

MARINE PROTECTED AREAS IN THE NORTHERN ADRIATIC

ZAŠČITENA MORSKA OBMOČJA V SEVERNEM JADRANU

Robert TURK, Roberto ODORICO

Key words: marine protected areas, Northern Adriatic, human activities, impacts, joint basin management

Ključne besede: zaščitena morska območja, severni Jadran, človekove dejavnosti, vplivi, skupno upravljanje

ABSTRACT

Conservation of marine biodiversity requires some coastal and open ocean water areas to be retained in their natural state or as near to natural as possible. The same is true of sustainable use of coastal and marine resources. Safeguarding critical habitats for fish production, preserving genetic resources, protecting scenic and coastal areas, and enjoying natural heritage all may require the protective management of natural areas.

The creation of marine and coastal protected areas can be an effective tool for providing protection of species and habitats, enabling restoration and sustainable use of marine and coastal resources. In order to meet this target, the protected areas have to be representative, viable in terms of number, size, management and resources.

The Northern Adriatic is relatively shallow, considering that its depth does not exceed 50 m. It is earmarked by the stratification of its water column, great fluvial input, and high productivity. It is also a very sensitive ecosystem, for apart from the stated characteristics it is known for its intensive fisheries, tourism and maritime transport.

The paper presents the current situation in the Northern Adriatic concerning marine protected areas and discusses their role and possibility to have a major impact on the conservation of marine biodiversity and sustainable use of resources. Indirectly, through increasing public awareness and directly through sustaining and improving ecosystem services.

IZVLEČEK

Glede na določbe zaščite morske biotske raznovrstnosti moramo nekatere obalne vode in odprta morja ohraniti v njihovem naravnem ali vsaj v kolikor mogoče naravnem stanju. Enako velja za trajnostno rabo obalnih in morskih virov. Zaščita kritičnih habitatov za gojenje rib, ohranjanje genskih virov, zaščita obalnih območij in uživanje v naravni dediščini, vse to lahko terja zaščitno upravljanje naravnih območij. Ustanavljanje zaščitene morskih in obalnih območij je lahko učinkovito orodje za zagotavljanje varstva vrst in habitatov, ki omogoča obnovo in trajnostno rabo morskih in obalnih virov. Toda če hočemo doseči ta cilj, morajo biti zaščitena območja reprezentativna, sposobna za življenje glede na njihovo število, velikost, upravljanje in vire.

Severno Jadransko morje je razmeroma plitko, saj njegova globina ne presega 50 m. Zaznamujejo ga slojevitost vodnega stolpca, veliki rečni vnos in visoka produktivnost. Hkrati je tudi nadvse občutljiv ekosistem, saj je ob naštetih značilnostih poznan tudi po intenzivnem ribištvu, turizmu in pomorskem prometu.

Članek opisuje trenutno stanje v severnem Jadranu, kar zadeva zaščitena morska območja, in razpravlja o njihovi vlogi in možnosti, da v veliki meri vplivajo na ohranjanje morske biotske raznovrstnosti in trajnostno rabo virov – posredno prek ozaveščanja javnosti in neposredno prek ohranjanja in izboljševanja ekosistemskih storitev.

1. INTRODUCTION

Covering 70% of the planet's surface area, marine and coastal environments contain very diverse habitats that are the base of the abundance of marine life. Marine fish and invertebrates are among the last sources of wild food on the planet, moreover, the world's oceans host 32 of the 34 known phyla on Earth and contain somewhere between 500,000 and 10 million marine species. Species diversity is known to be as high as 1,000 per square metre in the Indo-Pacific Ocean, and new oceanic species are continuously being discovered, particularly in the deep sea. It is therefore not surprising that the genetic resources in the oceans and coasts are of actual and potential interest for commercial use. Life in our seas produces a third of the oxygen that we breathe, offers a valuable source of protein and moderates global climatic change. Marine and coastal habitats include mangrove forests, coral reefs, sea grass beds, estuaries in coastal areas, hydrothermal vents, seamounts and soft sediments on the ocean floor a few kilometres below the surface.

