

Assessment of the possibilities for reintroduction of a Mediterranean monk seal (*Monachus monachus*) based on an analysis of the changes in the factors that led to its extinction



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Abstract

The monk seal is a critically endangered species, whose world population currently numbers about 700 individuals. In the 18th century this species was still living on colonies inhabiting sandy beaches and later due to human persecution moved to caves. This represents a loss of valuable adaptive traditions. The drastic change in the breeding grounds for the young and the conditions in which they grow up have probably led to a reduction in survival and reproductive success. The application of conservation measures in the natural habitats of the species and its protection do not guarantee success for the survival of the species. Unforeseen events such as epidemics or mass poisonings can cause drastic damage to this species. For example, the mass mortality of the population in Cabo Blanco coast in 1997. This raises the issue of the formation of captive populations of this species in order to create a genetic resource for the support of the wild species populations. Over the last decade, due to complex conservation measures worldwide, some populations have stabilized and the number of the species is slowly increasing. The species is registered more and more often in new places. This raises the question of assessing the possibilities for reintroduction of the species in the Bulgarian waters. The presence of experience and a functioning rescue center that raises and restores young animals in a neighboring country such as Greece, as well as plans to reintroduce the species to Turkey is an important prerequisite for assessing these possibilities. In the past, the monk seal was widespread on the Bulgarian Black Sea Coast and sometimes entered the Danube River. The areas that the species has inhabited in the past are now covered almost entirely by NATURA 2000 protected areas, which is an important prerequisite for the potential recovery of the species. Moreover, in recent years in our country marine mammals and the attitude of the fishing community to them are the subject of intense research. This has led to the creation of significant scientific and expert potential in this field. In the Red Book of Bulgaria it is noted that reintroduction in appropriate places is the last opportunity for population resumption (natural resettlement is practically impossible).

Introduction

The Mediterranean monk seal (*Monachus monachus*) (Fig.1) is one of the most endangered mammals and the rarest pinniped species in the world. Several isolated subpopulations remain: in the Aegean Sea (in the waters around Greece and Turkey) and in the Atlantic Ocean (off the coast of the Portuguese archipelago of Madeira and the Cabo Blanco Peninsula in Western Sahara). However, in the last few years, there have been indications of an improvement in the state of the species (especially with regard to its subpopulations in the Atlantic). This also leads to a change in its status in the IUCN Red List: from "critically endangered" (CR) to "endangered" (EN). Behind this success, lie decades-long programs to rehabilitate and reintroduce the species, off the east coast of the Atlantic, which raise the question of assessing the possibilities for reintroduction of the monk seal in the Bulgarian waters.

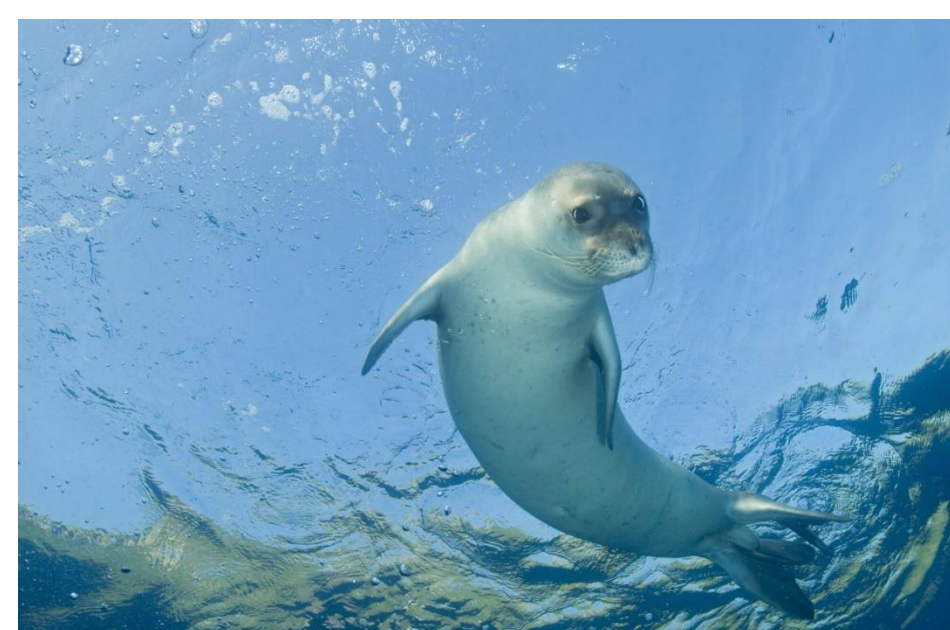


Figure 1. Mediterranean monk seal
Source: <https://phys.org/news/2020-04-endangered-mediterranean-monk-aided-unique.html>; Credit: Zafar Kizilkaya

