INTEGRATED COASTAL ZONE MANAGEMENT (CASE STUDY ON THE SLOVENIAN MEDITERRANEAN)

CELOVITO UPRAVLJANJE OBALNEGA OBMOČJA

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Key words: pressures, environmental limits, ecosystem services, integrated coastal zone management, Slovenia
Ključne besede: pritisk, okoljske omejitve, ekosistemske storitve, celovito upravljanje z obalnimi območji, Slovenija

ABSTRACT

A small percentage of Slovenia's surface area belongs to the Mediterranean basin, yet the undersea, marine and coastal area is an exceptionally important natural landscape. This region has an opportunity to actively integrate a relatively well conserved and biologically extremely diversified ecosystem into development planning. Ecosystem-based management is increasingly being used to establish links between the processes of integrated coastal zone management and based on the application of the regional-geographical approach. The starting point for Integrated Coastal Zone Management is that land developers take into account the stress and impacts that their plans could have on the coast and the marine ecosystem, and propose the most appropriate developmental solutions. The project takes, as its basis, measures to reduce pressures from land and maritime activities that affect the marine ecosystem. Research was oriented at the collection of data at the level of pollution of the sea from various substances and their sources. The effects of pollution on the marine environment and organisms were explored, and changes over time in the status of the marine environment were investigated. Afterwards, the collected data measures for environmental improvement were determined and the effectiveness of interventions was monitored. A lack of coordination in coastal zone management was ascertained. During the next steps, cooperation between ministries, regional and local authorities was aligned. The involvement of various stakeholders in the process of the regional programme of sustainable development preparation was of great relevance as well.

IZVLEČEK

Čeprav povodju Jadranskega morja in ožje, porečju jadranskih rek, pripada le majhen odstotek površine naše države, pa njen podvodni, morski in obalni svet oblikuje izjemno pomembno naravno pokrajino. Obalno območje, kot v članku poimenujemo porečje jadranskih rek, ima možnost, da se s svojim razmeroma dobro ohranjenim in biološko izjemno raznolikim ekosistemom vključi v razvojno načrtovanje. Ekosistemski pristop se čedalje pogosteje uporablja za vzpostavljanje povezav med procesi celovitega upravljanja obalnega pasu z regionalno-geografskim pristopom. Izhodišče celovitega upravljanja obalnega območja leži v načelu, da lastniki zemljišč upoštevajo, kako negativno lahko njihovi načrtovani projekti vplivajo na življenje na tem območju in morskem ekosistemu, in da predlagajo takšne razvojne rešitve, ki najbolj ustrezajo obstoječim razmeram. Vsekakor pa je potrebno že v začetku uvesti ukrepe, ki bodo zmanjšali pritiske s kopnega in iz različnih morskih dejavnosti, ki imajo močan vpliv na morski ekosistem. Raziskave so bile usmerjene k zbiranju podatkov glede onesnaževanja morja zaradi različnih snovi in njihovih virov. Raziskani so bili učinki onesnaževanja na organizme v morskem okolju in preučevane dolgoročnejše spremembe v stanju morskega okolja. Pozneje so bili zbrani podatki o ukrepih za izboljšanje okolja in nato spremljana njihova učinkovitost. Ugotovljeno je bilo pomanjkljivo

usklajevanje pri upravljanju obalnega pasu. V naslednjih korakih je bilo usklajevano sodelovanje med ministrstvi, regionalnimi in lokalnimi oblastmi. Zelo pomembna je bila tudi udeležba različnih zainteresiranih javnosti v procesu priprave regionalnega programa za trajnostni razvoj.

1. INTRODUCTION

The increased use of the coastal area and the sea, an increase in urbanisation and population, increasing tourist visits, and an increase in the number of tourist vessels and maritime transport require special attention in coastal and marine environment management. The impoverishment of marine ecosystems causes a loss of biological diversity, and it also decreases the stability and resistance of ecosystems. Furthermore, this consequently erodes the quality of human life in coastal areas.

