b>Mean</b>	<b>333</b>	<b>255</b>	<b>588</b>
<b>Standard deviation</b>	<b>277</b>	<b>363</b>	<b>617</b>

Data source: MPA authorities.

<sup>a</sup>Running costs, including scientific monitoring and enforcement.

### Discussion: Sorting out the “reserve effect” from the “site effect”

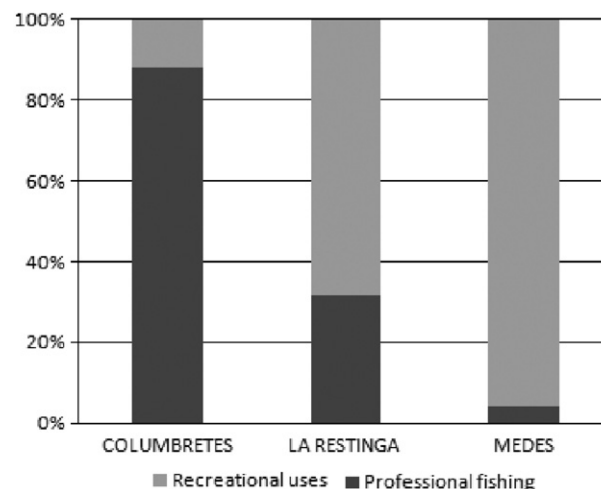
The estimated economic impacts presented in the former section cannot be attributed unambiguously to MPAs; if the areas under survey were not protected, there probably would still be some fishing and scuba-diving in these places. It is therefore necessary to sort out the “site” effect from the “reserve” effect, in order to assess the real economic consequences of protecting a marine area (Pendleton, 1995).

In many cases (including our case studies), the lack of baseline and the difficulty in defining a control zone make it impossible to estimate directly the reserve effect on the basis of observed behaviours. An alternative is to ask users how they would behave if the area was not protected. This type of contingent approach is used by Carlsen and Wood (2004) in their assessment of the economic impact of recreation and tourism in Western Australia’s national parks, marine parks and forests. These authors estimate a “substitution factor” which they define as “the amount of retained tourist expenditure attributable to national parks, marine parks and forests that would otherwise not have occurred”. Their estimation is based on answers to a field survey, where park visitors were asked what would have been their holidaying behaviour “if the natural environments of the national park and forests in the region did not exist” (Ibid.). However, answers to this question are not easy to interpret for our purpose, because it does not clearly differentiate between

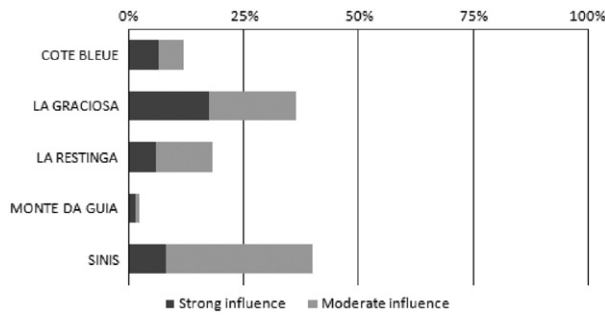
what is due to the site and what is due to its protection. Moreover, in our case studies, the population under survey is not wholly composed of holidaying visitors. In the case of local fishers, the question is not simply whether they would still operate in the area or not, but, rather, how much money they would still make if the area was not protected.

Generally speaking, the obvious problem raised by the contingent approach to the reserve effect is that respondents do not necessarily have a clear vision of the implications of protection on the ecosystem services they use. In our sample, 18% of recreational fishers and 30% of scuba divers did not even know that they were operating in a MPA (from which it would be imprudent to conclude that there is no reserve effect in their case). Nevertheless, some qualitative information concerning the relative importance of the site and reserve effects may be obtained through the analysis of the field survey presented in this paper. To this end, we now focus on the part of the survey results concerning perceptions and opinions of MPA users (Figure 5).