Methodology

An overview of the current state of the monk seal and the attempts for rehabilitation and reintroduction of the species has been made. The reasons for its disappearance from Bulgarian waters and the challenges facing its possible reintroduction off the Bulgarian coast have also been sought.

Results and discussion

In the 18th century the Mediterranean monk seal was still living on colonies inhabiting sandy beaches and later due to human persecution moved to caves. This represents a loss of valuable adaptive traditions (they are diurnal animals). The drastic change in the breeding grounds for the young and the conditions in which they grow up have probably led to a reduction in survival and reproductive success. Other threats against the species, include: deliberate killing (mostly by fishers); incidental entanglement in fishing gear (juveniles are highly vulnerable); lack of food as a result of

overfishing; reduced fecundity and pup survival caused by "inbreeding depression".

The application of conservation measures in the natural habitats of the species and its protection do not guarantee success for the survival of the species. Unforeseen events such as epidemics or mass poisonings can cause drastic damage to this species. This raises the issue of the formation of captive populations of this species in order to create a genetic resource for the support of the wild population. The seals will also need pre-release training, as preparation for life in the wild and in the anthroposphere- the part of the environment, that is made or modified by humans (a resource that many other pinnipeds use) (Fig.2).



Figure 2. Monk seal resting on a dock; Source: en.wikipedia.org

The most significant results have been achieved near Cabo Blanco in Mauritania: from a colony numbering about 100 individuals in 1998 (after a devastating epidemic in the previous year) to approximately 400 individuals in 2019 (with 77 newborns in the same year), which is more than half of the remaining seals of the species worldwide (about 700). For the first time in decades, seals are returning to the open beaches (on the territory of the created reserve) (Fig.3) and their number continues to grow. The main measures taken in Mauritania, are: the creation of a protected area (Fig.4); offering social assistance and raising awareness in local fishing communities and schools; constant monitoring of the seal colony (Fig.3).



Figure 3. The seals in marine reserve "The Seal Coast", are under constant video surveillance; Source: https://www.mediterraneanmonkseal.org/?page_id=128&lang=en