Data on the state of the environment indicate that the Slovenian sea is not over-polluted with nutritional substances and other pollutants. Bacteriological pollution in areas of bathing water and water quality in mariculture areas are also within the limits of regulated values. The methodology for assessing the ecological state of surface water and the sea is still being prepared.

Protection of the marine and coastal environment is regulated by politics, implemented at European Community and Mediterranean levels. The three most important documents are: the Water Directive, the Marine Strategy Framework Directive, and the Mediterranean Action Plan for Sea Protection.

The environmental objectives for surface-water bodies within the framework of the Water Directive (2000/60/EC) are: protection, improvement and restoration of surface-water bodies in order to achieve a sound ecological and chemical state by 2015 and that the first review of the River Basin Management Plans should take place in 2020.

The Marine Strategy Directive (2008/56/EC) stipulates that it is necessary to provide for the following: protection and restoration of the functionality and structure of natural systems, their sound ecological state, no increase in the risk of emergence of harmful effects on humans and ecosystems through the level of environmental pollution, sustainable use of the sea and development of activities that influence the quality and encourage responsible management of the sea at the European Community level and globally.

The main objectives of the Mediterranean Action Plan for Sea Protection are: ensuring sustainable management of natural marine and land-based resources, integration of the environment in the social-economic development and spatial policy of the Mediterranean, protection of the marine environment and coastal areas through pollution prevention and a decrease or elimination of harmful emissions into the sea, protection of nature and areas of ecological and cultural value, strengthening the solidarity between Mediterranean countries in the management of common heritage and resources for the welfare of present and future generations, as well as contributing to the improvement of quality of life.

Beside the three indicated bases, the coastal and marine environment quality is regulated by numerous other sectoral documents, as shown in Figure 1.

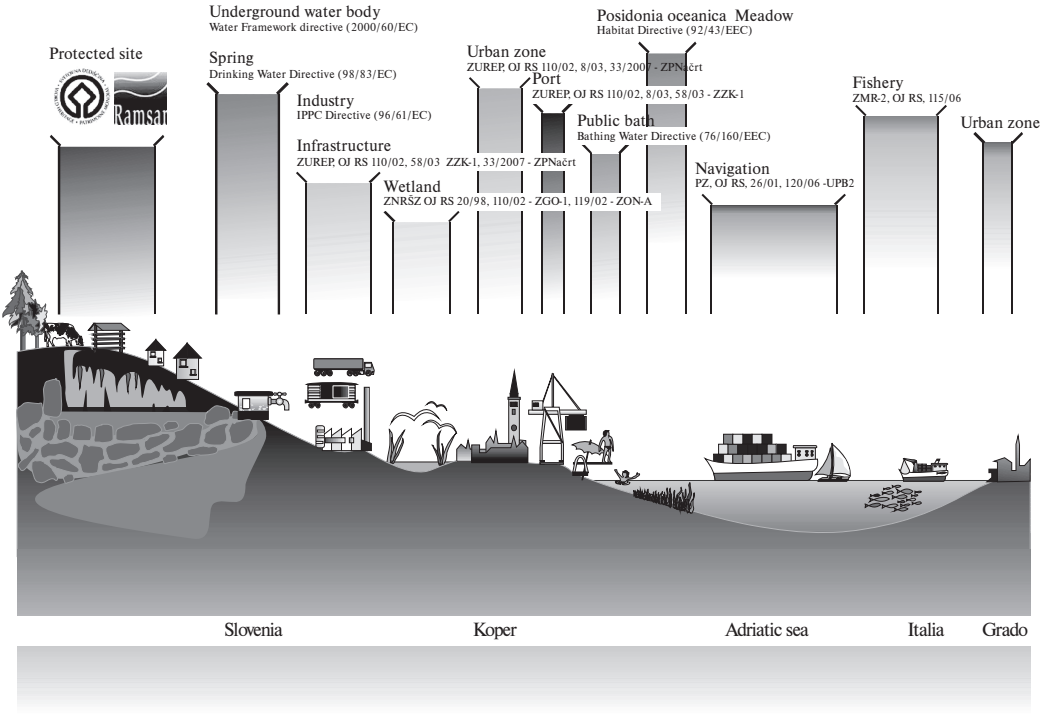

Figure 1: Legislative context of coastal and marine resources management
Slika 1: Zakonodajni okvir upravljanja z morskimi viri

