

## DEFINING A STRATEGY FOR MONITORING MARINE LITTER IN THE PROTECTED AREA OF ASINARA ISLAND, BY INVOLVING THE LOCAL COMMUNITY

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<https://doi.org/10.11118/978-80-7509-963-1-0041>

### Abstract

Environmental pollution, especial of water bodies is the main problem of the local authorities. The main objective of the present study is to develop some actions to raise awareness among the fishermen and all actors involved, identifying the most vulnerable areas from the point of view of marine pollution. The study area is the Asinara Island (Sardinia Island, Italy), one of the most vulnerable protected area face to marine litter pollution whose argument is fishing activities by "Fishing for Litter". The methodology consists of field investigations, questionnaires, cartography, and data collection regarding the typology of marine litter. The analyses also include interpolations, correlations, GIS, cartographic and statistic models. The main results is the network of fishermen ("The Guardians of the Sea") for the efficiency of the fishing activities as an useful tool for the main actors involved keeping a clean environment.

**Keywords:** Marine pollution, fishermen community, tourism activities, marine waste, vulnerable areas

### Introduction

Marine pollution became an important environmental issue in the last decades, and a lot of actors became interested in being involved to solving it. The main objective of this study is to identify the vulnerable areas from the marine litter pollution point of view and to develop some actions of sensibilizing the local communities and all the actors involved. The main purpose is to define some strategic actions for maintaining a clean environment.

Marine Protected Areas (MPAs) are a widely used protection strategy, but there are questions about their impact on the economy of the communities in their vicinity. The scientific literature assessing the impact of MPAs has identified five indicators of community well-being: food security, right to resources, employment, community organization and income. Food security generally remained stable after the establishment of MPAs, or even increased in older and smaller MPAs. Access to resources was positively correlated with MPA zoning and compliance with the regulations governing these protected areas. The results of the analyzes demonstrate that MPAs influence the standard of living and the political and administrative involvement of fishing communities; the impacts they have, both positive and negative, differ within and between social groups; at the same time social impacts are correlated with some – but not all – explanatory factors used in the working hypotheses. MPAs may thus represent a viable strategy for increasing food security and engaging local communities, but current practices negatively affect at least a minority of fishers. For policymaking, further research needs to better argue and explain the differentiations of positive and negative social impacts of MPAs (Mascia *et al.*, 2010).

In terms of management, various approaches have been proposed to analyze the alarming depletion of marine resources in coastal areas. One of these would be community management and the establishment of marine protected areas (MPAs). The failure to effectively include local communities in the design and implementation of relevant protection measures is reflected in the poor performance of MPAs. Community management, in fact a hybrid form of management, which ideally builds on existing local management practices. The main challenge of this process is the development of adequate frameworks to support successful participation in the management process of local communities. Review of studies on MPA design and community-based marine resource management, as well as field observations, provide clues on how to address current socio-economic disparities in MPA design and implementation, while

successfully involving local communities to provide a better basis for the creation of larger and more effective MPA networks. For conservation approaches to be successful, a combination of tools is needed as a formal framework and community-based natural resource management, as an adaptive core that recognizes the relevance of local communities as partners, not competitors (Ferse *et al.*, 2010).

Community priorities can be identified through individual and group interviews with users who are knowledgeable about the resources. A decision support tool is the maps that were made and capture the priorities of communities on the one hand and those of scientists on the other and were very similar for coastal areas, which gives credibility to both approaches. Resource users consider maps based on scientific analysis necessary in highlighting areas important from the point of view of the conservation process, but rather prefer an integration of the two approaches. Spatial variation in human impact on marine areas, as well as variation in commercial fishing, both represent protection costs. The results highlight the value of integrating approaches based on community and scientist priorities in conservation planning to achieve community buy-in and, of course, conservation utility. Also, community assessments based on their traditional ecological knowledge can be used as a reasonable proxy for scientific approaches in selecting areas of ecological value (Ban *et al.*, 2009).

The acceleration of ecosystem degradation has influenced the increase in the number of proposals to expand protected areas (PA), potentially affecting the means and livelihoods of local communities (IPLC). The benefits of multifunctional PAs emphasizing the management role of IPLCs have long been recognized. Quantitative analyzes of how resource governance and the distribution of management rights affect conservation outcomes are, however, critical to the long-term sustainability of the protected area. Study results suggest that well-governed, multifunctional PAs can achieve conservation goals without undermining IPLC rights (Fidler *et al.*, 2022).

