

## Contribution of Marine Protected Areas in Fisheries Governance in South Mediterranean

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### Abstract

When studying fishing activities in south Mediterranean, particularly in Algeria, we face the particular case of coastal territory. The high dependence of human activities on marine territories and their resources is always related to the high level of conflicts, between fishing actors and other stakeholders, generated by some conservation projects. The aim of this paper is to highlight and illustrate the approach of MPAs (Marine Protected Areas) governance and their role in conserving biodiversity, in order to clarify their economic, social and environmental impacts on human activities such as fishing. This paper defends the flowing thesis: in the long term, protection could reduce conflicts, contribute to sustainable management of fisheries and improve the welfare of fishers' community.

**Keywords:** *Governance, MPA, Fisheries, Conservation, Sustainable management, South Mediterranean, Algeria, Taza.*

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### Introduction

Natural resources are extracted without any control of our ecological print, which expands day after day. Seas and oceans for example, which constitute the lungs of our planet (Artus-Bertrand, 2010), are now under pressure, and the threats caused by pollution and anthropogenic activities are extending.

The lack of marine resources has led to the development of new fishing techniques, driving overfishing and proliferation of negative impacts in a larger zone. Therefore, it becomes important to think about conservation of those resources as insurance for the next generations, through the creation of Marine Protected Areas (MPAs).

Ecologically, the creation of such zones is beneficial for the restoration of natural habitats which is directly linked to the recovery of natural characteristics in that environment. But economically, that will be a lagging factor for the development of local communities.

The aim of this paper is to highlight and illustrate the approach of MPAs and their role in conserving biodiversity, in order to clarify their economic, social and environmental impacts on human activities such as fishing.

In the other side, human activities in coastal zones, such as agriculture, fishing, coastal industries and aquaculture, have contributed to chemical, physical and ecological impacts (Lameed, 2012) that may had big effects on ecosystems; changing the abundance of species and their biomass, the populations' genetic, the trophic cascade etc.

Human activities such as tourism and fishing are transforming marine spaces at extraordinary rates and scales, leading to pollution, overexploitation..in addition to climate change impacts. Gendering natural environment degradation and making this capital unproductive, in addition to negative externalities on the local communities and the human well being.

The diversity of marine life has a great richness of ecosystems which plays a central role, maintaining life on earth, and thus to human well being by providing a variety of services (Millennium Ecosystem Assessment, 2006), representing a significant source of biological diversity, water, biomass, oxygen, and other important aspects to human well-being. However, the coastal areas bellow 200 meters are very fragile because of their character of externalities' receptacle of human current development. At the same time, these zones constitute the areas of fish's reproducing and the habitats and nurseries where the larvae hide.

The Panel of The Global Ocean Observing System (GOOS) used in this context the term of the health of the oceans (I. O. C., 2002), which refers to the state of marine environment when speaking about the degradation caused by human activities, such as habitat destruction, changes in the proportion of sedimentation, mobilization of contaminants and climate changes. While the law of the sea (part XII of the LOSC) targets all the effort on controlling and preventing from pollution, marine environment was subject to a far broader range of anthropogenic threats than just pollution (Roberts, 2007). To avoid a complete destruction of natural habitats in marine environment, policy makers can adopt a project of marine environment's conservation, by the establishment of Marine Protected Areas (MPAs), which are the most common policy, to face the lack of resources and the loss in fisheries yield. The results of the simulation will explain the role can be played by MPAs at the local scale.

This kind of research and studies is scarce and could contribute to improving governance including sensitive marine areas. In this context this paper attempts to answer to the following question: How can MPAs contribute to governance of coastal territories and to make balance between environmental and economical objectives?

## **The Need for Fisheries Management and Regulation**

### **Fisheries Management**

When trying to understand fisheries management and regulation, it is important to consider all the aspects and attributes of marine resources affecting short- and long-term fishing behavior and exploitation patterns, both with and without regulation (-Anderson & Seijo, 2010). It is of higher important that policy makers do not have to

manage fisheries, in order to maximize yield at short-term, but to have a global vision at long-term scale yield.