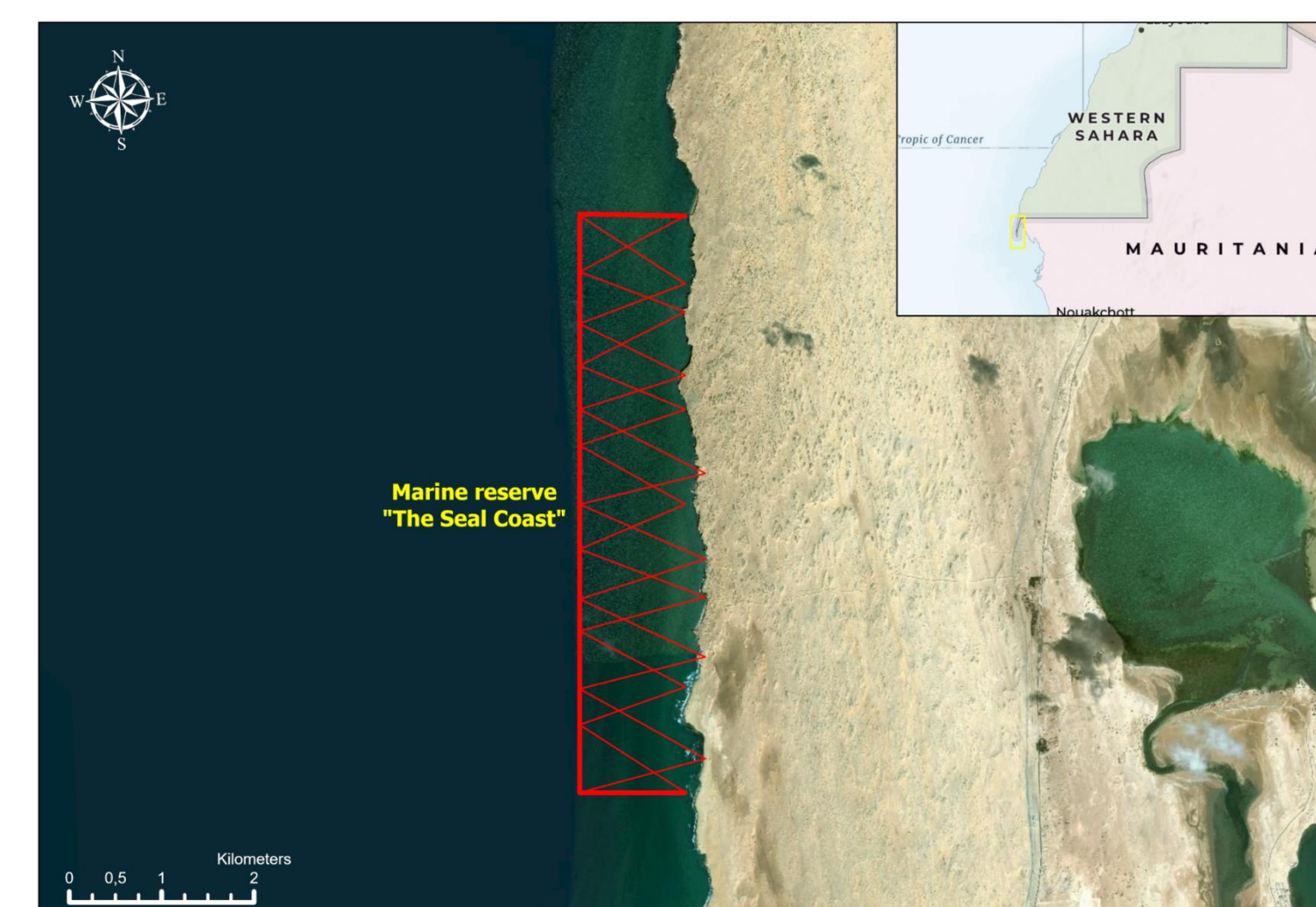


Figure 4. Marine Reserve "The Seal Coast", Cabo Blanco Peninsula, Western Sahara

Since 2014, other areas have applied the methodologies developed in Mauritania. Starting with six remaining individuals off the coast of Madeira and Desertas (part of the Madeira archipelago, Portugal), the seal colony now numbers 25 and continues to grow (Fig.6). All the existing caves have been located and those, which may be of interest to the seals, have been identified (26 of the 141 caves): they are sheltered from the ocean and have inner beaches. The "LIFE Lobo Marinho Project" have cleaned the caves have of the accumulated garbage over the years and have installed cameras in 18 of them (Fig.5). Through the obtained footage, it is determined, which of the caves are most suitable for the seals to rest and breed.



Figure 5. Monitoring of caves at Madeira, Portugal
Source: <https://www.parquesreunidos.com/en/protecting-the-monk-seal-now-in-madeira/>