Globally, the objectives of marine protected areas (MPAs) have changed, from a focus mainly on maintaining ecosystems by prohibiting extractive activities, to more equitable approaches that address both the needs of people and the needs of nature. This has resulted in MPAs with a diverse range of fishing restrictions as well as debates about the type of restrictions that will contribute to the achievement of biodiversity objectives. For example globally, 172 MPAs (representing 31 nations) alongside nine detailed case study MPAs (Australia, Belize, Cambodia, Federated States of Micronesia, Fiji, Indonesia, Madagascar, Solomon Islands and the United States of the Americas), plus partially protected areas that allow regulated fishing, have been used to illustrate the many measures that some MPAs have adopted to protect biodiversity and protect the rights and livelihoods of dependent coastal communities of these resources. MPAs are grouped based on their restrictions and analyzed from four key perspectives that emerge from these groupings: (i) for fisheries regulation, MPAs use very diverse approaches; (ii) gaps in regional fisheries management in the case of partially protected areas can be addressed; (iii) chosen fishing restrictions are influenced by the transfer of resource management rights to communities; (iv) highly tailored fishing restrictions can be used to increase equity in access to resources, in the case of state-governed MPAs. It is noted that in the case of partially protected MPAs, biodiversity conservation, effective and equitable solutions can be identified if they are adapted to the local context. It is thus recommended that a combination of locally appropriate levels of protection – from fully protected areas to partially protected MPAs – be used to achieve the new global MPA targets to achieve positive biodiversity conservation outcomes (Andradi-Brown *et al.*, 2023).

Overfishing has reduced fish biomass and resulted in fragmentation of food webs, weakening the resilience of ecosystems. Carbon emissions led to ocean warming and acidification, with negative impacts on marine biodiversity, and sea level rise threatens communities in coastal regions. Plastic waste breaks down into microplastics that significantly affect marine life (Entwistle *et al.*). The unprecedented threats facing the oceans and seas require urgent and coordinated global action. Reference to other effective area-based conservation measures and recognition of traditional territories has laid the foundations for successful action to halt biodiversity loss, but progress needs to be monitored to ensure that the livelihoods and property rights of local communities are not compromised. However, we need to ensure that area-based marine conservation networks are designed and managed with the agreement, participation, and leadership of local stakeholders. By initially adopting a small-scale, community-based approach, we ensure that existing and newly designated sites achieve objectives, benefit

marine ecosystems and the communities that rely on them and provide a solid foundation for scaling up effective marine conservation and. fair. Ongoing support has strengthened the traditional fisheries management system and created partnerships between fishermen and local authorities (Church *et al.*, 2023).

## Material and Methods

### a. The Study area

The study area is the European Marine Protected Area of Asinara, located in Sardinia Island (Italy). The protected area represents a small territory, about 50 km<sup>2</sup> (51,9 km<sup>2</sup>) with a length of 17.4 km, with a range of 290 m, a hilly territory, situated in the north-western part of the Island. The highest point is 408 m in Punta della Scomunica. The area is an inhabited territory, one of the important parts of the National Parks system of Italy, a state property. (Figure 1).

