



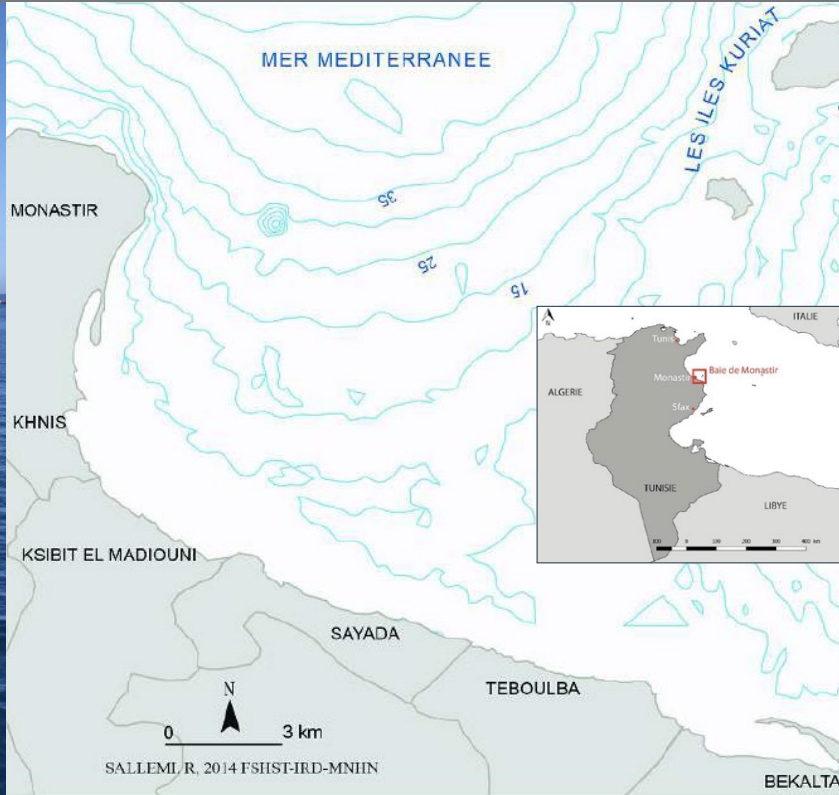
IUCN Aquaculture and Marine Conservation

TUNISIA CASE STUDY

Offshore Finfish Cage-Farming and the Marine Protected Area of the Kuriat Islands in Monastir Bay



Floating aquaculture cages at Monastir Bay © R le Gouvello.



Geographical location of the Kuriat Islands MPA and the Monastir Bay (CAR/ASP - PNUE/PAM, 2014).



“The second case study explores the important issue of the proximity between fish cage culture and marine protected areas (MPAs). Sustainable fish cage culture and MPAs are both important to address the elements of the post-2020 global biodiversity framework of the Convention on Biological Diversity as well as to meet the Sustainable Development Goals (SDGs) by 2030. Fish cage culture have impacts on local ecosystems but by looking for synergies and opportunities between aquaculture and marine conservation, solutions can be identified for making aquaculture sustainable and marine conservation efficient and to meet the need to reconcile nature conservation and sustainable development. This case study provides concrete illustrations of the value of joining efforts for conserving vulnerable and important habitats and supporting local economy.”

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MPA short description

The Kuriat Islands are two islands located in the North East part of the Monastir Bay (Tunisia). The Monastir Governorate area covers about 1,024 km² and is inhabited by 548,000 people¹. Tourism and fisheries are essential activities for the local economy. Monastir is the first seafood producer in Tunisia and the fishing sector is one of the main pillars of the local economy, with five fishing ports and important fishing grounds along 64 km of coastline. Furthermore, Monastir is one of the most important areas for tourism in Tunisia. The Kuriat Islands are distinguished by their natural characteristics and their important role in maintaining the socio-ecosystem equilibrium of Monastir Bay. They were identified as a sensitive natural area through the census of biological diversity in Tunisia, conducted by the Ministry of Environment and Spatial Planning (MEAT) in 1995. The coastal marine environment is subject to many anthropogenic pressures which are threatening

the local marine ecosystems, in particular the *Posidonia oceanica* meadows (Sallemi, 2017).

In this context, the Ministry of the Environment in Tunisia as well as APAL (Coastal Protection and Planning Agency) proposed the establishment of a marine protected area (MPA) in the Kuriat Islands in their second report in 2000 about the management of sensitive coastal areas. This proposal included a sustainable and integrated management plan that takes into account all the marine activities while having a priority to preserve the environment.

The initiative has a participatory governance approach and also involves the non-governmental organization (NGO) "Notre Grand Bleu"². The creation of an MPA in the area was difficult, as a legal and institutional framework did not exist, however, the Law number 13 of 6



Artisanal fishing in Kuriat area © Notre Grand Bleu.