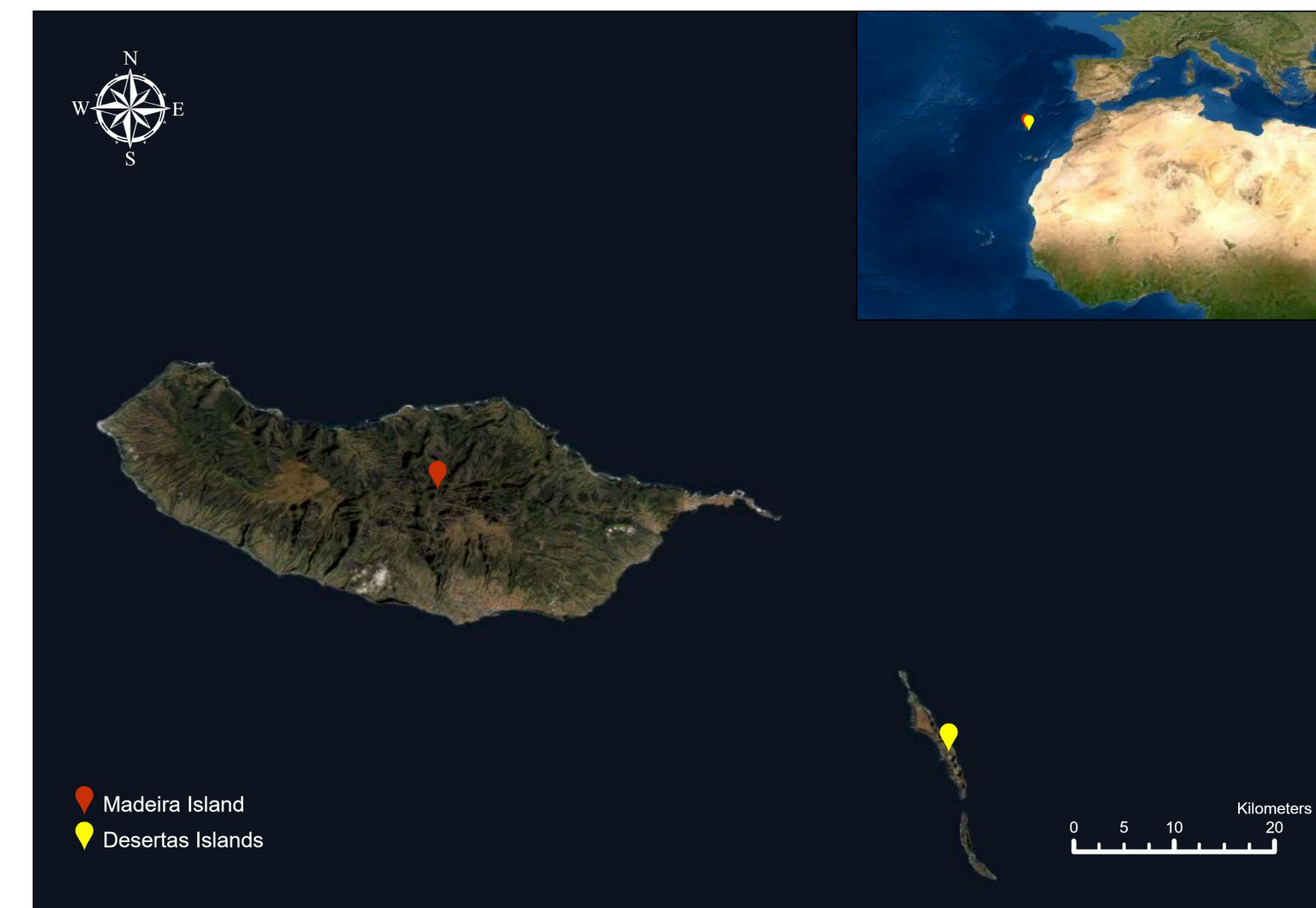


Figure 6. Madeira and Desertas islands, Madeira archipelago, Portugal

In recent years, there has been a stabilization of the species off the coast of Greece, too, particularly the monk seal colony of the island of Gyaros, in the Cyclades Archipelago in Greece (Fig.7), the largest colony in the Mediterranean. There are also plans to reintroduce the species to Turkey.



Figure 7. Gyaros Island, Greece

In the past, the monk seal was widespread on the Bulgarian Black Sea Coast and sometimes entered the Danube River. After first being hunted commercially, in the second half of the 20th century, the species was subjected to targeted slaughter, which, combined with other types of human disturbance, prompted the seal to spend more and more time hiding in caves. This has led to various diseases and high mortality rates among the young, which later turned out to be the main reason for the disappearance of the monk seal from our waters.

The areas that the species has inhabited in the past are now covered almost entirely by NATURA 2000 protected areas (Fig.8), which is an important prerequisite for the potential recovery of the species. Moreover, in recent years in our country marine mammals and the attitude of the fishing community to them are the subject of intense research.