According to the Millennium Ecosystem Assessment, which dealt with the consequences of ecosystem change for human well-being, the world's oceans and coasts are highly threatened and subject to rapid environmental change. Major threats include land-based pollution and eutrophication, overfishing, destructive fishing, and illegal, unreported and unregulated (IUU) fishing, alterations of physical habitats, invasions of exotic species and global climate change. Overfishing is widely acknowledged as the greatest single threat to marine wildlife and habitats. The Food and Agriculture Organization of the United Nations reports that nearly 70% of the world's fish stocks are now fully fished, overfished or depleted. Moreover, overfishing and depletion of marine resources is moving seaward, into areas beyond national jurisdiction, into open ocean waters and to the deep sea bottom.

2. THE NORTHERN ADRIATIC

The Adriatic Sea, part of the Mediterranean Sea, linked with it through the Strait of Otranto, is a semi-enclosed sea forming a distinct sub-region within the Mediterranean Sea Region. With just a few exceptions, the Adriatic's western coast is more or less sandy, while its eastern coast is composed predominantly of limestone, except for its northernmost part, which is made up of flysch. The Adriatic Sea is divided into three larger geographical units, i.e. Northern, Central and Southern Adriatic.

The Northern Adriatic is limited by a fictitious diagonal between the towns of Karlobag and Ancona. As in the rest of the Adriatic, there is a clear difference between the geomorphology of its western part – flat and uniform coast – and its eastern part, which is rocky, steep and highly diversified with numerous islands, promontories and bays. The Northern Adriatic is a relatively shallow ecosystem, considering that its depth does not exceed 50 m. It is earmarked by the stratification of its water column, great fluvial input, and high productivity. In fact, from spring to fall, the estuarine areas and lagoons located in the Northern Adriatic provide nursery grounds for many economically important species, including *Solea solea*, *Platichthys flesus*,

Mugil spp., *Dicentrarchus labrax*, *Sparus aurata* and *Sepia officinalis*. The shallow waters are also important spawning grounds for sardines and anchovies but also for numerous demersal species like red and striped mullet, musky octopus, common squid and cuttlefish, and many others.

At the same time it has to be stressed that the Northern Adriatic is a very sensitive ecosystem, for apart from the stated natural characteristics it is known for the intensive urbanisation of its coasts, port facilities, tourism and fisheries. The absence of joint planning and management of different human activities makes harder to monitor their impacts and consequences and prevents an efficient implementation of conservation measures.

2.1 THREATS TO MARINE AND COASTAL BIODIVERSITY IN THE NORTHERN ADRIATIC

The threats to marine and coastal biodiversity in the Northern Adriatic are in line with those encountered in other parts of the Mediterranean and elsewhere in the world. Habitat degradation is one of the greatest problems. It is caused mainly by the increasing urbanisation, industrialisation, building of traffic and tourist infrastructure, and other forms of land-use. Fishery and mariculture, too, can have a marked impact on these habitats.

2.1.1 Urbanization

The Slovenian part of Piran Bay and the northernmost part of the Gulf of Trieste (Muggia, Trieste) are a characteristic example of a totally built up natural coastline. The approximate percentage of totally or partially urbanized Slovenian supra- and mediolittoral is 80%. Even the infralittoral has been only partially preserved from this direct degradation. Still strong, however, is the indirect impact on infralittoral habitat types and species, caused by poorly treated sewage run-offs, increasing maritime traffic and other human activities on sea and on land. Environmental pollution is one of the direct consequences of urbanization. The need of a modern purification plant system considering the heavy role of large urban areas (i.e. Monfalcone, Trieste, Koper, Piran) is crucial not only for the nature degradation herself but also for human activities (fishery, aquaculture, tourism). While there are some data on the impact of environmental pollution on certain marine species (*Mytilus galloprovincialis*, *Pagellus erythrinus*, *Conger conger*, *Caretta caretta*), only few concrete data on the impacts of environmental pollution on marine biodiversity as such are available. Problems with pollution in the Northern Adriatic are due also to the turnover time for water exchange that is not sufficiently fast to disperse pollution.