During a long period, fisheries scientists, policy makers and managers were alienated from each other stakeholders (fishers), this has resulted into groups acting for different objectives. The degradation of marine biodiversity made the objectives of both scientists and policy makers into the same road (Weigel et al., 2007), their main objective was the control and regulation of human activities while fishers were focusing on the maximization of their incomes to ensure their survival (fishing more to earn more money) and the survival of their activities, especially for the poor communities in the developing countries.

Policy makers have to consider fishers as the sole stakeholder, without ruling out the others, according to their complete dependence on the sea. Actually, marine resources constitute the only fishers' source of incomes; this is why, they consider MPAs as a cost they incur. Thus, they are generally against conservation projects, and policy makers have to think to make up for their losses.

Further, fishers and environmentalist are in competition, and it's at that moment that a policy may be made to referee the competition in order to ensure both marine resources regeneration and fishers' sustainable income. The aim is to avoid the contrast of view points of the different stakeholders (both conservationists and fishers). That way, all stakeholders have to work together in order to reach a consensus between conservation, economic and social goals and prevent resentment and rivalry between them.

### **The Objectives of Fisheries Management**

A key role for a fishery management is to include the resources' protection, in order to inform about the state of fisheries and enforce rules, including the managing of the access and the activities that can be practiced in it (Goodstein, 2011; Mesnildrey et al., 2010; Motos & Wilson, 2006). Hilborn and Walters (1992) organized those objectives into four categories (Hart & Reynolds, 2002): the biological, the economic, the recreational and the social objectives. It is of particular importance to understand some basic principles about the fisheries resources, in order to come to a mixture of the four types of objectives. Instead of yield's maximization, policy makers have to aim to optimization, through the sustainability of fishing activity at long-term scale.

### **Governance of Marine Protected Areas: The Effects on Fisheries Management**

#### **MPAs Between Conservation and Economic Development**

When studying marine conservation, it's important to understand the marine biology and all parameters that influence fish stocks' behavior and fishing activities in order to highlight the possible economic consequences as far as the human activities are inextricably linked to marine biology.

The most common way to conserve marine environment, and protect vulnerable habitats, ecosystems and marine biodiversity, is the establishment of Marine Protected Areas (MPA).

Since the genesis of the conservation's principle which includes the manner how to manage and protect marine areas, several concepts emerged (PROTECT, 2006; Alban, 2003; Boncoeur et al., 2011; Raffin, 2003) with different degrees of protection such as : Marine park, marine reserve, nature reserve, habitat reserve, protected area, no-take area, multiple-use area, etc. Thus, the conservation's degree varies from a concept to another; differing from highly protected areas, to very large multiple-use areas in which human activities (extractive and/or non extractive activities) are allowed but controlled in order to achieve conservation's goals.

The conservation of marine environment must be regarded as a priority when establishing a public policy aiming to manage natural resources and ensuring their productivity, for that it's important to choose the area to protect very well (Port et al., 2008; Raffin, 2003). The number of MPAs all over the world is increasing; it passes from 118 in 1970 to 319 in 1980. By 1995 Kelleher and al listed over 1300 MPAs - of which 400 concerns the coral reefs-. We noticed that this number quadrupled by the year of 2005 when we count 5127 MPAs. Today there are over 6300 MPAs (Aubertin et al., 2008; Thorpe et al., 2011). Really, the number of MPAs increased considerably in the last 40 years, but many regions and countries remain out of date when speaking about MPAs or even a basic initiative of marine conservation, such as south-western Mediterranean.

### **The Need for Governance of Natural Resources and Marine Territories**

According to the Food and Agriculture Organization of the United Nations (FAO), the term "governance" covers both: (i) the activity or process of governing; (ii) those people charged with the duty of governing; and (iii) the manner, method and system by which a particular society is governed. In fisheries it is usually understood as the sum of the legal, social, economic and political arrangements used to manage fisheries. It has international, national and local dimensions. It includes legally binding rules, such as national legislation or international treaties as well as customary social arrangements.

In the other hand, the World bank defines as the way "... power is exercised through a country's economic, political, and social institutions." – the World Bank's PRSP Handbook.

However, governance refers to the formal and informal laws and traditions of a society, and a working definition is « steering human behavior through combinations of civil society, state, and market incentives to achieve strategic objectives» (Jones et al., 2011).

