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Marine Conservation in a Southwest Portuguese Natural Park

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ABSTRACT

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Most of the SW Portuguese continental coast is protected by a natural park (Parque Natural do Sudoeste Alentejano e Costa Vicentina – PNSACV). A marine zone 2 km wide has been designated along the coast of this park (ca. 130 km) with oceanic sandy beaches, extensive rocky shores, and small estuaries and coastal lagoons. In this coast, intensive and traditional fisheries affect several target species for subsistence, commercial use or recreation. Most regulations are national and almost no specific regulations are in place to allow sustainable exploitation. Control and enforcement are generally insufficient or ineffective and the decrease of catches and the increase of fishing effort are apparent. In order that these resources and habitats can be exploited sustainably, there is an urgent need for taking management and conservation measures, like the effective use and update of existing regulations and the designation of marine protected areas. The restoration of exploited populations in marine reserves is one of several potential benefits of this protection, as well as the export of fish biomass to adjoining areas and the improvement of conservation, education, science, tourism and recreation. The existing marine protection of this natural park is an opportunity for taking such management and conservation measures, in an adaptive and integrated process that should allow co-responsibility of users and managers. We present a review of estimates of intensity and yield of fisheries, data on users perception of management and conservation needs, and proposals for the implementation of a marine conservation programme in PNSACV through the designation and management of marine protected areas.

ADITIONAL INDEX WORDS: *Fisheries intensity and yield, Fishermen perception, Co-management, Marine protected areas*.

INTRODUCTION

Several marine protected areas have been designated in Portugal, namely in the Atlantic islands (SANTOS *et al*., 1995; FERRAZ *et al.*, 2001), but many have no management plan and most lack its implementation (KELLEHER *et al.*, 1995; CRUZ, 2000; ANDERSSON *et al.*, 2003). A non-governmental Portuguese organization has recently concluded that "*marine biodiversity in Portugal is very high, but so it is the degradation caused by overfishing, pollution and poor coastal management practices*" (ANDERSSON *et al.*, 2003).

In the natural park "Parque Natural do Sudoeste Alentejano e Costa Vicentina" (PNSACV; Figure 1), located in the SW coast of continental Portugal, a marine zone 2 km wide along its coast was designated since 1995. With almost 130 km length, it comprises oceanic sandy beaches, extensive rocky shores, and small estuaries and coastal lagoons. However, intensive fisheries affect several target species for subsistence, commercial use or recreation in this coast (CASTRO *et al.*, 2000; CRUZ, 2000; CASTRO, 2004).

In marine PNSACV, there is a lack of specific regulations to allow sustainable exploitation, control and enforcement are generally insufficient or ineffective and the decrease of catches and the increase of fishing effort are apparent (CRUZ, 2000; JESUS, 2003; CASTRO, 2004). As well as in commercial fisheries, gathering food and bait for subsistence or recreation is expected to increase in severity worldwide and continue to cause major impacts on marine communities (THOMPSON *et al.*, 2002).

Tourism, agriculture and fisheries are the main economic activities in this natural park. In order that the marine resources and habitats can be exploited sustainably, there is an urgent need for taking management and conservation measures. The existing marine protection of this natural park is an opportunity for taking such measures, but in an adaptive and integrated process that should allow co-responsibility of users and managers.

We present a review of estimates of intensity and yield of fisheries published elsewhere (*e.g.* CASTRO, 2004; DGPA, 2008), unpublished data on fisheries and on users perception of management and conservation needs, and proposals for the implementation of a marine conservation programme in PNSACV through the designation and management of marine protected areas (MPAs).

PROBLEMS AND OPPORTUNITIES

Fisheries

In PNSACV, the highest fishing effort is probably made for commercial purposes. Main fishing ports are located near both northern (Sines) and southern (Sagres, Lagos and Portimão) ends of this park (Figure 1). Other small fishing ports can be found along its coast. In 2007, the total amount of marine fish landed at

all these ports was 22843 tons, although only 248.4 tons were landed at those small fishing ports (fresh weight; DGPA, 2008). However, these fisheries data refer to a much greater region than marine PNSACV and the real catch and effort made by commercial fisheries in this park are not known.