2. METHODS

In dealing with the problems of marine and coastal areas management, we used the ecosystems approach (Bricelj 2008). Firstly, we analysed the individual influences of various activities and endeavoured to evaluate their cumulative pressures on ecosystems. We evaluated ecosystem functions and environmental limits in the light of existing ecological objectives. The main objective is to ensure healthy and resilient ecosystems.

Table 1 indicates the pressures and impacts of activities on the coastal and marine environment, identified within European Community.

Table 1: Pressures and impacts of activities on the coastal and marine environment (Environment Agency of the Republic of Slovenia 2008)
Tabela 1: Pritiski in vplivi različnih dejavnosti na obalni in morski ekosistem (Agencija RS za okolje 2008)

Pressures	**Impacts**
Urbanisation and tourism	Fragmentation and construction in the coastal area, seasonally variable impacts on the environment, loss of natural habitats, decrease of biodiversity, euthrophication, pollution due to intentional or unintentional discharges, underwater noise, increased water consumption, transport changes of sediments, increased amount of waste, pollution of the coast and the sea with floating waste, microbiological pollution

Pressures	Impacts
Marine traffic	Pollution due to intentional or unintentional discharges, introduction of non-indigenous species, waste pollution, underwater noise
Aquaculture and shellfish farming	Overfishing of marine organisms as food for cultivated species, introduction of non-indigenous species, genetic changes, introduction of diseases and parasites, pollution, euthrophication
Fishery	Overfishing of fish and other marine organisms, fishing of non-target species, destruction of demersal habitats, changes in ecosystem structure
Development of industry and infrastructure	Fragmentation and construction in the coastal area, loss of natural habitats, erosion, decreasing biodiversity, euthrophication, pollution, increased water consumption, transport changes of sediments, increased amount of waste, increased water turbidity, thermal pollution
Agriculture	Euthrophication, pollution, loss of natural habitats, decreasing biodiversity, salination, increased water consumption
Climate change	Increased probability of occurrence of floods, increased erosion level, rising sea level, change in the structure and arrangement of species and organisms, decreasing biodiversity

The main data sources of the state of the coastal and marine environment are reports on the regular monitoring of the environmental state, carried out on the basis of the Environmental Protection Act, Waters Act, and on the basis of requirements by the Convention on the Prevention of Mediterranean Sea Pollution from Land-based Sources. The Environment Agency of the Republic of Slovenia has been keeping the Common Database on Water Quality Monitoring. The reports include: assessment of the euthrophication level and general state of coastal sea quality, trends of pollution from dangerous substances, quality of the sea, brackish water and water for the life and growth of marine shellfish and marine gastropods, sanitary quality of bathing water and estimation of emissions from terrestrial point sources.

3. RESULTS

3.1 PRESSURES ON ECOSYSTEMS

3.1.1 Increasing population density in the coastal area

Nowadays, the entire coastal area is densely populated. The growing urbanisation of the coastal area is also mirrored in the transformation and solidification of the coastline. Less than 25% of the coast has been preserved in its natural state; the remaining part of the coast has been altered. In the coastal area, economic activities are increasing, along with infrastructural land development; the inflow of inhabitants and tourists is also increasing, accompanied by construction trends. On the other hand, the more inland areas are faced with various structural problems and issues, which represent developmental retardation.