1 <http://www.ins.tr/>

2 <http://www.notregrandbleu.org/home>

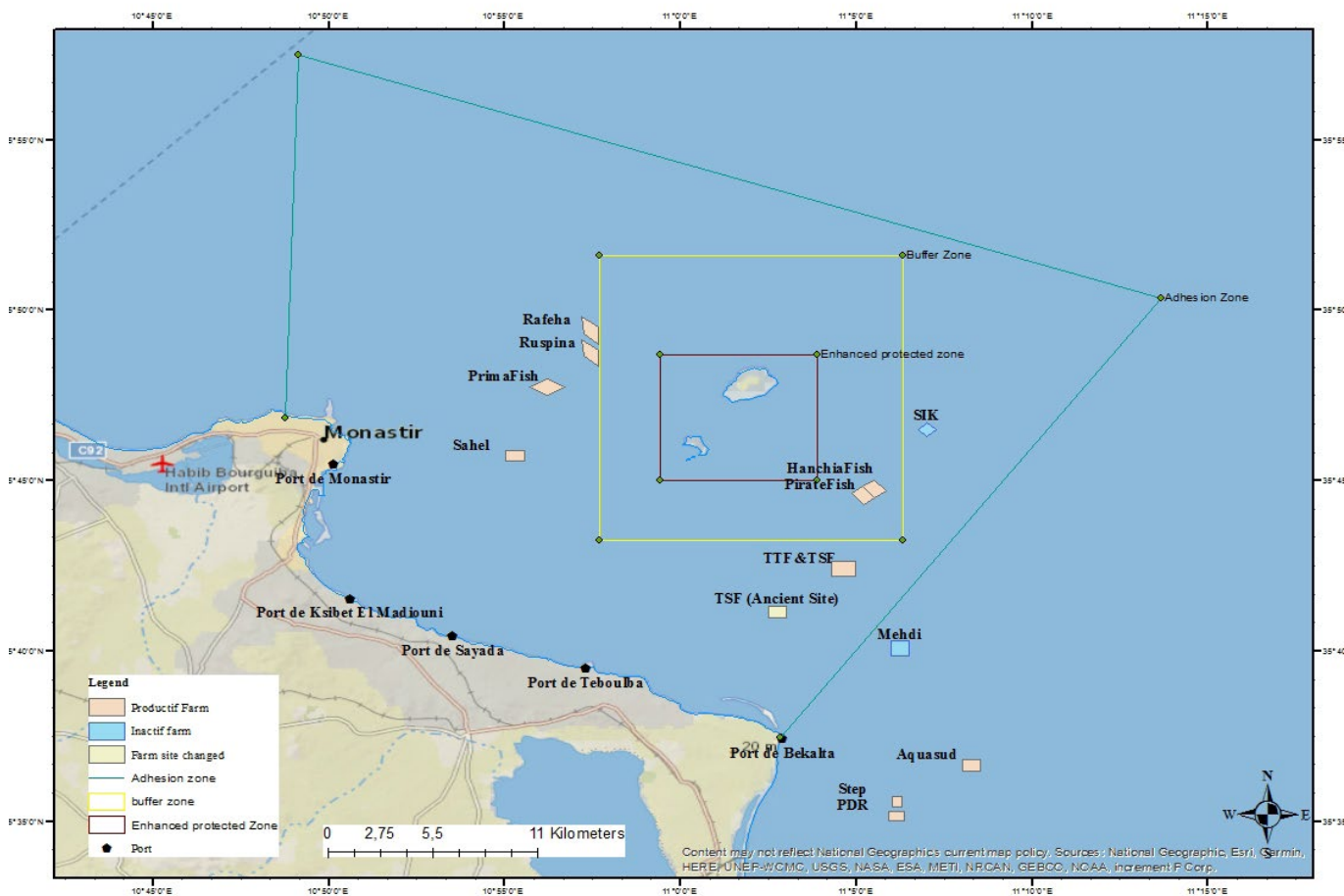
July 2009³, provides a legal framework allowing for the establishment of an MPA.

Starting in 2015, studies were conducted on the Kuriat Islands as part of the “Regional project for the development of a Mediterranean network of marine and coastal protected areas” and “Towards an ecologically representative and efficiently managed network of Mediterranean Marine Protected Areas” MedMPANet Project. This project, led by the Specially Protected Areas Regional Activity Centre (UNEP/MAP - SPA/RAC, Tunis), is part of the Strategic Partnership for the Large Marine Ecosystem of the Mediterranean (MedPartnership).

SPA/RAC carried out all activities of the project in collaboration with APAL. The objectives in the scope of the pilot action plan were to create, plane, zone and develop the future marine protected area of the Kuriat Islands. The overall goal was the development of a management plan, identified and constructed based on

information gathered during the assessment, diagnosis and implementation of integrated management of the site.

The SPA/RAC proposed an MPA with different zones. The objective of zoning will essentially be the protection and conservation of the sensitive species and limitation of conflicts of use. The proposed reinforced central protection zone (red square: 4,143 ha) is dedicated to conservation, where activities are limited and regulated to protect the main features of conservation importance (*Posidonia oceanica* meadow and maërl bottoms) and their immediate environment; an in-between area, a buffer zone (yellow square: 15,531 ha) where activities that are not harmful to the environment can be carried out (including artisanal fishing); and finally a transition zone (red square: 64,389 ha) where human activities are restricted to environmentally friendly practices (CAR/ASP - PNUE/PAM, 2015).