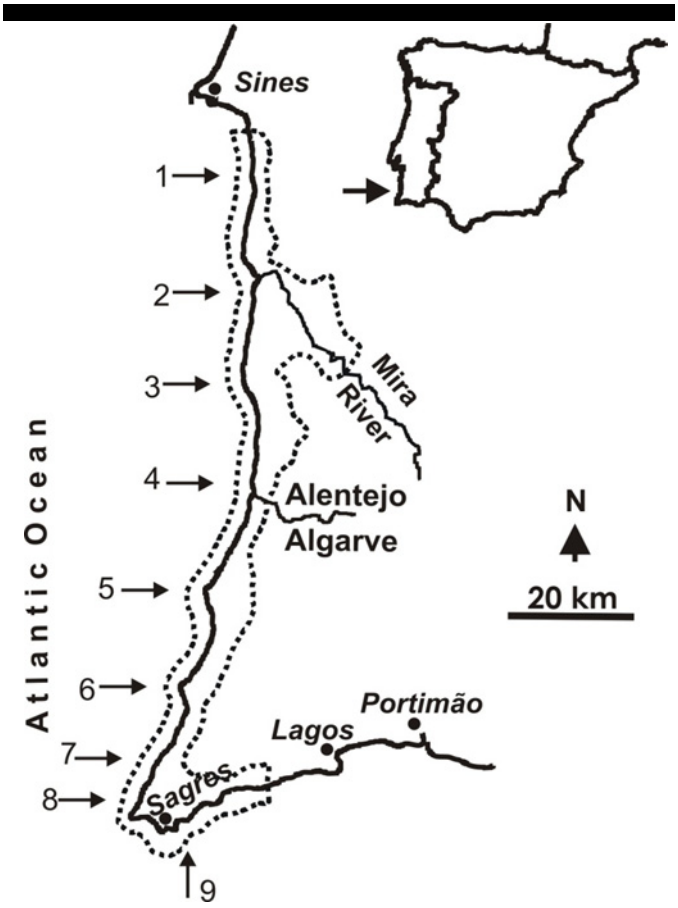

Figure 1. The natural park PNSACV (area within the dotted line) and location of MPAs (1- "Ilha do Pessegueiro", 2- "Nascedios", 3- "Cabo Sardão", 4- "Carvalhal/Castelo Velho", 5- "Monte Clérigo/Arrifana", 6- "Pontal da Carrapateira", 7- "Torre de Aspa", 8- "Telheiro", 9- "Ilhotes do Martinhal") proposed by CASTRO (1996).

Other fishing activities include those made for subsistence, recreation or sport. Subsistence and recreational fishing are traditional in Portugal and in the SW continental coast they generally exploit intertidal or shallow subtidal rocky shores and target shellfish and teleost fishes (CASTRO, 2004). Shellfish collecting is mainly done on the low shore and almost exclusively during low tide (except in free-diving fishing). In this coast, shore angling is the most frequent recreational fishing activity, but at a lower intensity at both low and high tide. Other common activities are bait collection during low tide, boat angling and free-diving fishing. Fishing competitions are allowed in PNSACV and generally involve shore angling or spear fishing.

No official fisheries statistics are known on catches made for subsistence, recreation or sport. CRUZ (2000) and JESUS (2003) present some data on the stalked barnacle *Pollicipes pollicipes* catches made in PNSACV. However, most of these catches are made for commercial purposes. CASTRO (2004) presents estimates of intensity and yield of fishing activities made on rocky shores of Alentejo (most of the rocky shores of Alentejo are located in PNSACV; see Figure 1). The intensity and yield of boat angling are unknown.

Since 2006, a licence is required for recreational angling or free-diving fishing in continental Portugal. From the fisheries governmental agency website (http://www.dgpa.min-agricultura.pt/), the total number of these licences valid in October 2008 was 131 218. Of these, 72 684 (55.4%) were valid to fish in PNSACV. Most of these licences (58 445) allowed shore angling, 10 427 allowed to angle from the shore or using a boat and 3 812 allowed free-diving fishing and angling.