2.1.2 Fisheries and mariculture

Among the direct impacts on marine and coastal biodiversity, mariculture and some fishing practices are to be mentioned. The studies carried out in Piran Bay have shown that the breeding of European seabass and gilthead bream in cages led to the characteristic

depletion in the abundance and structure of the meiofauna population and that there was almost no macrofauna under the fish cages. The negative impacts on the environment were felt up to 300 m from the cages. Bottom trawling, dredging with the so-called »ramponi« as well as date mussels collection are also causing major impact on habitats and species. Apart from direct damages, i.e. collection of date mussels, the consequences are also manifested in the habitat loss for a variety of algal and animal species. Recent studies have revealed that this type of poaching causes reduction in fish fauna. By-catch, which is usually connected with marine turtles and dolphins, has detrimental effects also on numerous other marine species, sharks among them, as well as on no commercial value species that fishermen throw overboard.

2.1.3. Oxygen depletion

One of the characteristic features of the Northern Adriatic is that it is richer in nutrients than other parts of the Adriatic Sea. The nutrients are being brought into the sea primarily by rivers and municipal sewage run-off. The superabundance of these substances, together with the distinct stratification of seawater during the warmer part of the year, is the base of oxygen depletion phenomena, resulting in almost yearly hypoxic or even anoxic conditions on the sea bottom that have long-term impacts on habitats, communities and species.

2.1.4. Climatic changes

The rising of sea temperature is one of the consequences of climatic changes and at the same time the major factor influencing the spreading of species towards the north. These are usually thermophilous species, characteristic of the southern parts of the Mediterranean, which owing to the gradual warming of this sea (and the Adriatic) spread their range northwards. The spreading of fish species is getting most of the attention.

In the last thirty years, more than 30 new fish species have been documented in the Adriatic Sea, the majority of which can be specified as migrants towards the north. Two of the most characteristic species in this respect are the triggerfish (*Balistes carolinensis*), which is today a well establish species in the Slovenian waters, and the ornate wrasse (*Thalassoma pavo*), recently registered on the edge of the Kvarner Archipelago.

2.1.5. Bioinvasion

Bioinvasion is defined as the arrival of non-indigenous organisms, introduced intentionally or unintentionally, into a new environment, outside the boundaries of their natural range. More than fifty non-indigenous species have been recorded in the Adriatic. Many experts believe that shipping is the most important vector of non-indigenous species introduction. This can happen mainly through ballast waters and epigrowth. With the development of mariculture in the last century, some non-indigenous species were introduced in the Adriatic, too. Today they are found outside breeding areas replacing their indigenous counterparts.

Such species are, for example, the manila clam (*Tapes philippinarum*) and the Japanese oyster (*Crassostrea gigas*).

2.1.6 Other factors

Sea traffic, which is to a certain extent the result of intensive urbanisation of coastal areas, exerts influence on maritime environment in several ways. The most important among them is the density of cargo vessels (1,900 yearly only in the Port of Koper), together with the ever-present danger of pollution with oil and other slicks stemming from the intense sea traffic. Comparing the accident rate in the Adriatic to other areas around the world shows that the Adriatic belongs to the highest accident frequency category.

In the same line of importance are tourist ports (approximately 50,000 moorings) and consequently pleasure boat traffic. Beside oil&fuel spills, underwater noise, solid waste and other direct and indirect negative impacts on the marine environment, direct collisions between vessels and some endangered species, such as bottlenose dolphin (*Tursiops truncatus*) and loggerhead turtle (*Caretta caretta*), are to be mentioned.

The diversity of impacts on the marine environment implies an extended set of measures and activities to be carried out on national as well as international levels. Applying the ecosystem approach and the precautionary principle within decisions at national level is of key importance, and joint programs and strategies between the three riverine states for different activities would be mostly welcome.

Marine protected areas, probably the best known although not often enough used measure, could significantly contribute to the sustainable use of marine environments and conservation of their biodiversity. At the same time they represent one of the measures that could be dealt with at both - national and international levels.