With regard to the increasing number of inhabitants in coastal municipalities and in connection with the seasonal increase in tourism, we can expect a deterioration of the environmental state of this area, since along with increased pressures, conflicts of interest and use of space on land and sea are increasing as well.

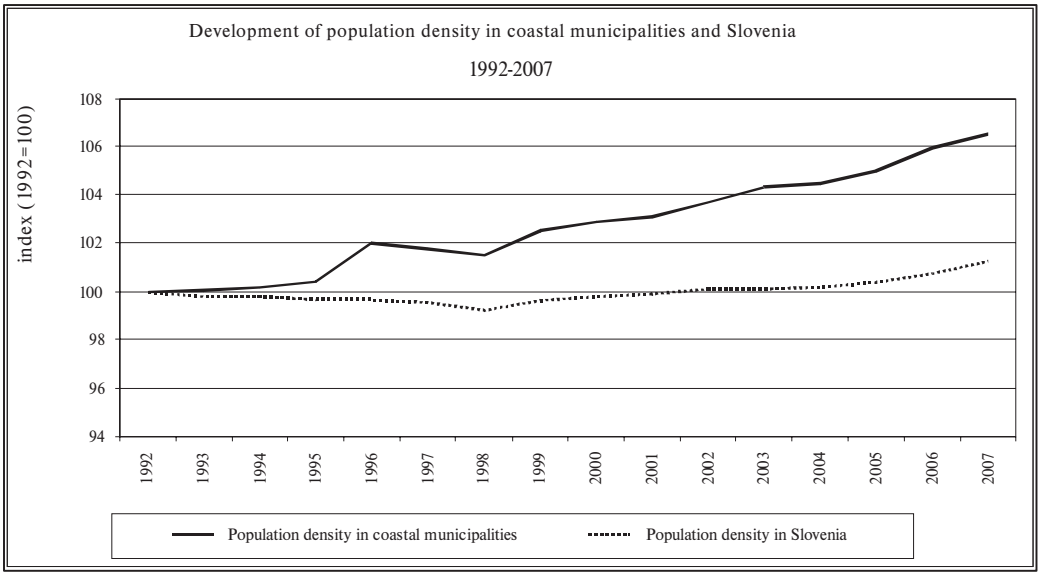

Figure 2: Development of population density in the coastal area during the 1992–2007 period (Data source: SI-STAT 2009)

Slika 2: Razvoj gostote prebivalstva v obalnem območju med letoma 1992 in 2007 (vir: SI-STAT 2009)

3.1.2 Equipping of settlements with treatment plants is inadequate

In the catchment area of Adriatic rivers with the sea, there are 108 settlements with a population greater than 50 population equivalents. Only 24 of these settlements are connected to municipal treatment plants. According to the size of the population, 75% of inhabitants in the settlements live without municipal treatment plants; however, this does not include the number of tourists. According to the available data from the Environment Agency of the Republic of Slovenia, the majority of treatment plants (82%) only provide the first purification level, which removes particles >0.1 mm and only partially (up to 30%) decomposes organic substances. Other treatment plants (18%) also provide the secondary purification level, where organic substances as well as some nutritional substances are removed or partially removed.

The results indicate a significant increase in emissions of substances due to releases from treatment plants, which emitted effluents directly into the sea or into the vicinity of the sea in 2002; in the later phase, a slowly decreasing trend of emissions of nitrogen and suspended substances has been indicated (MOP 2003). In the 2003–2005 period, emissions of nutritional substances and suspended substances from rivers into the sea slightly decreased, while the data also indicate a decreasing trend of phosphorus emissions from industrial sources. The entire area of Adriatic rivers indicates only modest equipping of settlements with treatment plants, while the existing treatment plants have a low purification level.