Zoning system of Kuriat Islands (CAR/ASP - PNUE/PAM, 2015).

3 <http://www.fao.org/gfcm/activities/aquaculture/sipam/haso-nalo/en/>

Main MPA and aquaculture facts

MPA	Type (IUCN⁴ category)	Cat. I to V: Strict Protection Zone: 4,143 ha Buffer zone: 15,531 ha Transition zone: 64,389 ha
	Surface area	84,403 ha
	National status	Public
Aquaculture	Type	Intensive. Floating cages for seabass and seabream. Hatcheries. Fish feed plants.
	Number of farms in 2020	11 productive farms out of 13 granted licences.
	Surface area of productive farms	The surface of concession varies between 24 and 80 ha. The total granted surface of concessions is 569 ha.
	Creation date	Offshore aquaculture cages were created in 2008.
	Organization type Investors, ownership, capital, shareholders	Private Tunisian Investors.
	Production	About 14,065 tonnes in 2019 with a value of 52 million euros. Full Time Employments: 600. Total granted capacity of production is about 18,600 tonnes/year (productive farms in 2019).

According to the Report of the survey on marine habitats and main species in the Kuriat Islands (CAR/ASP - PNUE/PAM, 2010), the marine and coastal area of the Kuriat Islands is characterized by an extraordinary biodiversity. The area presents a wide variety of habitats and species that are of great importance for the Mediterranean, and which provide important ecological and biological functions for the Kuriat ecosystem.

The Kuriat Islands host remarkable marine habitats characterised by a very good conservation status. These habitats include *Cystoseira* shallow forests, sponge gardens, rhodolith associations, *Cymodocea nodosa* meadows, and *Posidonia oceanica* meadows. *Cystoseira* forests are well developed around the rocky bottoms of the Kuriat Islands, and sponge gardens are located in both Kuriat Islands, exhibiting a rare high density for the Mediterranean Sea.

In addition, associations with rhodoliths of various species of unattached red calcareous algae (similar to maërl, but more dispersed) can be found at much shallower waters than the rest of the Mediterranean and are considered very rare and vulnerable.

Furthermore, *Cymodocea nodosa* meadows occupy a large area in the Kuriat Islands. They are found on fine and muddy sand, as well as on rocky areas. *Cymodocea* meadows are important as nursery areas and feeding grounds.

Finally, *Posidonia oceanica* meadows are a priority habitat, whose conservation is necessary. *Posidonia* provides a valuable habitat for fish and is very well represented around the Archipelago of Kuriat where it extends between 0 and 27 m. However, despite the excellent transparency of the water, the densities of *P. oceanica* remain modest in comparison with other regions of Tunisia, which may be due to

4 IUCN uses seven MPA categories:

Protected area category and International name	Management objectives
Ia - Strict Nature Reserve	for science
Ib - Wilderness Area	to protect wilderness qualities
II - National Park	for ecosystem protection and recreation
III - Natural Monument	Managed mainly for conservation of specific natural/cultural features
IV - Habitat / Species Management Area	for conservation through management intervention
V - Protected Landscape / Seascape	for conservation and recreation
VI - Managed Resource Protected Area	for the sustainable use of natural ecosystem

the impact of fishing gear dragging on the bottom.

As far as species of conservation interest are concerned, the waters of Kuriat host the loggerhead turtle *Caretta caretta*, the bottlenose dolphin *Tursiops truncatus*, the endangered fan mussel *Pinna nobilis* and seahorses *Hippocampus* sp. The loggerhead turtle is one of the most characteristic species of the Kuriat Islands, nesting on the beaches of both islands, which constitute the most important nesting area for *Caretta* in Tunisia.



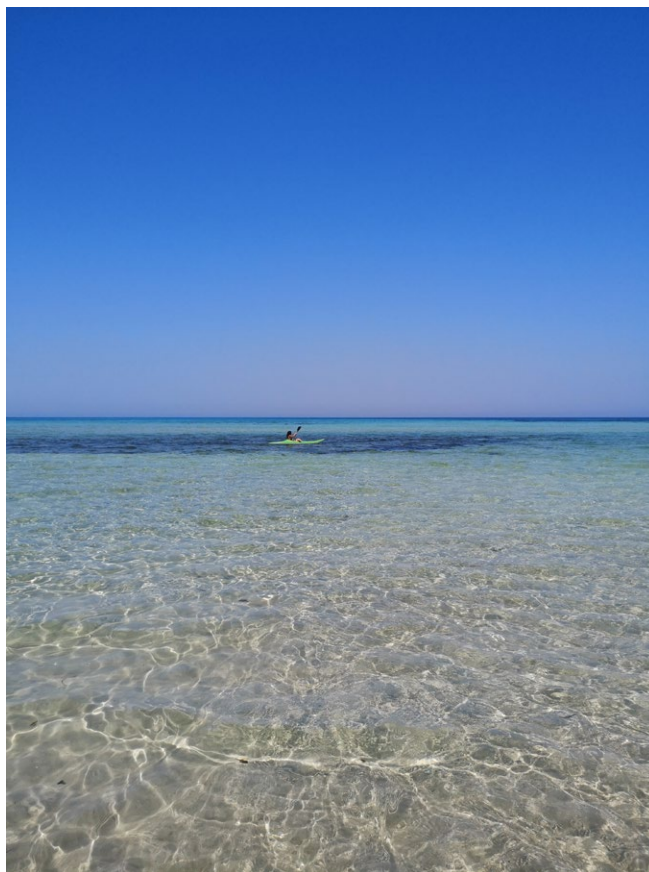
***Cymodocea nodosa* meadows in Kuriat © Notre Grand Bleu.**