According to Rhodes (1996), the term of governance is popular but imprecise however governance could be an instrument for allocating resources.

The United Nations Development Programme (UNDP), in its 1997 policy paper (UNDP, 1997), defined governance as "the exercise of economic, political and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differ-

ences”.

Canada's Institute on Governance (2003), defines governance as the process whereby societies or organizations make their important decisions, determine whom they involve in the process and how they render account. Since a process is hard to observe, students of governance tend to focus our attention on the governance system or framework upon which the process rests - that is, the agreements, procedures, conventions or policies that define who gets power, how decisions are taken and how accountability is rendered.

The different definitions given to Governance by the different institutions (FAO, World Bank, UNDP, IOG), turn around the main idea stipulating that governance is based on a participatory process, where all stakeholders are included in the decision process, in order to come to a consensus. Therefore, governance is about the manner how decisions are taken. In our context, we can consider, Governance as efficiency tool for resolving conflicts between different stockholders and to insure sustainable management of territories and natural resources taking in to account, economic efficiency and equity.

To insure sustainable management of fisheries we need control of access to the marine resources thought Marine protected area. In this case we can consider governance of MPAs as tenure governance. “Governance of tenure affects whether, and how, people are able to acquire rights and to protect already existing rights to use and to control these resources. Many tenure problems arise because of weak governance, and the quality of governance affects the attempts to fix these problems (...) The livelihoods of many, particularly the rural poor, are based on secure and equitable access to and control over these resources. They are: the source of food and shelter; the basis for social, cultural and religious practices; and a central factor in equitable economic growth” (FAO ,2012a).

For these reasons, fisheries governance becomes an emergency and interested in both policy-makers and international institutions. To this end, guidelines for governance of fisheries resources and fisheries are often recommended (FAO, 2013).

### **Defining Marine Protected Areas**

In addition to the variety of terms, MPAs have different meanings depending on the categories of stakeholders: some (fishermen) consider MPAs as zones where their activities are constrained, while others (environmentalists and conservationists) have a completely different vision, defining MPAs as a specially managed area designed to restore marine health. We tried to gather some definitions, different examples are listed below.

The most commonly used definition of MPAs is the one given by the International Union for the Conservation of Nature (IUCN) (Resolution 17.38 of the IUCN General Assembly, 1988, reaffirmed in Resolution 19.46 (1994). Both are given in full in Annex 4.), which considers as an MPA “Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the

enclosed environment" (Kelleher, 1999).

Tundy Agardy (1997), in her book, defined Marine Protected Area as any area of the coastal zone or open ocean, conferred some level of protection for the purpose of managing the use of resources and ocean space, or protecting vulnerable or threatened habitats and species.

According to the definitions above, we define MPAs as the special zones that are set aside to conserve marine environment and its resources, through the regulation of exploitation methods in that zone; its long term objective is to come to a sustainable development by the implication of all stakeholders in the management of that area (Chaker, 2012).

### **Goals of MPAs: The Vision**

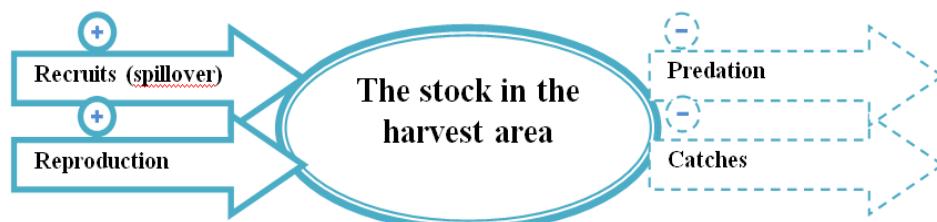
MPAs may be established for a wide range of purposes, Kelleher and Kenchington (1992) assert that there were two primary reasons for applying the MPA concept; The first one is the conservation of biodiversity and habitat, through protecting depleted, threatened, rare, or endangered species of populations and preserving or restoring the viability of representative habitats and ecosystems. The second is the sustainability of fisheries management by facilitating the control of exploitation rates, protecting critical stages of the species' life history, reducing secondary fishing impacts, ensuring against possible failures of conventional regulatory systems and finally conserving life -history traits and genetic diversity.