During 1994-96, mean daily values of intensity of all human activities (including amenity use), shore angling and low tide shellfish gathering were, respectively, 7.8, 2 and 9.4 persons per kilometre of coastline on rocky shores of Alentejo (CASTRO, 2004). According to this study, human use of rocky shores of Alentejo was regular but generally more intensive during summer, at low spring tides, over weekends or holidays, on shores near sandy beaches intensively used for tourism, and when the sea roughness, wind intensity and sky cloudiness were lower. The higher intensity observed during summer and weekends/holidays may be related to a recreative use of the shore due to a higher abundance of people using the shore for recreation. However, the regularity of human predation suggests that the predatory use of the shore may also be important for subsistence, and in the case of some valuable preys (e.g. the stalked barnacle *P. pollicipes*, the seabass *Dicentrarchus labrax* or the white seabream *Diplodus sargus*), for commercial reasons.

Comparing intensity and yield values of fishing activities made on rocky shores of Alentejo and other similar coastal habitats, CASTRO (2004) concluded that those observed in Alentejo were higher or as high as some estimated on other countries coasts where several conservation and management measures were taken or proposed to protect exploited living resources and habitats (reviews by UNDERWOOD, 1993, SIEGFRIED, 1994, CASTILLA, 2000, CASTILLA and DEFEO, 2001 and MORENO, 2001).

Since 2006, several restrictions to recreational fishing activities are enforced in continental Portugal, including those made on rocky shores. Nowadays, shellfish collection with tools is forbidden, and several bag and size limits have been imposed. According to direct observations made on rocky shores of Alentejo during spring low tides (J. J. CASTRO, unpublished data), abundance of shellfish collectors was higher in 1995 and lower in 2007 (working days) or 2008 (weekend/holidays), but this variation was not significant in shore angling and bait collection.

Due to life history characteristics and intra- and interspecific interactions, many target species are vulnerable to human exploitation and their stocks can be easily overexploited (DYE *et al.*, 1994). Prey species are abundant and active consumers (e.g. fishes, octopuses, crabs, limpets) or important space occupiers (e.g. stalked barnacles, mussels) and its intensive removal and predation may have important, direct and indirect, and lasting negative effects on the exploited populations with consequences at the community level (HOCKEY, 1994; MORENO, 2001; THOMPSON *et al.*, 2002).

Scientific knowledge on the biology and ecology of the exploited populations and their communities, and on the impacts of these activities, is still scarce in marine PNSACV. However, studies made on this coast (CANÁRIO *et al*., 1994; SILVA *et al*., 1998; SANTOS *et al*., 2003) have found stocks fully or intensively fished (e.g. the knobbed triton *Charonia lampas*, the common spiny lobster *Palinurus elephas*, the axillary seabream *Pagellus acarne*, the black seabream *Spondyliosoma cantharus*, the striped red mullet *Mullus surmuletus* and the white seabream *Diplodus sargus*), stocks in risk of overexploitation (e.g. the agarophyte

algae *Gelidium sesquipedale*, the common seabream *Pagrus pagrus*, the common pandora *Pagellus erythrinus* and the common two-banded seabream *Diplodus vulgaris*) and a stock overexploited (the seabass *Dicentrarchus labrax*). On rocky shores of Alentejo, the exploitation rate of the purple sea urchin *Paracentrotus lividus* was not considered to be a risk for its conservation and the stock of the china limpet *Patella ulyssiponensis* was considered to be moderately fished, but the stock of the stalked barnacle *P. pollicipes* was considered to be highly to fully fished (CASTRO, 2004).

Considering recreational (on rocky shores) and commercial fisheries, CASTRO (2004) estimated a total annual yield of 5.9 tons per km^2 in the coast of Alentejo. On open continental shelves with upwelling-type circulation of medium latitudes (the case of continental Portuguese coast, but see FIÚZA *et al.*, 1982), BAX and LAEVASTU (1990) considered that an annual yield of 4.5 to 8 tons per km^2 of an intensive fishery is sustainable.