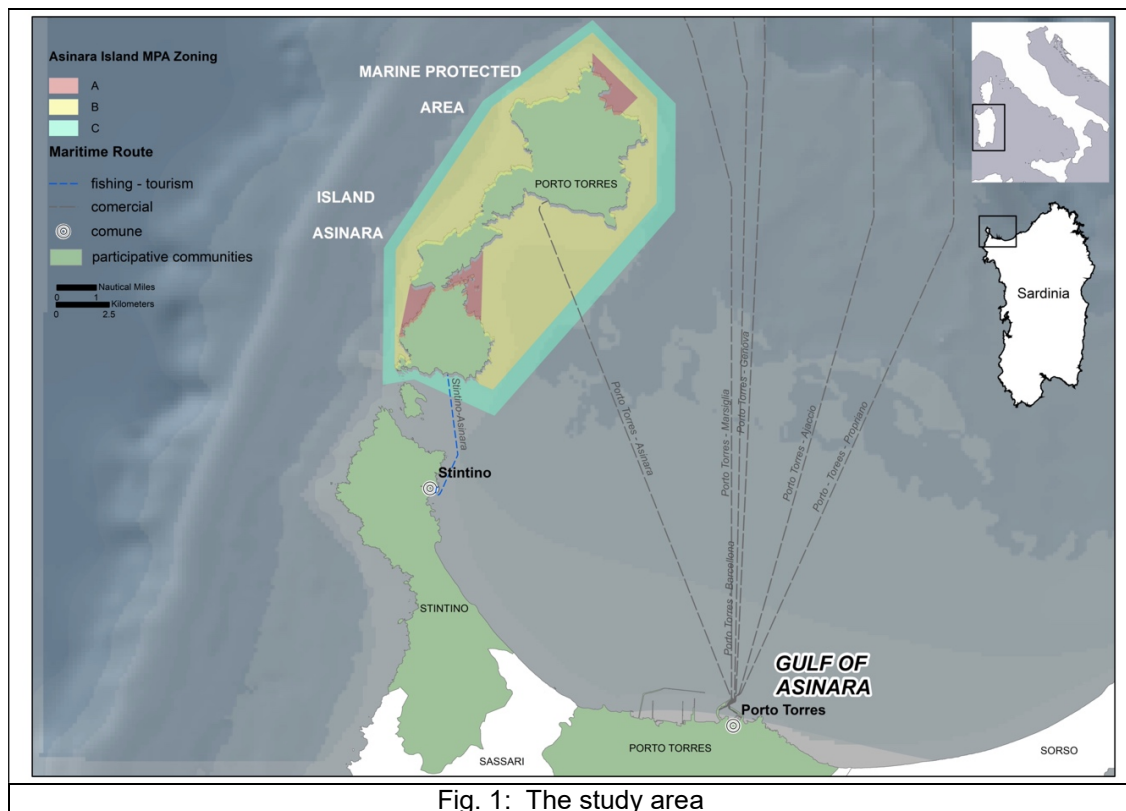


Fig. 1: The study area

### b. Data collection

The study is part on a specific project based on the cartographical documents, open-source data, and some field investigations. The participants were the community of fishermen (about 50 participants) involved, in their daily activities, in focus groups, answering questionnaires, participative cartography, data collection regarding the typology of the marine litter (Figure 2). They were trained how to identify marine litter, how to take their GPS coordinates, to take photos and trying to collect them (if possible). The analyses consisted of interpolations, data correlations and GIS methods.

## Results

The main results of the study were obtained by involving the fishermen community. Their participation was a great contribution to the study. Their main activity for the study was to identify the marine litter on and in the water, to take its GPS coordinates, to photo them and trying to collect it, if possible.

Their multiple preferences for the fishing areas (Figure 2) identified the areas where the marine litter is present, also. Most of them (35 fishermen) prefer the 4<sup>th</sup> area (23%), a coastal area between the two ports Stintino and Porto Torres, then the 3<sup>rd</sup> area (21%), that partially belongs to the Marine Protected Area of Asinara. Some minor preferences were for the 1<sup>st</sup> (11%), 2<sup>nd</sup>

(15%) and the 6<sup>th</sup> area (14%), the latter ones located in the western and north-eastern part of the area.

Regarding the typology of the marine litter identified in the fishing areas on their routes (Figure 3) could be classified into five major types: most of them are plastic (in red – 20.5%), multi-material (in yellow – 12%) wood (in green – 4%), misc (in purple – 2.5%) and glass (in turquoise – 1%).

The distribution of the marine litter overlays both on commercial and touristic routes (40% along the waterways, until 1000 m buffer area), 17.5% between waterways and other in the coastal area. The sources of the marine litter are also diverse; 45% from them (especially plastic and misc.) could have as possible determinant the sea transport and tourism activities. The state of the marine litter identified was 47.8% already collected and taken onboard, 37.7% adrift, 4.5 failed onshore.

The marine litter that was floating were identified along the eastern and western shores of Asinara Island and off the Bay.