We noticed that a third category of objectives was born (National Research Council , 2001; Alban, 2003; Boncoeur et al.,2011), including scientific knowledge and providing a source of baseline data, educational opportunities, enhancement of recreational activities and tourism, sustainable environmental benefits and the protection of cultural heritage.

### **The Spillover Effect**

The most important part on literature where about the abundance and size effects of MPAs (reserve effect), while few studies were targets on the orientation of species across the boundaries of the protected area (11) (23). Spillover effect refers to the net flow of fish (larvae and/or adults) from the protected area to the adjacent fisheries, so that the protected area serves as a source of recruits to the surrounding fishery with more frequently spawning (Laboy-Nieves, 2009).

**Figure 1. The evolution of the stock in the harvest area.**



To justify every conservation projects, the most common way is to refer to the spillover effect is, that is responsible of gendering more species in the harvest area. Our hypothesis for the simulation are mainly based on this effect on the biomass and the fisheries yield.

The spill over effect is considered as the effect that will permit to justify every conservation project, gendering more species in the harvest area. It's on that effect and its impacts on the biomass and the fisheries yield, that is based our paper.

### **The Contribution of MPAs Governance to Sustainable Development of Fisheries In Algeria**

“Fisheries generate income, provide food for local, national and international markets and make important contributions to nutrition” (FAO, 2012b; World Bank, FAO & World Fish Center, 2012). South Mediterranean in general, and Algerian coast are known with their traditional small scale fisheries, which is characterized by conflicts between the different stakeholders.

#### **Presentation Of The Project “Taza’s MPA”**

Due to the fishing prohibition in a part of the MPA, fishers are negatively influenced by the creation of such projects. In the following part of the paper, we will try to highlight the main effects of MPAs on the local communities, especially on the fishing activities; the aim of this part is to try to find the economic justification of conservation projects. This was be through a simulation model (Chakour, Blue Plan, 2013). It is a model based on a prospective approach, to estimate on Ex-ante the impact which can generate MPAs on the local development of the Mont Chenoua territory (located in the north centre of Algeria). We tried to apply this model on our case study which is considered as the first real project of MPAs in Algeria, the MPA of Taza (MPAT). The project of Taza’s MPA creation is the pilot project of Algeria led by the Mediterranean Protected Areas Network (MedPAN) in South Mediterranean (from November 2008 to October 2012) and constitutes the continuation of the Interreg IIIC MedPAN Project, initiated by the World Wild Found (WWF).

The marine area linked to the terrestrial zone of the National Park of Taza has a very rich marine biodiversity (more than 617 species of flora and fauna in addition to the population’s diversity, coastal and underwater landscapes...). This zone constitutes an underwater volcanic mountain and has a very important ecological value (PNT, 2009).

A study initiated by the National Park of Taza between 2003 and 2005, reveals the richness of that zone (PNT, 2009), and called the local decision makers to support the conservation project and the area’s classification, in addition to the necessity and the urgency of a rational management for its preservation.

## **Evolution of The Impacts of Taza's MPA Governance on Fishing Activities**

### **Method And Assumptions**

This paper defends the flowing thesis: in the long term, protection could contribute to sustainable management of fisheries and could improve the welfare of fishers' community.

However, we consider that there is an interaction between the protective action of the marine area and fishing activity. The protected area is ecologically homogeneous and has two compartments open to fishing area (the buffer and the peripheral zone) and another compartment closed to fishing called "integral zone". The natural rate change of resources is a function of the density of the stock in the the considered area. There is a transfer flow from the integral zone to the fishing zone. The rate of transfer is related with every zone. Catch per unit of effort is proportional to the density of the biomass in the fishing area after transfer.

Our evaluation is meant to put in evidence the socioeconomic effects resulting from Marine Protected Area. We have based our calculation on data coming from National Park of Taza, local fisheries administration, and other investigations. The following table shows the principal assumptions and data used in this Study.