Perception

From 2005 to 2008, direct inquiries were made in the coast of Alentejo to know the opinion of rocky shore fishermen (shellfish collectors and anglers) on their fishing activity and on management and conservation issues related with this activity (J. J. CASTRO, unpublished data). A total of 362 fishermen (192 shellfish collectors and 170 anglers) were interviewed during their fishing activity or just before they left the shore. Eight rocky shores were sampled in Sines municipality (Figure 1), six of them in northern PNSACV.

Most fishermen (76.4%, N=360) considered that catches have been decreasing since they begun this activity (58% do it for more than 20 years). However, most (65.3%, N=340) did not agree that rocky shore fishing negatively affects the yield of this activity, and the majority (78.2 and 72.4%, respectively; N=340) blame it on pollution and trawling.

Almost all (98.3%, N=361) answered that the fish or shellfish taken was going to be eaten by themselves or by their family or friends. Only 3% (N=361) told that they were going to sell some part of their catch. Most fishermen (71.2%, N=361) told they were fishing for recreation, 37.4% were fishing because this activity is important to get food for them, for their family or friends (11.1% chosen both options), and only 3.3% considered that this fishing activity is important to their own economy or their family's.

Regarding marine resources conservation and fisheries management, the majority (78.2%, N=362) agreed that measures are necessary to be taken on rocky shores of Alentejo. Most popular measures were (N=288): minimum size/weight of preys (75.7%), one annual closed season (73.3%), more and better control (65.6%) and continuous no-take marine reserves in some areas (63.9%).

In 2008, commercial fishermen were interviewed in the ports of Sines and Porto Covo (Sines municipality; Figure 1; J. J. CASTRO, unpublished data). Regarding marine resources conservation and fisheries management, the majority (87.5%, N=48) agreed that new measures are necessary to be taken on the coast of Alentejo. Most popular measures were (N=42): one annual closed season (88.1%), co-management of certain areas (57.5%, N=40), rotation of fisheries closures in space and time (45.2%) and continuous no-take marine reserves in some areas (45.2%).

PROPOSALS AND RECOMMENDATIONS

Marine conservation programme

In marine PNSACV, most regulations are national and almost no specific regulations are in place to allow sustainable exploitation. Control and enforcement are generally insufficient or ineffective and the decrease of catches and the increase of fishing effort are apparent (CRUZ, 2000; JESUS, 2003; CASTRO, 2004; perception data presented above). Marine PNSACV existing protection is an opportunity for taking special measures on marine resources conservation and fisheries management. Besides, such measures are apparently socially acceptable and required among local fishermen (see above). Potential benefits of these measures are the restoration of exploited populations in MPAs and with special regulations, the export of fish biomass to MPAs adjoining areas and the improvement of conservation, education, science, tourism and recreation (DYE *et al*., 1994; GUBBAY, 1995; CROWE *et al.*, 2002; PALUMBI, 2001).

As a natural park, PNSACV was created to protect natural, cultural and other values, and also for the sustainable use of resources and habitats. So, the main goal of a marine conservation programme to be accomplished in PNSACV is to ensure long-term protection and maintenance of biological diversity and ecological functioning, while providing at the same time a sustainable flow of natural products and services to meet community needs.

As seen above, fisheries are intensive, traditional and have high economic importance in the coast of this natural park. The success of such a marine conservation programme is highly dependent on community involvement (ODENDAAL *et al.*, 1994; WELLS and WHITE, 1995; KELLEHER, 1999; SALM *et al.*, 2000) and is strongly needed a co-management approach that should allow co-responsibility of users and managers in an adaptive and integrated process (ATTWOOD *et al.*, 1997; CASTILLA, 2000, CASTILLA and DEFEO, 2001, COCKCROFT *et al.*, 2002; MOLARES and FREIRE, 2003).

According to CASTRO (1996; 2004), this marine conservation programme should: (1) designate and create a network of small oceanic MPAs, involving local communities in their selection and management, to act as benchmarks for environmental public awareness, (2) simultaneously, protect PNSACV estuaries and coastal lagoons for a sustainable multiple use, increase control and enforcement, and protect overexploited stocks with special regulations, (3) before 1 and 2, and afterwards, raise public awareness on the objectives of protection, as well as on their scientific basis, (4) at the same time as 3, start monitoring biological, social and economic factors to assess protection effects and help management, and (5) some years later, redraw the MPAs network and management to integrate conservation and management at the PNSACV scale.