3. MARINE PROTECTED AREAS

The Convention on Biological Diversity defines a protected area as “*a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives.*” The definition implies that conservation is a major goal for protected areas and that this goal is to be achieved through specific regulation and management. The definition of *conservation*, adopted within the framework of the Convention, and which states that “*in-situ Conservation is the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings*”, makes a clear link to biodiversity. Both concepts are somehow melted into the IUCN, the World Conservation Union definition of protected areas, that is “*areas of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.*”

A short review of the history of marine protected areas shows that the first was most probably established as early as in 1935. This was Fort Jefferson National Monument on

Dry Tortugas Island, 65 miles off Key West (Florida, USA). At the end of the 1950s and 60s, the first nature marine reserves were established in the Bahamas and in Florida (Key Largo Reserve). In a short period, many others, particularly in North and Central Americas, Canada, Philippines, Malaysia and Antilles, followed, including the Australian Great Barrier Reef Marine Park, established in the year 1975 and covering no less than 207,000 km². The oldest marine protected area in the Mediterranean is the French Port-Cros National Park, situated on the island carrying the same name. The Mediterranean can boast in fact relatively few protected marine areas, situated mainly in the NW part of the basin. With few exceptions they are spatially more or less limited, covering only from few ten to few thousand hectares. The smallest among them are Red Coral Reserve in Monaco and Fungus Rock Nature Reserve on Malta, both covering approximately 1 ha, while the largest are National Marine Park Alonissos in Northern Sporades (Greece) with 2,265 km², and Pelagos between France, the Principality of Monaco and Italy, covering 87,000 km². The latter is in the first place intended for the protection of cetaceans and the conservation of their natural environment and is the first case of a protected area in the Mediterranean that encloses open sea as well.

We can see already from the above that marine protected areas differ greatly among each other in view of their size, natural characteristics, use, manner of their management etc., but pursue the very same goal, i.e. conservation of natural resources. Some of them are fishery reserves, while others have been established exclusively for nature conservation purposes. The “reserve” effect, which is in most cases perceived as protection of fish resources but has beneficial impact on other species and habitat types too, is a factor of sustainable development. In protected areas, fish live longer, are fatter and are more numerous. And indeed, larger specimens are better spawners: they produce more eggs and spawn more frequently than smaller ones. Their eggs and larvae drift to surrounding areas and they themselves can migrate outside the reserve. Scientific monitoring carried out over the last 20 years in the Natural Reserve of the Bouches de Bonifacio (Corsica, France), indicate a biomass index that is 6 times higher inside the protected and managed areas, compared to the freely exploited zones or to those that are protected but without surveillance.

Marine protected areas are a “hot spot” also within the Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention). A Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean was adopted by the Contracting Parties already in 1995. According to the general obligations, each Party shall take the necessary measures to

a) protect, preserve and manage in a sustainable and environmentally sound way areas of particular natural or cultural value, notably by the establishment of specially protected areas;

b) protect, preserve and manage threatened or endangered species of flora and fauna.

The objectives of specially protected areas, as defined in the Protocol, are to safeguard:

- representative types of coastal and marine ecosystems of adequate size to ensure their long-term viability and to maintain their biological diversity;

- habitats that are in danger of disappearing in their natural area of distribution in the Mediterranean or have a reduced natural area of distribution as a consequence of their regression or on account of their intrinsically restricted area;
- habitats critical to the survival, reproduction and recovery of endangered, threatened or endemic species of flora and fauna;
- sites of particular importance due to their scientific, aesthetic, cultural or educational interest.

In spite of the Convention and the protocol there are less than 80 marine protected areas in the Mediterranean that cover app. 4% of its surface - if Pelagos is taken into account. Without it, the surface of the Mediterranean covered with marine protected areas, is around 0.5%.

The regional and global importance of marine protected areas was clearly demonstrated with the adoption of the decision to have a representative and efficiently managed network of marine protected areas by the year 2012. The decision, known as the 2012 goal, was adopted within both - the Convention on biological diversity and the EU environmental policy. Within this framework, the Contracting Parties to the CBD adopted at their 9th Conference in Bonn in 2008 important decisions concerning the establishment and management of marine protected areas on regional and on global scale and proposed to the UN General Assembly to set the next steps towards a global, representative network of marine protected areas.

The scientific criteria for identifying ecologically or biologically significant marine areas that would build the representative network are: uniqueness and rarity, importance for life history stages of species, importance for threatened, endangered or declining species and/or habitats, vulnerability, fragility, sensitivity or slow recovery, biological productivity, biological diversity and naturalness. Marine protected areas should not be considered as pieces of nature placed under total protection but as tools in the service of the sustainable management of ecosystems, in this case of marine ecosystems in oceans and littoral spaces. If they protect sensitive environments and threatened species, they also contribute to increasing the productivity of fishing areas, to regulating the different uses of the sea, to fostering sustainable tourism and to creating new job-generating activities.