The main pressures from human activities on the valuable Kuriat marine ecosystems include fishing and tourism. Apart from the decrease of fish stocks, fishing pressure involving towed gear on the bottom may cause the destruction of the seagrass meadows. As far as tourism is concerned, a large number of tourists visit the islands during the summer period, particularly the small Kuriat Island (around 20,000 per year/season), and tourist numbers in the region display an increasing trend. The impacts include

frequenting the *Caretta* nesting beaches during the nesting period, as well as physical destruction of *Posidonia* meadows by the anchors of vessels.



Dead sea turtle hatchling © Notre Grand Bleu.



Kayaking on Kuriat islands © F. Simard.

MPA management

The participatory approach of the MPA Kuriat is part of the implementation process. This approach enabled the preparation of the management plan in 2015. The association Notre

Grand Bleu launched its CEPF-TN65414 project, entitled “Conservation of the Kuriat Islands and the Bay of Monastir through the involvement of the civil society and the private sector”, funded

by the Critical Ecosystem Partnership Fund (CEPF), and with the support of APAL, the French Coastal Conservatory (Conservatoire du Littoral), and the Initiative for the Small Mediterranean Islands (PIM), to implement the management plan. The project involved the different stakeholders in a participatory approach with the creation of a local multi-stakeholders committee to support the management of the Kuriat Islands in February 2016.

In 2017, a joint management unit for the MPA Kuriat was created with the support of the

MedFund, and became the body in charge of coordinating, implementing and supervising all management activities related to the MPA, including: (i) ensuring the preparation of future work programs and annual budgets based on the management plan; monitor the physical and budgetary execution of annual action plans; (ii) assessing the participation of partners and evaluate the actions carried out in conjunction with them; (iii) examining and evaluate the monitoring and progress reports of the activities; and (iv) exchanging results with other stakeholders and with the Local Committee.

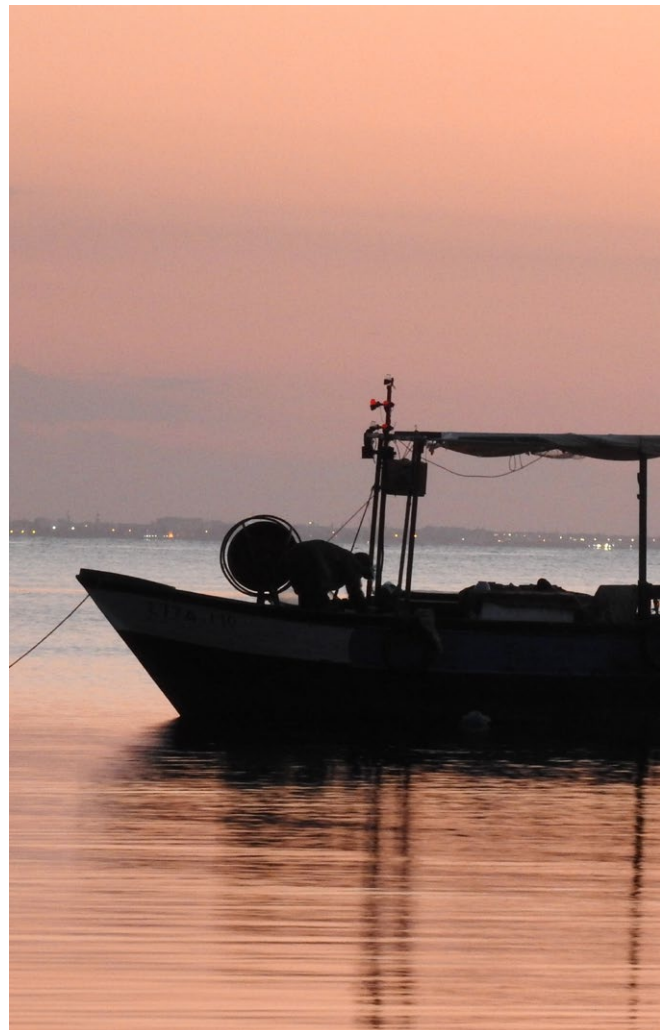
Activities and resource use in the MPA

The richness of the ecosystem makes it possible to develop certain economic activities (such as fishing, tourism and scuba diving) in the region of Monastir. Much of the inshore fishing activity in this region takes place close to the Kuriat Islands. During the summer season, one of the islands welcomes around 20,000 tourists per season on daily tourist excursions.