MPAs

The location of the small oceanic MPAs proposed by CASTRO (1996) is presented in Figure 1. Instead of some large MPAs, a network of small ones may be more socially acceptable and manageable, at least in an initial phase. Although the protection of a large MPA may be more effective, specially for species with high adult or larval movement, small no-take zones can be effective and may be more desirable for enhancement of recruitment to overfished species if they are numerous enough and close enough to allow hopscotching between them (BOTSFORD *et al.*, 2001; PALUMBI, 2001).

This MPAs network has a total length of ca. 40 km, equivalent to ca. 30% of total length of PNSACV coastline. Several authors

(see review by PALUMBI, 2001) consider that 20% protection may represent a minimum level at which MPAs provide both diversity and fisheries benefits. However, this amount is clearly not enough to provide optimal fishery benefits in most cases and several authors proposed values higher than 35% (BOTSFORD *et al.*, 2001, 2003; ROBERTS *et al.*, 2006).

Considering IUCN categories of protected areas, CASTRO (1996) proposed (see Figure 1) the designation of two Natural Monuments on two groups of small islands ("Ilha do Pessegueiro" and "Ilhotes do Martinhal"), three Protected Seascapes on low use areas ("Nascedios", "Cabo Sardão" and "Carvalhal/Castelo Velho"), two Habitat/Species Management Areas on medium use areas ("Torre de Aspa" and "Telheiro") and two Managed Resource Protected Areas on high use areas ("Monte Clérigo/Arrifana" and "Pontal da Carrapateira"). Using the simplified taxonomy of MPAs proposed by PALUMBI (2001), the first two MPAs above mentioned are mainly focused on ecosystem diversity, requiring local effects to be visible within the boundaries of the reserve; the others are focused on fisheries (fisheries reserves), requiring export of a reserve effect from the boundaries of the MPA to the adjoining region.

However, the two MPAs mainly focused on ecosystem diversity should be no-take zones and will also tend to export biomass, and the fisheries reserves should have core (no-take zone, in the centre) and buffer (co-managed fishing zones, northwards and southwards) zones in order to provide both ecological and economic benefits.

In all MPAs, visitation should be allowed in order to raise public awareness on the effects of protection and for the improvement of non disturbing touristic (e.g. nature tourism, scuba diving), educational, scientific and recreational activities.

On the fisheries reserves, fishing should be subjected to regular biological planning and monitoring and restricted to the less disturbing and more selective activities and fishing gears (traps or longlines). With the goal of achieving sustainability, the fishing effort should be defined and controlled by the natural park, the fisheries authorities/agencies and organisations of fishermen through co-management. Priority should be given to local organisations of professional fishermen, in order that co-management is feasible and economic benefits of protection help meet community needs.

Co-management through territorial user rights for fishing (TURFs; CASTILLA, 2000) should be implemented in the case of stalked barnacle *P. pollicipes* fisheries, adapting the system used since 1992 in Galicia, NW Spain (MOLARES and FREIRE, 2003). This measure should be taken in zones of marine PNSACV important for *Pollicipes* fishing, namely in co-managed fishing zones of future MPAs, where recreational fishing of this barnacle should be avoided.

TURFs and individual quotas (transferable or non-transferable; CASTILLA, 2000) should also be implemented to co-manage other commercial fisheries in marine PNSACV, namely in fishing zones of future MPAs, incorporating fishermen as active role-players in the processes of management.

CONCLUSIONS

In marine PNSACV, fisheries are intensive and traditional, and one of its main economic activities. In order that marine resources and habitats can be exploited sustainably, there is an urgent need for taking management and conservation measures, like the effective use and update of existing regulations and the designation of MPAs. The restoration of exploited populations in MPAs is one of several potential benefits of this protection, as well as the export of fish biomass to adjoining areas and the improvement of conservation, education, science, tourism and recreation.

The existing marine protection of this natural park is an opportunity for taking such management and conservation measures, in an adaptive and integrated process that should allow co-responsibility of users and managers.

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