**Table 1. The Data And Assumptions**

Data And Assumptions	Values
Size of " Taza MPA (Ha)	9603
Size of the integral zone (Ha)	1299
Size of the buffer zone (Ha)	2011
Size of the peripheral zone (Ha)	6293
Current biomass in the protected area in tons:	38000
Transfer rate of the integral Zone to the fishing area	10%
Current catches in tons	6550
Catchability rate relative to the biomass	0,172368421
Average price per ton of fish DZD (Algerian Dinar)	450000
Average price per ton in Euros	4439,533553

**Table 2. Average Growth Rate Per Phase**

Phase	Biomass	Average Growth Rate Per Phase	
	Scenario 1: without AMP	Scenario 2: with AMP	
Present Situation (starting) T = 0	0	0	0
Phase 1: End of 1st year	0%	0%	0%
Phase 2: 3 years after the creation of MPAs	5%	10%	10%
Phase 3: 5 years after the creation of MPAs	3%	40%	40%
Phase 4: 10 years after the creation of MPAs	2%	100%	100%
Phase 5: 20 years after the creation of MPAs	-10%	125%	125%
Phase 6: 30 years after the creation of MPAs	-25%	150%	150%

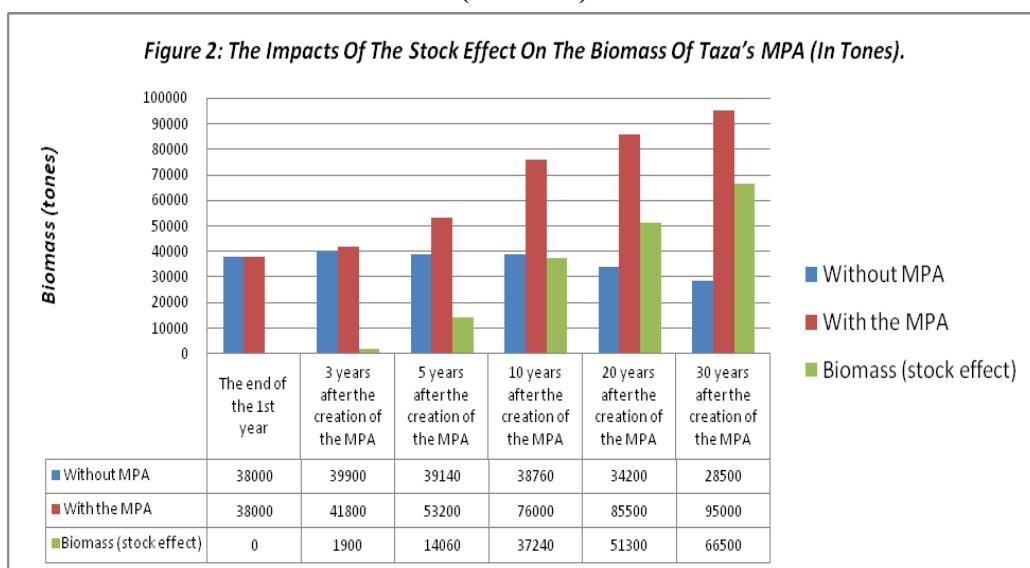
With regard to the fleet, we issued the following hypothesis: the average rate of increase of the fleet is set at 3% per year during the first 20 years (or for phases 1, 2, 3 and 4). After this period, the rate becomes zero (for phases 5 and 6).

Since it is progressing project, and the real effects of the MPA have not yet started to appear, two scenarios are proposed in order to clarify the main differences between two cases (with and without MPA) in the short-term (between 0 and 3 years), medium-term (between 3 and 5 years) and the long-term (between 5 and 30 years), in order to justify or not the conservation project.

The dynamic of this evolution was based on two hypothesis related to the increasing rate of biomass and the captures evolution. In this context, we tried to estimate the possible evolution of the most important determinants of fishing activities and their impact on the catches and the fishing yield through two aspects; the biological one (populations' dynamic, biomass evolution in the MPA, estimation of the stock's effect) and the economic one (evaluation of the production, costs, incomes, estimation of the evolution of prices).

### **The Evolution of The Biomass Under The Stock Effect In The MPA (In Tones)**

**Figure 2: The Impacts Of The Stock Effect On The Biomass Of Taza's MPA (In Tones)**



Source: Chakour And Chaker, Results Of Our Research.

The graphic above represents the changes in term of biomass in the MPA for the two scenarios, taking in consideration the biomass resulting from the stock effect in the case of the second one.