1. Fishing activities

The Bay of Monastir has 5 fishing ports. Fishing is a traditional activity in Monastir Bay, contributing to the identity of the area, but has strongly industrialized over the past years. It generates a production of 19,000 tonnes in 2019 with a turnover of nearly 29 million euros annually and employs around 1,176 active boats and 5,000 fishermen.

Among the most prevalent types of fishing in this area are purse seiners and small-scale fisheries. The fisheries production during the last 10 years has remained stable, while aquaculture production has been increasing (DGPA, 2019).



Artisanal fishing in Kuriat area © Notre Grand Bleu.

2. Tourism

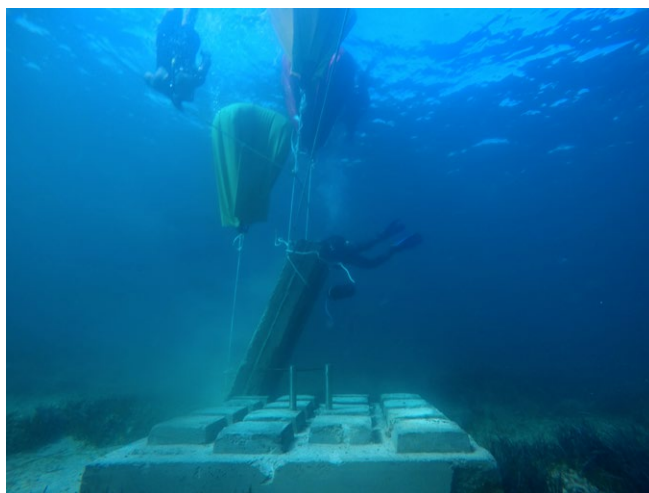
The tourism activities within the Monastir Bay are essential to the local economy. Monastir is one of the most important areas for tourism in Tunisia, with a capacity of more than 21,000 beds⁵.

The touristic attractiveness of the Kuriat archipelago is high. The Kuriat Islands, mainly the small one, constitute a place of relaxation for visitors (up to nearly 700 people per day, with a maximum of 1,200 during weekends) during June, July and August for many years, in the form of a private beach operated by six local touristic boat owners (boatmen). The islands have also always attracted scuba divers through the beauty of the underwater landscapes of the archipelago.

It should also be noted that the local environmental organization, Notre Grand Bleu, in coordination with the authorities, worked on the implementation of an ecological anchoring area for these touristic boats. These involved the immersion of six ecological moorings with artificial reefs and the organisation of volunteer patrols to raise awareness of fishermen and tourists.



Caretta caretta in the Kuriat Island © Notre Grand Bleu.



Immersion of ecological anchoring in Kuriat © Notre Grand Bleu.

Aquaculture activities within the MPA

Aquaculture activity within Monastir Bay is considerably recent; in fact, private investment in floating aquaculture cages started in 2008. Currently, 11 farms are productive, which represents more than 50% of the active farms in Tunisia. Aquaculture activity in the Bay results in more than 600 direct jobs (accounting for 62% of national direct jobs resulting from marine fish aquaculture).



Fish harvest from the floating aquaculture cages at Monastir Bay © F. Simard.

5 <https://www.onnt.tn/ar>

All farms operate at a depth ranging between 30 to 45 meters. They occupy a total area of 569 hectares, and each farm accounts for 10 to 50 cages (diameters between 22 and 40 m). A total of about 300 cages are installed with a total volume of about 1,352,613 m³. The volume of the installed cages would allow for the production of 18,600 tonnes, but the current production amounts only 76% of the granted capacity due to local market limitations.

Aquaculture production increased from 780 tonnes in 2009 to 14,065 tonnes in 2019, its contribution to the national production from marine fish farming rose from 28% to 65%, and from 4% to 43% in the regional fish production, recording an annual average rate of 34% in that same period. The farmed species are sea bream (83%), sea bass (15%) and meagre (2%).



Sea bream harvest from the floating aquaculture cages at Monastir Bay © H. Houssam.

The main inputs for marine aquaculture are feed and fry, representing more than 90% of the production cost. The average annual feed consumption over the last five years (2015-2019) is 27,000 tonnes. The imported quantities decreased from 74% in 2015 to 37% in 2019. As for fry, the average annual consumption in the same period is 55 million fry, of which 80% are imported.

The export of aquaculture product is about 2,900 tonnes for a value of 12,237 thousand euros (21% and 22% of the tonnage and value of local aquaculture product, respectively). This local production represents 82% of the

national exported aquaculture product in 2019. The exported quantity is shipped directly from the process plants belonging to the producers and intended for fresh consumption, especially towards Libya, Gulf countries (Saudi Arabia, UAE and Jordan), Italy and Canada (DGPA, 2019).