4. MPA IN THE NORTHERN ADRIATIC

Due to different definitions, categories, legislation etc., it is difficult to state the exact situation concerning the number of protected areas in the Northern Adriatic. Moreover, the different purposes, goals and conservation measures make it even harder to objectively evaluate their role and importance in conserving marine biodiversity and protecting endangered species and habitat types.

According to data gathered from governmental and nongovernmental organizations from the three riverine countries, there are 12 marine protected areas (or coastal protected areas with a marine component) in the Northern Adriatic (Table 1).

Table 1: Marine protected areas in the Northern Adriatic

Tabela 1: Zaščitena morska območja v severnem Jadranu

MPA	Country	Category	Size	Characteristics
Brijuni	Croatia	National Park	3,395 ha	Fourteen larger and small islands with Mediterranean and sub-Mediterranean vegetation. Typical marine flora and fauna of the Northern Adriatic.
Costa del Monte Conero	Italy	Nature park	6,011 ha	Specific geology and typical Mediterranean maquis. The area houses several rare and endangered bird species.
Cresko-Lošinjski arhipelag	Croatia	Area in the process of protection	52,576 ha	On the eastern side of Cres and Lošinj, including four smaller islands of Čutin, Trstenik, Oruda and Orjule, devoted mainly to the conservation of dolphins.
Debeli rtič	Slovenia	Nature Monument	25 ha	Peninsula with flysch cliffs, interesting geomorphological phenomena, seagrass meadows and typical hard bottom habitat types.
Donji Kamenjak i Medulinski arhipelag	Croatia	Typical landscape	375 ha	Southernmost part of Istrian peninsula, extremely diversified coastline with Mediterranean maquis hosts typical coastal habitat types and some endangered marine species.
Limski zaljev	Croatia	Protected area	600 ha	Picturesque deep sea bay, very narrow and sharp, important spawning ground and aquaculture area
Miramare	Italy	Nature Reserve	120 ha	Gulf of Trieste, between the tourist port of Grignano and Barcola beach. With a high level of marine biodiversity it represents most of the features and characteristics of the area.
Otok Prvič	Croatia	Ornithological Reserve	7,000 ha	Mainly terrestrial protected area, devoted mainly to the protection of bird species.
Rovinjski otoci	Croatia	Typical landscape	1,200 ha	Group of islands in front of the town of Rovinj. Protected area devoted mainly to the conservation of the typical landscape.
Rt Madona	Slovenia	Nature Monument	13 ha	Marine protected area in front of the town of Piran with specific habitat types and species composition and large colonies of stony coral.
Strunjan	Slovenia	Landscape Park	430 ha	Peninsula with coastal lagoon and salinas, and marine reserve with pristine natural conditions.
Tegnue	Italy	Natural reef (ZTB)	1,000ha (3,000ha)	Hard bottom of biogenic concretions managed by local law for scuba tourism (enlarged area in which fishery is forbidden).

As it can be seen from Table 1, the categories of the Northern Adriatic marine protected areas vary from national park (Brijuni) to nature reserves (Miramare), nature monuments (Debeli rtič) and protected landscape (Rovinjski otoci). Together with that, they differ greatly also in terms of size, regulations and, last but not least, in terms of goals. Their conservation goals can be as broad as “conservation of characteristic landscape” as it is in the case of Strunjan, Rovinjski otoci and also Donji Kamenjak i Medulinski arhipelag, or

“conservation of species and habitat types”, as it is in Debeli rtič, Miramare and elsewhere. Two of the twelve areas, namely Tengue and Limski zaljev, differ slightly from the rest as they are important spawning grounds and thus their main goal is the conservation of fish stocks. The conservation measures for the marine parts of the protected areas show less diversity than it would be expected. In general, they address direct pollution and destruction of habitats (no mooring or/and anchoring), the taking of marine organisms (no spear fishing or professional fishing, collecting mussels etc.) and the protection of endangered species.