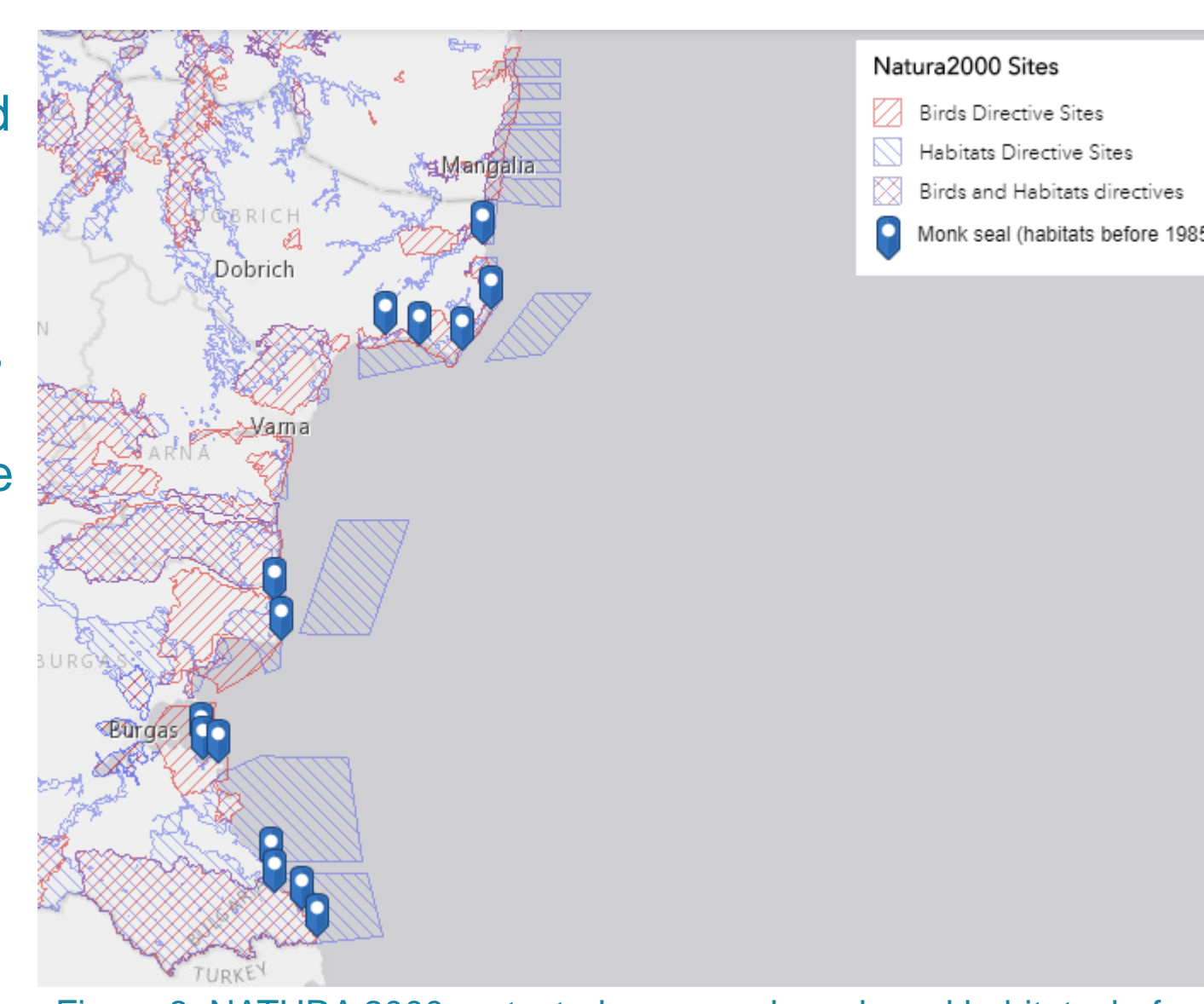


Figure 8. NATURA 2000 protected areas and monk seal habitats, before 1985

This has led to the creation of significant scientific and expert potential in this field. In the Red Book of Bulgaria it is noted that reintroduction in appropriate places is the last opportunity for population resumption (natural resettlement is practically impossible).

Conclusion

Some of the main conditions for the reintroduction of wild animals (including monk seals) into natural habitats, from which they have disappeared, are the following: 1) The needs of the species outweigh the desire of founding a new population and no damage should be done to any existing population, when taking animals from it. 2) The individuals used in the reintroduction must belong to the same species and, if possible, subspecies, of the extinct animals. 3) The selected area must keep the original habitat and all the ecological conditions necessary for the survival of the reintroduced species (the cause for the previous extinction must be direct destruction by man, and not modification of the environment). 4) Creating a protected area and restricting access to it.

The dangers that could threaten the survival of a future population of *Monachus monachus* in Bulgarian waters would be largely related to its small size and its isolation - the threat of epidemics and the so-called inbreeding depression, which will lead to reduced biological fitness.