Despite the remarkable development of aquaculture and the technical proficiency of this activity, the production stagnated in the last three years, due to several factors such as:

- High production costs due to the dependence on the import of inputs and equipment, and the devaluation of the Tunisian dinar,
- Local market limitations,
- Lack of a development and management plan for the integration of aquaculture in coastal zones to prevent conflict with other activities, especially artisanal fisheries,
- Lack of good aquaculture practices especially for environmental and zoosanitary issues.

To overcome these difficulties, accompanying measures must be adopted to improve aquaculture performance and ensure its sustainability, such as:

- To support and raise awareness of the local aquaculture committee on the importance of this activity and its provision with decision-making tools to promote governance and social acceptability of aquaculture,
- To implement a legal and institutional framework enhancing the aquaculture sector and strengthening supervision and assistance of the activity,
- To implement allocated zones for aquaculture (see Box),
- To assess the environmental impact of aquaculture and to establish an official environmental monitoring program,
- To strengthen the sanitary and zoosanitary monitoring of the activity,
- To establish a guide of good practices for aquaculture,
- To support species diversification and new technologies (multitrophic aquaculture).

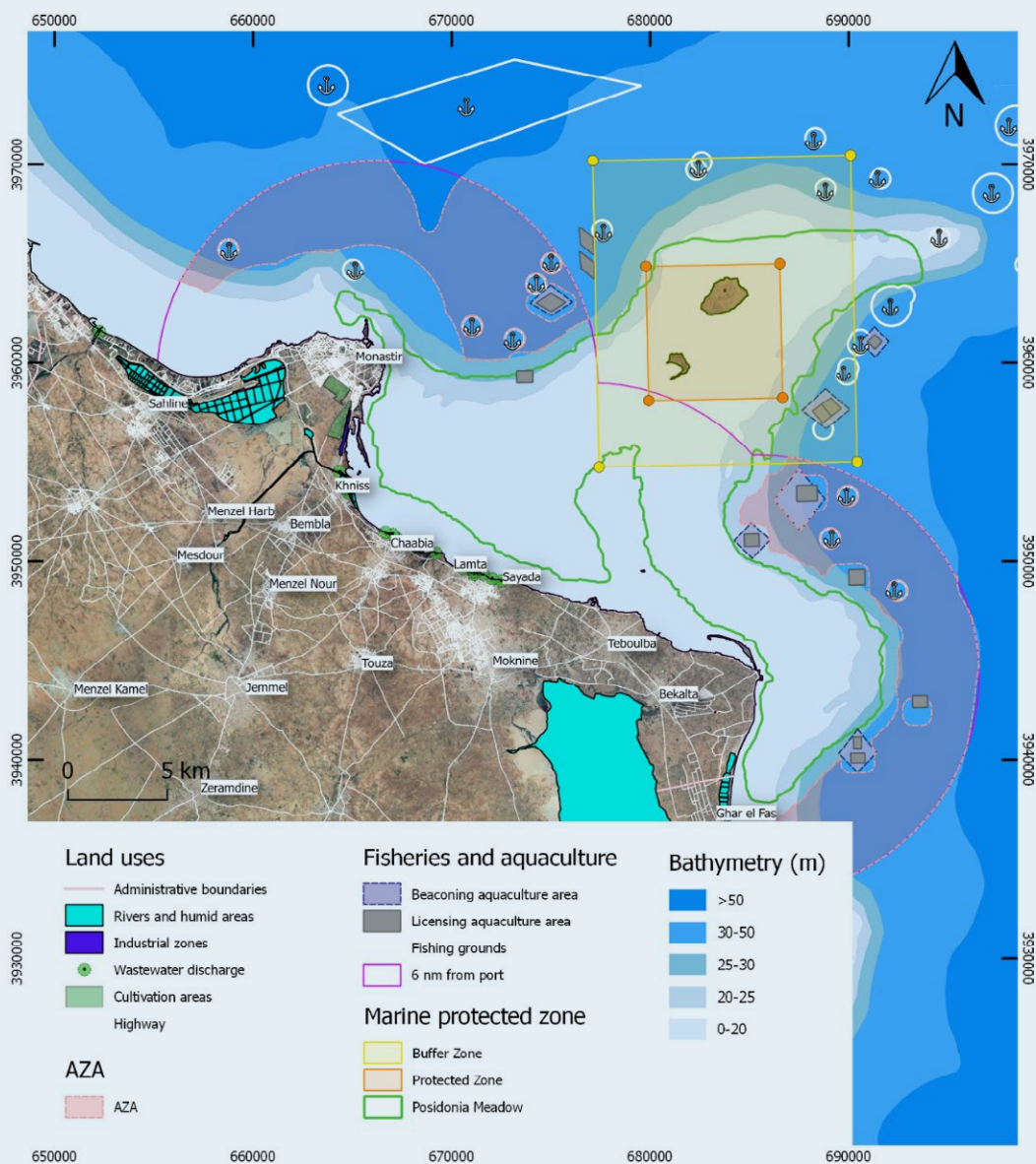
Box 1: Allocated zones for aquaculture, a pilot case in Monastir Bay

The expansion of aquaculture and the fast-growing demand for seafood products have called for the implementation of measures to better integrate aquaculture within coastal areas (Fourdain et al., 2019). In order to raise awareness among the Mediterranean and the Black Sea bordering countries on the relevance of spatial planning for aquaculture, the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) adopted in 2012 (GFCM, 2012) specific guidelines for the establishment of allocated zones for aquaculture (AZAs).