The listed areas are all sites of great natural value. They represent some typical habitat types and ecosystems of the northern Adriatic and host threatened or/and endangered species. However, in terms of conserving the biodiversity of the whole northern Adriatic, they are weak in both – number and representativeness. In terms of percentage, the situation is very much the same as in the whole Mediterranean. The protected areas cover 4% of the Northern Adriatic surface when Cresko-Lošinjski arhipelag is taken into account and only 0.4% without it. With the exception of Cresko-Lošinjski arhipelag, they are all coastal areas (or islands) that encompass only a relatively tiny belt of coastal sea. There are no protected areas in the open waters of the Northern Adriatic and also the western part of the basin is poorly represented.

5. STRENGTHS AND WEAKNESSES

Looking at the strengths and weaknesses of the existing protected areas, we can see that their strengths are mainly at the local level, while they reveal their weaknesses when we consider their role at a wider scale – in this case the Northern Adriatic.

Every single marine or coastal protected area is undoubtedly important for raising public awareness concerning the sustainable use of the marine environment. This is especially true when the protected area is properly managed. In this case they can be also key reservoirs of biodiversity, conserving typical habitat types, flora and fauna and protecting endangered species. In most cases, however, this is true only at the local level, considering their limited size and number. Due to the fact that marine protected areas usually display more or less pristine natural conditions, they have great potentials in terms of scientific research and educational activities. The last, together with activities devoted to public awareness, can on the long run strengthen the implementation of the basic principles of sustainable development and the integrated management of the coastal area.

At the same time, when we look at the marine protected areas having in mind the whole Northern Adriatic, with all the human activities impacting on its natural resources and biodiversity, we can see that some of the strengths are in a certain way diluted and much weaker. On one hand their number and size are too small to really make a difference in terms of management of the coastal area as part of the ecosystem of the Northern Adriatic. On the other hand, there is a huge gap in terms of representativity as well as in terms of conservation of resources. Last but not least, their number and size are also far from

assuring the fulfilment of the 2012 goal – a network of representative, efficiently managed marine protected areas.

6. SUMMARY

For decades, the creation of marine protected areas has been considered the only tool to protect or restore natural communities and through that, protect marine ecosystems. As a consequence, the number of marine protected areas around the world is increasing at a rapid rate, and a similar pattern can be observed in the Mediterranean as well. Nevertheless, the number is still far from being adequate in order to ensure the conservation of its great specific biodiversity and high rate of endemism. This is especially true considering that different human activities, including marine based tourism, are growing even faster.

The Northern Adriatic is not an exception to the general situation observed in the world oceans and in the Mediterranean. In spite of the importance of the existing marine protected areas and the urgent need of creating new ones, the conservation of the biodiversity of the Northern Adriatic cannot depend only on this very useful tool. The reasons lie firstly in the fact that the human activities that have a negative impact on marine ecosystems grow and develop much faster to cope with. Secondly, the creation of marine protected areas is extremely demanding in terms of financial, technical and administrative resources and, last but not least, in terms of qualified personnel. Nevertheless, the three riverine countries should intensify their effort to create new marine protected areas and at the same time try to improve their representativeness. The increasing of conservation activities, including the creation of new protected areas, should be a direct consequence of the development of new and additional human activities in the basin.

Another tool that would improve our capability to better manage the Northern Adriatic and its coasts is scientific research. A much stronger and coordinated effort should be devoted to gain better knowledge of the ecosystem – its elements and functioning. An integrated and very important part of the research would be a common, long-term monitoring/observation system of physical, chemical and biological parameters of the basin.

The third and probably the most important tool that could really make the difference and contribute to overcome the weaknesses concerning the conservation of the biodiversity of the northern Adriatic would be a common strategy for the management of human activities and the use of natural resources. The implementation of the ecosystem approach, which is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way, should be at the core of this common strategy, together with the precautionary principle. Political borders do not and should not count in terms of biodiversity conservation and health of marine ecosystems. Either we all win or we all lose. Or maybe we should say either they all win or they all lose – them, the marine species, habitat types, ecosystems. The northern Adriatic – and as a matter of fact, the whole Adriatic, is a unique entity. So if they lose, we all lose too.