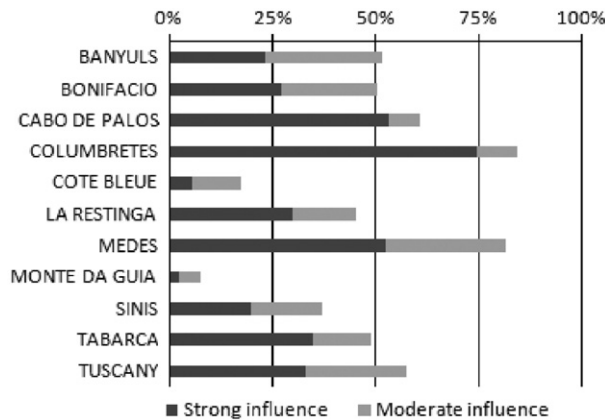
Through their responses to the survey, recreational fishers and divers provided information on how the site being a MPA influenced their decision to fish or dive in this area (Figures 6 and 7). On the whole, comparing these answers displays a clear contrast between the two types of recreational activities. In the case of recreational fishing (Figure 6), the proportion of users declaring that their choice of a fishing site had been influenced by the existence of the reserve is always below 50%, and, in four out of five cases, the proportion acknowledging a strong influence of the MPA is



**Figure 5.** Structure of locally generated income by activities using MPA ecosystem services. Data source: EMPAFISH field survey 2005–2006.



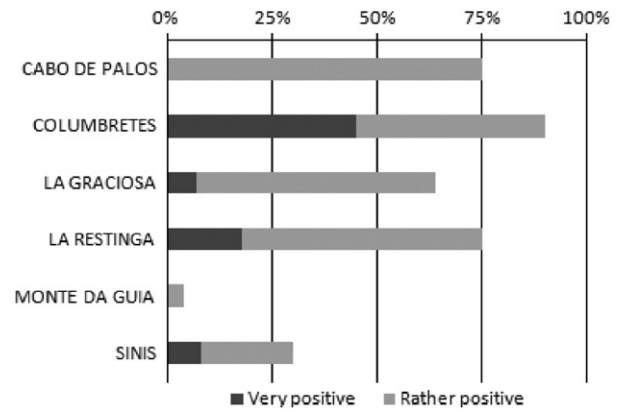
**Figure 6.** Declarations of recreational fishers concerning the influence of the MPA on their choice of a fishing site. *Data source:* EMPAFISH field survey 2005–2006.



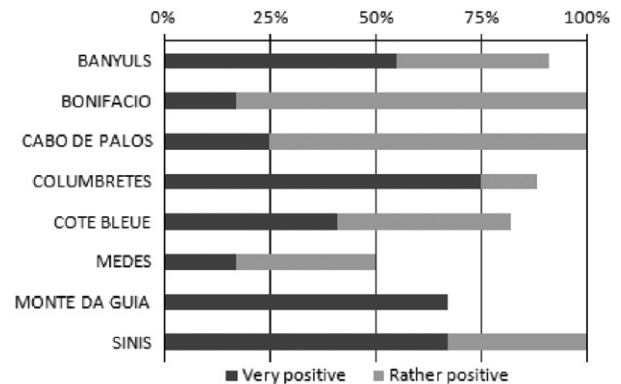
**Figure 7.** Declarations of scuba-divers concerning the influence of the MPA on their choice of a diving site. *Data source:* EMPAFISH field survey 2005–2006.

below 10%. According to divers' answers (Figure 7), the reserve effect seems to be more important for this second category of users; a majority of divers declared that the existence of the MPA had influenced their decision (six of the 11 case studies), and the proportion was over 75% in two cases. Moreover, the acknowledged influence of the MPA on the choice of a diving spot was frequently described as “strong”; beyond 50% in three out of eleven cases, and beyond 25% in seven out of 11 cases.

A similar pattern may be obtained by comparing the opinions of commercial fishers and diving operators concerning the impact of the MPA on their own business (Figures 8 and 9). Commercial fishers seem to hesitate about the impact of the reserve effect on their activity (Figure 8); the influence of the MPA was considered positive by a majority of fishers in four of the six documented cases, but only in one case was this influence described as “very positive” by more than 20% of respondents. Diving operators have more clear-cut



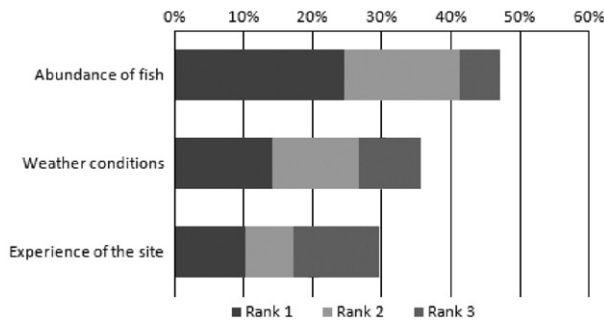
**Figure 8.** Opinions of commercial fishers concerning the impact of the MPA on their own business. *Data source:* EMPAFISH field survey 2005–2006.