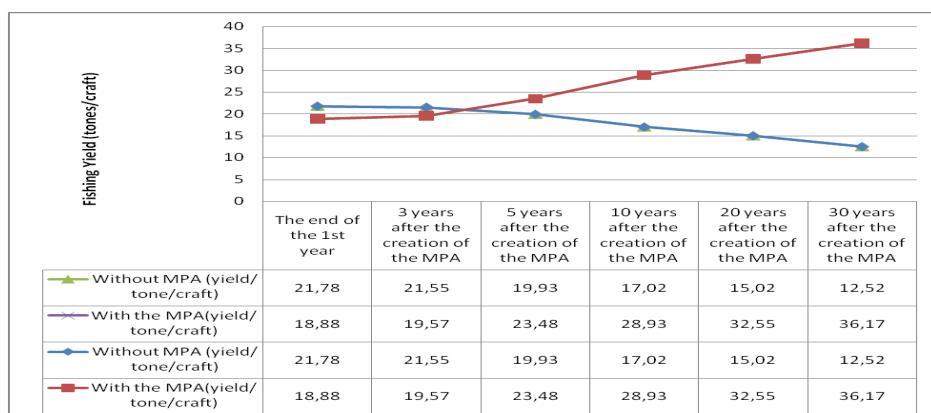
The data we have collected from the local administration of fisheries and fishery resources shows that there is a decline of fisheries resources in that region, despite of the increasing investments in that sector since the last 10 years (Chakour, 2012; Chaker, 2012), more than that, they will tend to be rare if there is no sustainable management applied to fisheries.

The results of the simulation demonstrate that if the MPA is not established, the fisheries stocks will tends to collapse in the long-term, loosing  $\frac{1}{4}$  of the stock in the next 30 years. In return, the establishment of the MPA will allow the renewal of population's stock and the progressive increasing of the biomass at the same time, ameliorating the health of the marine environment; the biomass will be multiplied by 2 after 10 years after the MPA's creation and by 2,5 after 30 years. These results show the interest of creating marine protected area and the effects of conservation on the renewal of resources in the medium and long term.

When taking in consideration the increasing in term of demographic pressure on marine resources combined to its negative externalities on the environment and the health of the oceans, we can make the conclusion that the contribution of the MPA is considerably important with the growing of the biomass which will have a positive effect on the fishing yield and consequently, on the human well-being of local fishers community in addition to the sustainable development of the considered sector.

### **The Evolution Of Fishing Yield: Comparison Between Biological And Technical Yield For The Two Scenarios**

**Figure 3. The evolution of the fishing yield: comparison between biological and technical yield for the two scenarios**



Source: Chakour And Chaker, Results Of Our Research.

The graphic above confirms the conclusions of the precedent, since the profits start to be generated from the fifth year of conservation for the second scenario.

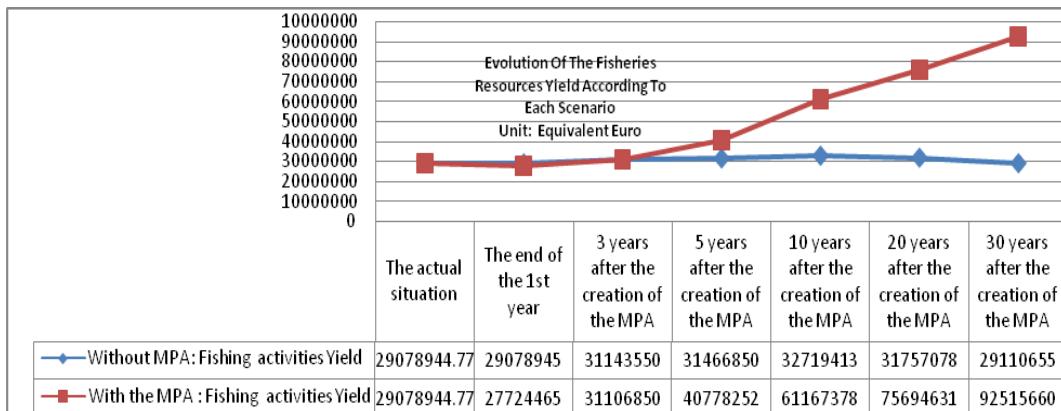
Despite the loss carried from the 20th year for both the first and the second scenario, this decreasing in term of profits is more important for the second scenario and the divergence between the two is too important.