Implementing AZAs has become key for the development and integration of aquaculture activities since it enables the identification of the most suitable sites for aquaculture while preventing and avoiding conflicts among coastal users (Macias et al., 2019). Based on a participatory approach, AZAs result from zoning processes within the framework of marine spatial planning (MSP) and involve coordination among different stakeholders (Sanchez-Jerez et al., 2016).

The GFCM has been actively supporting national capacity building towards AZA establishment. In particular, the GFCM carried out technical cooperation on the implementation of an AZA in the Bay of Monastir between 2016 and 2018. Several field missions took place in order to collect information and data and the results covered multiple topics including the spatial delineation of compatible zones, interactions with small-scale fisheries and MPAs, estimated production carrying capacity, advice on an environmental monitoring programme (EMP), and the identification of potential integrated multi-trophic aquaculture (IMTA).

The integration of administrative, socio-economic and environmental parameters, as well as the application of theoretical models, allowed for the identification of compatible zones for the sustainable development of aquaculture activities.



Spatial analysis and parameters used to delineate AZA in the Bay of Monastir © GFCM.

Interactions between the aquaculture activities, the MPA and local communities

Negative interactions

Since the independence of Tunisia in 1956, Monastir has been a motor of economic development, known for its agricultural production, in particular the cultivation of olive trees, its light textile industry, and its well-structured tourist sector with hundreds of hotels and restaurants. The fishing sector occupies a prominent space with five fishing ports.

The different sectors which make use of the coastal zone did not welcome the installation of aquaculture facilities, which are visible from the coast and constitute a visual nuisance and an obstacle to navigation. The new activity also occupies significant space at the fishing ports, causing opposition from the fishermen.

Added to these problematic interactions between the various users of the coastal space, a few farms initially had not succeeded in carefully selecting their sites, nor had they adopted good aquaculture practices, leading to an initially tarnished public image of aquaculture.

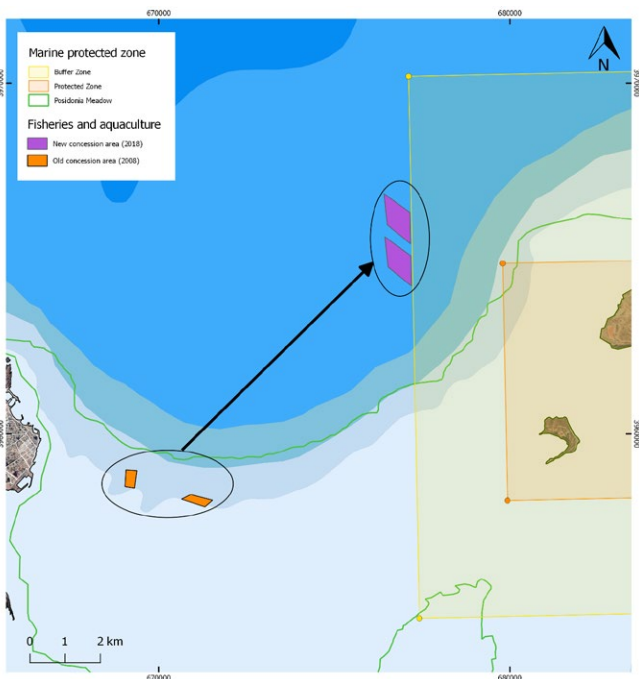
Within the framework of the collaboration carried out between the General Fisheries Commission for the Mediterranean (GFCM) and Tunisia for the establishment of an AZA in the Bay of Monastir (see Box), two farms were re-located in order to reduce their negative impacts on the environment. In particular, the EMP carried out in these farms showed a high level of suspended matter and phosphorous exceeding the limits set by the Tunisian regulations.

Positive interactions

Despite the aforementioned negative interactions, aquaculture activities worked as a buffer area around the MPA, given that fishing activity is forbidden inside the aquaculture area and 500 m around it. The area around the cages constitutes a nursery ground and a refuge area for several species. In addition, aquaculture is an important activity in the coastal zone of the Monastir Bay, with positive economic and social contributions. It provides job opportunities along the value chain and offers fresh protein to the local population at low prices.

In the surroundings of the cages, the results of monitoring of bottlenose dolphins using photo identification technique made by the INSTM team in the framework of an international project (ACCOBAMS, SPA/RAC, INSTM and GFCM) demonstrate that there is a resident group of delphinids in the bay of Monastir, which appear particularly when removing and cleaning the cage nets and during the feeding operation. This population is present mainly in spring and summer and does not have a negative impact on aquaculture activities.