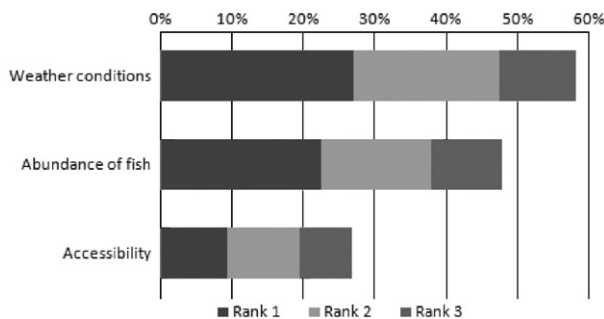
**Figure 9.** Opinions of scuba-diving operators concerning the impact of the MPA on their own business. *Data source:* EMPAFISH field survey 2005–2006.

opinions on the same topic (Figure 9), with a proportion of positive opinions reaching at least 50% in all documented cases, and above 75% in six of the eight cases. Moreover, these opinions were frequently qualified as “very positive” (above 50% in four of the eight cases).

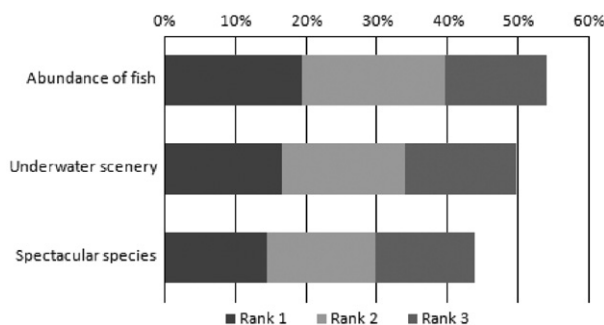
Considering the major criteria mentioned by fishers and divers for choosing a site of activity may help to explain these differences. Figures 10–12 exhibit, for the whole sample (all case studies aggregated), the three major criteria mentioned by professional fishers, recreational fishers, and scuba divers. The proportions and ranking refer, respectively, to the frequency of citations and to the order of priority of each criterion. Unsurprisingly, the figures exhibit the major role played by fish abundance in the choice of fishing or diving site. In the case of fishing, considerations related to fish abundance are balanced by the importance of weather conditions. In the case of scuba-diving, the quality of the



**Figure 10.** Professional fishers' three major criteria for selecting a fishing site. *Data source:* EMPAFISH field survey 2005–2006.



**Figure 11.** Recreational fishers' three major criteria for selecting a fishing site. *Data source:* EMPAFISH field survey 2005–2006.



**Figure 12.** Scuba divers' three major criteria for selecting a diving site. *Data source:* EMPAFISH field survey 2005–2006.

underwater scenery and the presence of some spectacular, or “emblematic” species (e.g. grouper in the Mediterranean), also play a major role.

Several regulations used by MPA authorities are likely to directly influence the state variables that divers regard as major decision criteria (e.g. banning spear fishing in a given place directly influences the abundance, average size and behaviour of fish in this place). This circumstance may account for the positive role acknowledged by divers and, even more, by diving operators to MPAs.

On the other hand, the expected positive influence of MPAs on fishing mainly relies on their alleged spill-over effects (biomass export and larval dispersion from the NTZ to the fishing zone). However, these effects are generally less conspicuous than those divers regarded as important. Moreover, they are partly balanced by the restrictive impact of MPA regulations on the fishing activity. Opinions of fishers concerning the influence of MPA on their activity reflect this ambivalence.