This result reinforce the thesis specifying that MPAs have positive effects on the development of fishing activities, gendering the amelioration of the local human well-being of fishers' community. But it's important to notice and assert that the real positive effects of MPAs do not appear at short- and medium-term; i.e. from the fifth year of its implementation. Thus, the effects of MPAs on the fisheries resources yield will be noticed in the long-term. So, the creation of marine protected area will improve the returns from fishing to medium and long term and will have positive effects on the fishermen's livelihoods.

#### **The Evolution Of The Fisheries Resources Yield According To Each Scenario (Equivalent Euro)**

The analysis of the graphic above shows that catches have the same evolution that the fisheries yield (turnover of fishing activities). Nevertheless, the monetary loss (the loss in term of turnover) expected just after the creation of the MPA (first 3 years), will be less important, because of the increasing of the prices of fish products, even if the catches are reduced.

**Figure 4. The Evolution of The Fisheries Resources Yield According To Each Scenario (Equivalent Euro)**



Source: Chakour And Chaker, Results Of Our Research.

This increasing in prices constitute a compensation of the loss registered in term of fish production's mass (due to the decreasing in the fishing effort) and accelerate the raising of the related yield.

In addition to that, fish products have a very high market value and are considered in this region as a staple product and an important source of protein and other nutri-

ments, they are rooted in the local culinary habits. Therefore, it is sure that the reduction of the quantities fished will generate an increasing of the prices of the sea products.

when conserving a part of the fish stock from collapsing and losing all its characteristics (through the part of the stock in the integral zone, and which plays a role of an insurance stock), MPAs participate to the protection and the sustainability of fishing activities, through a sustainable management of natural marine resources, and preventing from fluctuations of the production which emphasize the feeling of uncertainty and insecurity linked to human marine activities.

### **Conclusion**

MPAs are different from all other management tools for marine fisheries, they could be considered as a tool for public policy which aims to sustain marine resources. However, governance of MPAs is based on the modification of the actual ways used to manage fisheries traditionally. Such governance must be established on net bases, taking in consideration all the parameters to achieve initial objectives.

Our study showed that the MPAs can be a solution for fisheries management, in the way that they allow resources' regeneration and the stock reconstruction. Even if MPAs require the restriction of fishing activities, this must not be a lagging factor to fishers. Through the stock effect, MPAs permit to reconstruct stock and biomass, which is beneficial for fishing activities which depends on their catches.

The results of the simulation testify that catches in the fishing area will increase at the long-term because of the reserve effect. As a mirror, this rising will be reflected on the catches and on fishers' incomes.

To justify conservation projects and the need for the governance of MPAs, we tried to compare the actual situation without the establishment of the MPA to the case with the MPA. On the one hand, the result shows that there are real differences in term of biomass (in the fishing area), catches and yield, so even if in short- and medium-term it's better to not to establish the MPA. In the long term (and this is very important for the resources sustainability) it is necessary to conserve the resource for the protection of human well-being through sustaining fishing activities. More than that, MPAs will permit the increasing of the yield of their incomes and their well-being. On the other hand, these results show that if the MPA is not created, the biomass will decrease gendering a reduction of catches and the fishing yield which will have a great effect on the welfare of fishermen Community.

Finally, when thinking to establish a new MPA, policy makers have to think about the optimal solution to avoid the refusal of such project by fishers, in his context, many solutions can be proposed to help fishers at short- and medium-term, in order to conserve their activities at long-term. Governance of Marine Protected Areas (MPAs) can support sustainable development of fisheries and insure efficiency and equity by reconciling conservation and sustainable development. So, MPA could be an efficiency tool for governing marine's territories and ensure sustainable development of fisheries.

However, our study presents some limits which could be taken into account for more analysis. The use of Cost-Benefit-Analysis needs real and trustworthy data. In our case, all data is collected from local institutions and investigations. Our analysis does not take in consideration some recreational fishery activities. Because of the absence of some biological and environmental data, it's so difficult to integrate some ecological services in the Cost-Benefit-Analysis.

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