POVZETEK

Ustanavljanje zavarovanih morskih območij je bilo desetletja uveljavljeno kot edino orodje za varovanje ali ohranjanje naravnih živalskih in rastlinskih skupnosti in s tem tudi za varstvo morskih ekosistemov. Posledica tega je naglo naraščanje števila zavarovanih morskih območij po vsem svetu, podoben vzorec pa se kaže tudi v Sredozemlju. Pa vendar število takšnih območij še zdaleč ni zadovoljivo do te mere, da bi lahko zagotovili varstvo njegove velike in zelo specifične biotske pestrosti kot tudi visoke stopnje endemizma. To še posebno drži ob dejstvu, da še veliko hitreje naraščajo različne človekove dejavnosti, vključno s turizmom, vezanim na morje in na morsko obalo.

Severni Jadran ni izjema v tej splošni situaciji, ki jo opažamo na vseh oceanih sveta in seveda tudi v Sredozemlju. Kljub velikemu pomenu obstoječih zavarovanih morskih območij in takojšnji potrebi po ustanavljanju novih pa ohranjanje biotske raznovrstnosti v severnem Jadranu ne more biti odvisno samo od tega sicer zelo uporabnega orodja. Razlogi za to ležijo, prvič, v dejstvu, da človekove dejavnosti, ki negativno vplivajo na morske ekosisteme, rastejo in se razvijajo tako hitro, da jih kratko malo ne moremo več obvladovati. Drugič, ustanavljanje zavarovanih morskih območij je izjemno zahtevna naloga glede na obstoječe finančne, tehnične in administrativne vire ter nenazadnje glede na usposobljene kadre. Pa vendar bi se morale države, ležeče ob Jadranskem morju, potruditi, da ustanovijo nova zavarovana območja in hkrati povečajo njihovo reprezentativnost. Povečanje naravovarstvenih dejavnosti, vključno z ustanavljanjem novih zavarovanih morskih območij, bi moralo vselej in nemudoma slediti razvoju novih in dodatnih človekovih dejavnosti v tem delu Jadranskega morja.

Drugo orodje, ki bi izboljšalo naše zmožnosti za upravljanje severnega Jadrana in njegovih obrežij, je znanstveno raziskovanje. Da bi izboljšali svoje znanje o tem ekosistemu – njegovih elementih in delovanju – bi bilo treba nemudoma vložiti precej več koordiniranega dela. Enoten in nadvse pomemben del raziskovanj bi bilo skupno, dolgoročno opazovanje in sledenje fizičnim, kemijskim in biološkim parametrom v severnem Jadranu.

Tretje in morda najpomembnejše orodje, ki bi lahko resnično nekaj spremenilo in pripomoglo k odpravi šibkih točk pri varstvu biodiverzitete v severnem Jadranu, bi bila skupna strategija za upravljanje s človekovimi dejavnostmi in za rabo naravnih virov. Ekosistemski pristop kot strategijo za enotno upravljanje kopnega, vode in živih virov, ki propagira pravično varstvo in trajnostno rabo, bi morali izpeljati pri jedru te skupne strategije, skupaj z načelom previdnosti. Kar zadeva zaščito biotske raznovrstnosti in zdravja morskih ekosistemov, politične meje ne obstajajo in tudi nikoli ne bi smele obstajati. Mi vsi bodisi dobimo ali pa izgubimo. Ali pa bi nemara morali reči oni – morske vrste, habitatni tipi in ekosistemi namreč. Severni Jadran – in seveda celotno Jadransko morje – je svojevrsten in enovit organizem. Torej, če izgubijo "oni", izgubimo mi vsi.