3.1.3 Phosphorus emissions from industrial waste water have been decreasing

The catchment area of Adriatic rivers indicates 40 point releases from industry, with the release of easily degradable organic and nutritional substances. A total of 18 of these releases have exceeded the limit value for release in surface water according to regulations. According to the available data, 15 releases with effluents directly into the sea have been indicated (liable to emission monitoring). The data indicate that in the last five years phosphorus emissions have been decreasing, while ammoniacal nitrogen emissions in these releases have been increasing.

The catchment area of Adriatic rivers also records 133 industrial releases of dangerous substances after data from the Environment Agency of the Republic of Slovenia. The stipulated emission values have been exceeded in 23 releases. The majority of releases are from the food industry, timber and wood-processing industry, chemical industry and releases from laundry and cleaning (Report for Slovenia ... 2007).

3.1.4 Increasing maritime transport

A large part of the area of Koper Bay is occupied by Luka Koper, which has become an important international port in Central Europe over its fifty years of existence. In 1970, the amount of transhipment cargo reached 2 mil t; in 1990, 6 mil t; and in 2006, 14 mil t. This growth has been especially intensive in the last ten years, as indicated in Figure 3. In relation to the developmental trends of "motorways of the seas", it is expected that transport will increase. In connection with this, the risk of accidents and unintentional sea pollution is increasing as well. Increasing maritime transport also causes an increase in submarine noise.

In the 1978–2006 period, the number of berths in marinas increased from 100 in 1978 to 1,365 in 2006. Three marinas have a total aquatorium surface of 183,000 m2.

In 2006, all three marinas recorded a total of 6,773 vessels, 1,629 of them with long-term contracts and 5,144 anchored transitionally. In all, 1,722 vessels in Slovenian marinas were located on land, while 5,051 vessels used the arranged shores of marinas for berths (Statistične informacije 2007).

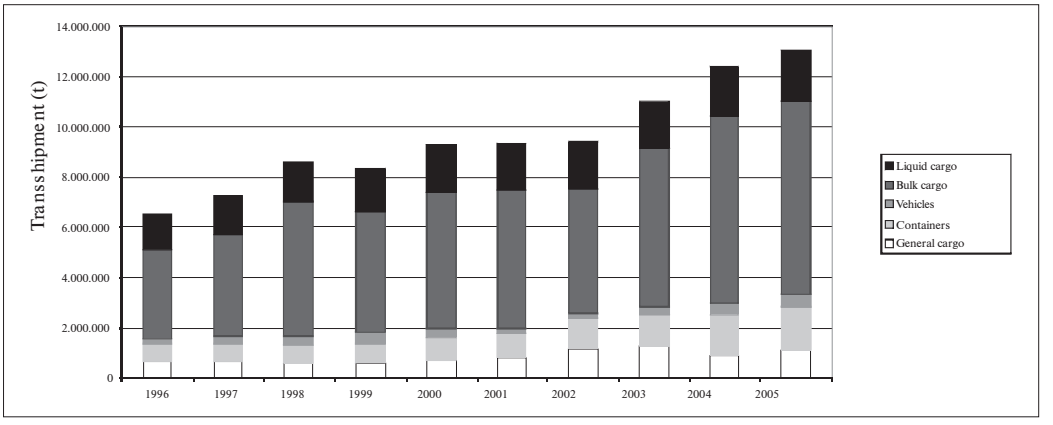

Figure 3: Transhipment cargo through Luka Koper in relation to the type of cargo (Data source: Ladijski pretovor 2009)
Slika 3: Pretovor blaga v Luki Koper glede na vrsto blaga (vir: Ladijski pretovor 2009)

Transport in marinas is the most intense during the spring and summer months. The majority of laytime days in all three Slovenian marinas are attributable to nautical tourists in April, May and June. In July, the majority are transitional vessels, while in October, towards the end of the season, permanent vessels prevail. According to the statistical data, the laytime in marinas has been getting longer in recent years.

3.1.5 Increasing number of tourists and significantly increased water consumption during the summer

Numerous problems are connected to the increasing number of tourists, such as: air pollution due to increased traffic density, increased quantity of waste, nature pollution due to uncontrolled dumping of waste, noise, increased potable water consumption and increased amounts of waste water.