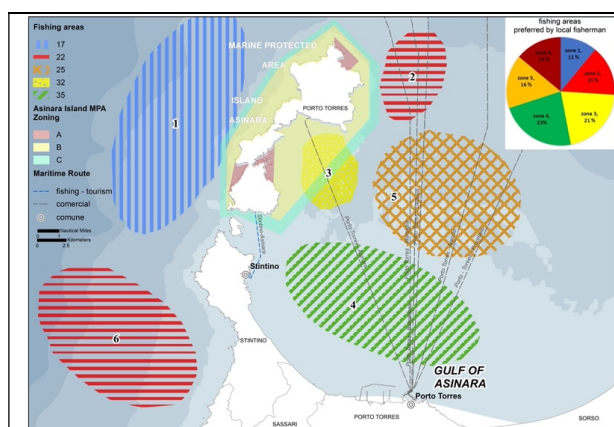


Fig. 2: Main routes preferred by fishermen for fishing

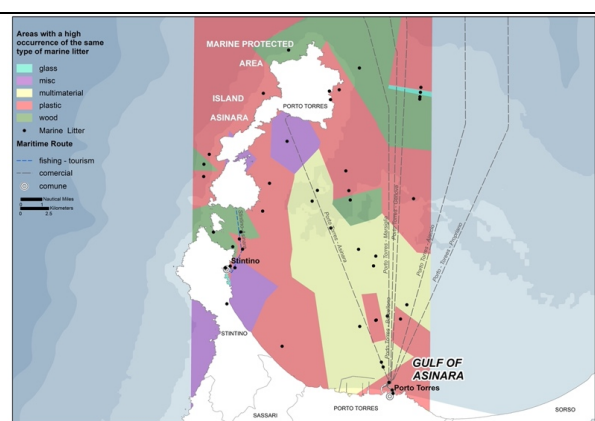


Fig. 3: Typology of the marine litter

## Discussions

During our study, some aspects were identified and demonstrated:

- the main area of concentration for the marine litter. Their GPS position illustrates the main distribution along the transportation corridors, but in very small distances between them (sometimes, even tens meters).
- the distribution of the marine litter depends on the natural factors (wind, local sea streams, seasons, etc) and socio-economic ones. Marine litter is predominant in the meridional part in the springtime and septentrional in the summertime. As main possible causes: tourism and wind direction. There is a seasonal difference between the spatial distribution of the marine litter between April to June and between July and August.
- only a permanent monitoring of the main transportation corridors allows the identification of the main sources and types for the marine litter;
- the efficiency of data collection, by the fishermen, they should be financially stimulated or receiving some royalties (kilos of fish/kilos of marine litter);
- the data collection and GPS data demonstrate the necessity of involving the fishermen in these activities, because only they are able to cross and to navigate along the water corridors (routes);
- the density and the frequency of the marine litter could be diminished through the contribution (involvement) of the fishermen, in their quality as "Guardians of the Sea", because they could prevent the spreading of the marine litter.

## Conclusions

The study demonstrated the need for a real involvement of the local community in the awareness and the preservation of the natural resources they have. The involvement of the local communities in preserving their environment represents a win-win relation between all the

actors. By receiving any royalties, they could get even more involved in these volunteer actions, to be more efficient and intensive.

An increasingly accelerated growth of the tourism phenomenon in the last period, especially after the pandemic crisis of 2019, when this phenomenon must recover from the accumulated losses. The role of local communities, in general, but of fishermen, in this case, of the Guardians of the Sea is becoming increasingly important and contributes to shaping a new form of tourism: civic tourism. This new form of tourism is based on the exploitation of natural and socio-economic tourism resources, through the involvement of local communities.

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## Souhrn

Znečištění životního prostředí, zejména vodních ploch, je hlavním problémem místních orgánů. Hlavním cílem této studie je vypracovat některá opatření ke zvýšení informovanosti rybářů a všech zúčastněných subjektů a určit nejzranitelnější oblasti z hlediska znečištění moří. Studovanou oblastí je ostrov Asinara (ostrov Sardinie, Itálie), jedna z nejzranitelnějších chráněných oblastí, která čelí znečištění moří odpady a jejímž argumentem je rybolovná činnost "Fishing for Litter". Metodika se skládá z terénního šetření, dotazníků, kartografie a sběru dat týkajících se typologie mořského odpadu. Analýzy zahrnují také interpolace, korelace, GIS, kartografické a statistické modely. Hlavním výsledkem je síť rybářů ("Strážci moře") pro zefektivnění rybářských činností jako užitečný nástroj pro hlavní aktéry podílející se na udržování čistého životního prostředí.

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