The possible reintroduction of the monk seal into Bulgarian waters (Fig.9) faces many challenges, but the main reason for its initial extinction - agonistic human behavior - is inhibited by the protected areas, created over the past two decades, as part of Natura 2000. Unlike the tragic history of the seal in the past, now its killing is not only illegal but also criminalized.

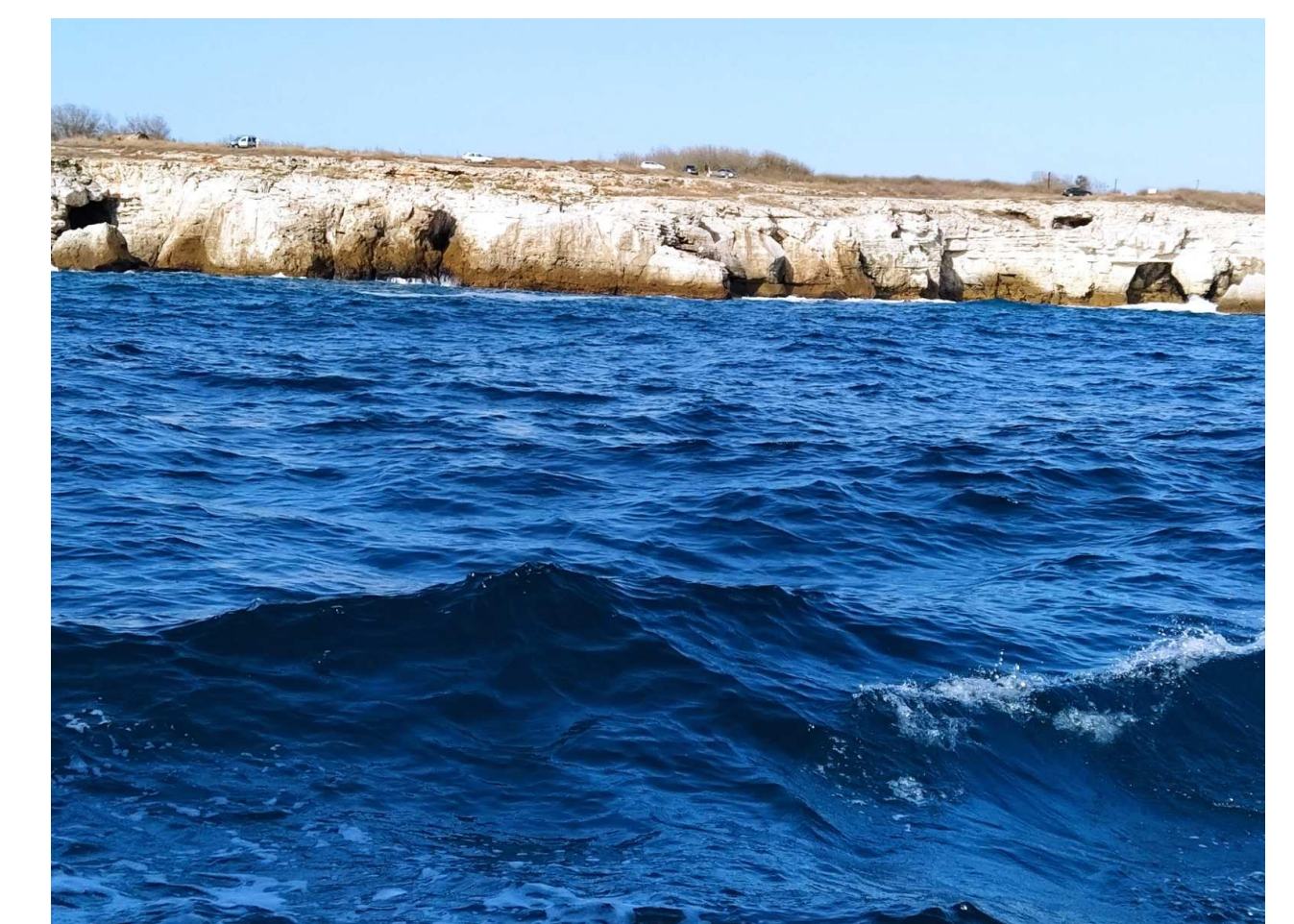


Figure 9. Caves between the villages of Kamen bryag and Tyulenov - possible target for a reintroduction project of *Monachus monachus* in Bulgaria

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