7. LITERATURE

1. Bellan-Santini, D., G. Bellan, G. Bitar, J.-G. Harmelin, G. Pergent (2002): Handbook for interpreting types of marine habitat for the selection of sites to be included in the national inventories of natural sites of conservation interest. UNEP, Action Plan for the Mediterranean. Regional Activity Centre for Specially Protected Areas, 217pp.
2. Forte, J. (2001): Vpliv gojišča rib na ekološke razmere notranjega dela Piranskega zaliva, Diplomsko delo, Univerza v Ljubljani, 51pp.
3. Guidetti P., S. Frascchetti, A. Terlizzi, F. Boero (2002): Effects of desertification caused by *Lithophaga lithophaga* (Mollusca). Fishery on littoral fish assemblages along rocky coasts of southeastern Italy. *Conservation Biology* 18(5):1417-1423.
4. Horvat, M., S. Covelli, J. Faganeli, M. Logar, V. Mandič, R. Rajar, A. Širca, D. Žagar (1999): Mercury in contaminated coastal environments; a case study: the Gulf of Trieste. *Science of total environment* 30 (237-238) 43-56.
5. Kovač, N., B. Vrišer, B. Črmelj (2001): Impacts of net cage fish farming on sedimentary biogeochemical and meiofaunal properties of the Gulf of Trieste. *Annales Series historia naturalis* 11(1), 65-72.
6. Lipej, L., J. Dulčić (2004): The current status of Adriatic fish biodiversity. In: Griffiths, H. et al. (ed.): *Balkan biodiversity: pattern and process in the European hotspot*. Kluwer Academic, Dordrecht. 291-306.
7. Lipej, L., R. Turk, T. Makovec (2006): Ogrožene vrste in habitatni tipi v slovenskem morju / Endangered species and habitat types in the Slovenian sea. *Zavod RS za varstvo narave, Ljubljana*, 264pp.
8. Malačič, V., J. Forte (2003): Distribution of the food surplus and faecal particles on the seabed below a fish farm in the Bay of Piran. *Annales Series historia naturalis* 13(1):3-8.
9. Malej, A., V. Malačič (1995): Factors affecting bottom layer oxygen depletion in the Gulf of Trieste (Adriatic Sea). *Annales Series histories naturalis* 7:33-42.
10. Ramade F. (1990). *Conservation des Ecosystèmes méditerranéens - Enjeux et Perspectives*. Les Fascicules du Plan Bleu, PNUE/PAM, 3: 1-144.
11. Frascchetti, S., A. Terlizzi, F. Micheli, L. Benedetti-Cecchi, F. Boero (2002): Marine Protected Areas in the Mediterranean Sea: Objectives, Effectiveness and Monitoring. *Publicazioni della Stazione Zoologica di Napoli: Marine ecology*, 23(1):190-200.
12. Milazzo, M., R. Chemello, F. Badalamenti, R. Camarda, S. Riggio (2002): The Impact of Human Recreational Activities in Marine Protected Areas: What Lessons Should Be Learnt in the Mediterranean Sea? *Publicazioni della Stazione Zoologica di Napoli: Marine ecology*, 23(1):280-290.
13. Salm, R.V., J. Clark, E. Siirila (2000): *Marine and Coastal Protected Areas: A guide for planners and managers*. IUCN. Washington DV. 371 pp.
14. Stachowitsch, M. (1984): Mass mortality in the Gulf of Trieste: The course of community destruction. *Publicazioni della Stazione Zoologica di Napoli: Marine Ecology* 5(3):243-264.
15. Stachowitsch, M. (1991): Anoxia in the Northern Adriatic Sea: rapid death, slow recovery. In: Tyson, r.v. & T. H. Pearson (ed.): *Modern and Ancient continental Shelf anoxia*. Geological Society Special Publication 58:119-129.
16. Stachowitsch, M., A. Fuchs (1995): Long term changes in benthos of the Northern Adriatic. *Annals Annales Series historia naturalis* 7:7-16.
17. Turk, R., A. Vukovič (1994): Preliminarna inventarizacija in topografija flore in favne morskega dela naravnega rezervata Strunjan. *Annales Series historia naturalis* 3:101-112.
18. Turk, R., 1999: Ocena ranljivosti slovenskega obrežnega pasu in njegova kategorizacija z vidika (ne) dopustnih posegov, dejavnosti in rabe. *Annales Series historia naturalis* 9:37-50.

19. www.medpan.org
20. www2.minambiente.it
21. www.cbd.int/marine
22. www.rac-spa.org
23. www.millenniumassessment.org
24. www.min-kulture.hr

Robert TURK
Zavod RS za varstvo narave, OE Piran
Tartinijev trg 12
SI- 6330 Piran, Slovenija
robert.turk@zrsvn.si

Roberto ODORICO
Area marina protetta di Miramare
Viale Miramare, 349
34014 Trieste
roberto.odorico@shoreline.it