## Conclusion

The aim of this paper was to assess, in terms of incomes and jobs, the local economic impact of human activities representing major uses of the ecosystem services provided by MPAs in southern Europe. Compared to previous monographic surveys, this assessment relies on a fairly large empirical basis, composed of 12 case studies which were analysed with the help of a standardised methodology. Though these MPAs are heterogeneous in terms of size, biogeographic characteristics and management regimes, they share two major similar patterns: (i) related commercial fishing activities are mainly or exclusively small-scale (with provision for one case); and, (ii) they are located in highly touristic zones. As a result, it was necessary to dedicate an important part of the analysis to recreational activities. Due to the very limited availability of pre-existing socio-economic data, the 12 case studies were investigated by means of a large scale socio-economic field survey, with the aim of gathering homogenous information about the profile of users of MPA ecosystem services, their activity, and their perception of the MPA. This information, complemented with data provided by MPA authorities and with exogenous ratios concerning commercial fishing and seaside tourism industry, was processed in order to obtain an estimation of the incomes and jobs generated in the neighbouring coastal zone. The methodology that was adopted to this end relies on two salient features: (i) a distinction between activities transforming MPA ecosystem services into commodities, and activities directly consuming these services for recreational purposes; and, (ii) for this second type of activity, a conservative approach to their local economic impact relying on local expenditure of non-resident users, with a filter based on the motivation of these users.

The results of the assessment display a variety of situations, depending on the relative importance of commercial fishing and of recreational activities.

Though full evidence could not be derived from the field survey, it seems likely that recreational activities are the major economic driver in most cases. Within the recreational sector, the analysis of documented cases suggests that scuba-diving has a larger local economic impact than recreational fishing. Another interesting feature is the fact that estimated local incomes generated by the investigated activities are generally significantly higher than MPA management costs. The question of sorting out the reserve effect from the site effect was addressed with the help of information provided by the field survey concerning MPA ecosystem users' perceptions. This subjective and mainly qualitative approach suggests that the reserve effect is substantially clearer in the case of scuba-diving than in the case of fishing, a conclusion that seems consistent with biological evidence concerning the impact of protection on marine ecosystems and fish populations.

The analysis presented in this paper suffers from some important limitations, calling for further investigations. Some of these limitations are due to the field survey itself, other concern complementary information that was required for the assessment, and a third category is due to the methodology.

Concerning the field survey, practical considerations imposed hard constraints on the scope of investigation. With few exceptions, this scope was limited to fishing and scuba-diving (snorkeling was also investigated in Banyuls, Côte Bleue and Bonifacio, but this part of the survey took place in the specific context of submarine trails, a feature which was found only in these MPAs). Moreover, due to the decentralised organisation of field survey implementation, the range of activities covered and the sampling rates differed substantially from one case-study to another (see Table 3).

As regards complementary information, three major limitations were encountered: (i) knowledge concerning MPA frequentation; (ii) activity zoning is fuzzy (notion of "local" economy) or not fully appropriate (use of administrative limits of the MPA as a proxy for the zone where reserve spill-over effects are significant); and, (iii) due to a lack of data at the proper scale, ratios concerning one of the four countries surveyed were conventionally used for estimating incomes and jobs in the three other countries.

Concerning methodology, the following limitations probably resulted in underscoring the local economic impact of the activities under survey: (i) non-cash incomes, as well as indirect and induced effects, were not considered; (ii) in the case of recreational fishing and scuba-diving, the attribu-

tion factor may be considered as excessively restrictive, since it amounts to retain only the local expenditures of non-resident users who are mainly driven to visit the area by the motivation of fishing or diving. However, this was accepted as a counterpart of the decision to propose a conservative estimation. A more serious problem lies in the fact that the question of the reserve versus site effects could be addressed only on the basis of subjective and qualitative considerations. Considering the state of available data, overcoming this limitation would probably require the help of bio-economic modelling (Sumaila & Charles, 2002), in order to simulate the consequences of the protection measures that are adopted within the MPA.

## Acknowledgements

The research presented in this paper was developed as a part of the research project "European Marine Protected Areas as Tools for fisheries Management and Conservation" (EMPAFISH SSP8-006539) supported by the Commission of the European Communities within the 6th Framework Programme. The views expressed in this work do not necessarily reflect those of the European Commission or anticipate the Commission's future policy in this area. Authors are grateful to MPA managers, to all the persons who contributed to the implementation of the field survey, and to the 1836 persons (commercial and recreational fishers, scuba divers and scuba diving operators) who agreed to spend some time answering the questionnaires forming the main empirical basis of this paper. Special thanks to Fabienne Daurès (Ifremer, UMR Amure, France) for her input concerning commercial fishing.

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