No negative interactions were recorded between aquaculture and dolphins during the observation period (Benmessaoud et al., 2019).



Relocation of two farms in the Bay of Monastir.



Dolphins next to the aquaculture cages near Kuriat Islands © Notre Grand Bleu.

Box 2: Impact of the COVID-19 pandemic on the aquaculture sector and the MPA

The COVID-19 pandemic revealed some of the vulnerability of the social-ecological system in the Monastir Bay. In parallel with the tourism industry that was drastically affected by the COVID, the sanitary crisis posed a major challenge to aquaculture activities by inhibiting the normal functions of providing fish farmers with the necessary supplies. Regarding feed, the slowdown of banks and financial institutions in approving lines of credit, due to the lack of preparedness for remote work and subsequent difficulties in adapting to the situation, resulted in a stagnation of orders coming in. Feed consumption declined as a result of the difficult financial situation most of the productive units faced: reduced liquidity, a decrease in fish prices, a decrease in demand within the domestic market due to the lower purchasing power of citizens and the closure of hotels and restaurants, and the lack of exports following border closures. The aquaculture production decreased by 30% during the first three months of the pandemic.

On the other hand, in the MPA of the Kuriat Islands, the impacts of the COVID-19 crisis were not as significant. Regarding the number of visitors, around 9,000 were registered in 2020, a number that represents almost 50% of the usual number (20,803 for 2019). Positive effects were observed on marine biodiversity. For instance, the number of loggerhead turtle nests this year is in the order of 44 nests, with an emergence rate of hatchlings equal to 2,719. This number is higher than the one of 2019 before the COVID-19 crisis with 41 nests and 1,782 of emerged hatchlings.

Conclusion: SWOT matrix⁶

The process of creating an MPA in the Monastir Bay together with the establishment of an AZA supported by the GFCM through a multi-stakeholder consultation, have contributed to raising awareness on marine conservation issues among all stakeholders, including the aquaculture producers. The monitoring and governance system that was defined around and within the MPA – including allocating specific zones for aquaculture – contributed to creating a very unique situation in Tunisia.

Thus, through a participatory process, synergies between sectors are explored, compatible with marine conservation. The whole social-ecological system of the Monastir Bay may benefit from this dynamism, as long as adequate support and financial means are devoted to the establishment and management of the MPA, as well as the management of the entire Monastir Bay coastal area through a participatory approach.

	Strengths	Weaknesses
PRESENT	<ul style="list-style-type: none"> • Creation of employment and economic opportunities in the area due to aquaculture activities, but also due to the MPA. • Technical and scientific support already installed around aquaculture activities. • Local protein production from fish farms. • Existence of a local stakeholders' platform and good dialogue between them. • Existence of a local NGO and its training centers aiming at creating the opportunity for synergies between aquaculture, fisheries and MPA. • Eco-tourism developed in the Bay of Monastir, driven by the MPA attractiveness. • Implementation of AZA and identification of production carrying capacity. 	<ul style="list-style-type: none"> • The delay of the MPA creation process and lack of an adequate legal framework. • Dependence of the MPA on an external budget. • Lack of holistic environmental monitoring programme. • The high level of dependency of the aquaculture sector on imports and exports. • The rather poor acceptability of the aquaculture industry, and weak integration with other activities within the bay. • The rather poor level of implementation of good practices within the aquaculture facilities.
FUTURE	Opportunities	Threats
	<ul style="list-style-type: none"> • Innovative projects development with a lesser environmental impact: IMTA • Possibility of including new autochthonous aquaculture species that are economically valuable. • Collection and transmission of environmental data around and inside the concession areas. • Restocking of selected species within the MPA. • Improvement of eco-sanitary support to fish farmers, improvement of aquaculture integration in local value chain and better integration-acceptability of aquaculture activities, through their links with the stakeholders' platform. 	<ul style="list-style-type: none"> • Introduction of alien species in the MPA and in the Monastir Bay. • Anthropogenic excessive pressures in the Bay of Monastir causing major damages to the marine and coastal ecosystems, to marine biodiversity and impacting activities such as aquaculture and fisheries. • Algal blooms and plastic pollution. • Illegal fishing. • Mass tourism. • Climate change.

⁶ Osita, I., Onyebuchi, I., Justina, N. (2014). [Organization's stability and productivity: the role of SWOT analysis](http://journalijar.com/uploads/2014-10-02_231409_710.pdf). *International Journal of Innovative and Applied Research* 2(9): 23-32. http://journalijar.com/uploads/2014-10-02_231409_710.pdf

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Fishing Boat at Monastir Bay © F. Simard.

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Warning: This document was edited for scientific purposes, as part of a collection of case studies providing useful background information about various sites in the world where Marine Protected Areas are established together with marine aquaculture production. Each case study is subject to be updated on a regular basis, according to new developments occurring in the region concerned. This document has no legal status.



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