The largest share of potable water comes from the Rižana water distribution system (71%); however, the latter does not provide for a sufficient water distribution. During this period, the water distribution system has been receiving a substantial recharge from the Karst (8%) and the Istrian water distribution system in Croatia (21%). The shortage of potable water in the coastal area amounts to 21% at the annual level.

The greatest demand for water is evident during the summertime. Besides a consumption increase in households and agriculture, this is connected primarily to the increasing number of tourists in this period. The majority of tourists come to Piran (65%), with fewer tourists visiting Izola (18%) and Koper (17%). In relation to the population and total number of tourists, water consumption is changing, fluctuating between 51 l/person/day in winter to 150 l/person/day in summer. The relationship between the number of tourists and water consumption is indicated in Figure 4.

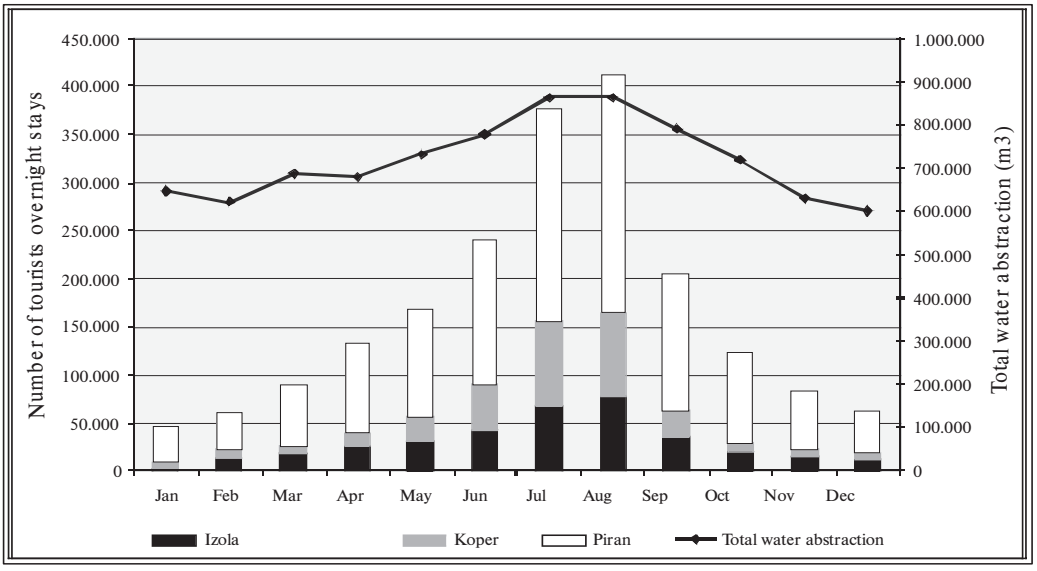

Figure 4: Water consumption and the number of overnight stays by tourists in the coastal area (Data source: SI-STAT 2009, Environment Agency of the Republic of Slovenia 2007)

Slika 4: Poraba vode in število nočitev s strani turistov v obalnem območju (vir: Agencija RS za okolje 2007)

3.1.6 Decreasing fish catch and mariculture

In the beginning of the nineties, the catch began to decrease rapidly, falling from 6,000 tonnes in 1990 to less than 2,000 tonnes in 1993. In the following years, the annual catch remained at around 2,000 tonnes. After 1998, the catch had been gradually decreasing and reached its lowest value, with 808 tonnes, in 2004. In the last two years, however, the catch has slightly increased; nevertheless, it has still remained below the limit of 1,000 tonnes. The reasons for the rapid decrease of the catch in the beginning of the nineties are primarily the loss of markets in the former Yugoslavia and the reduced fishing area (SI-STAT 2009).

Numerous areas are designated for fish and shellfish culture. Until 2004, the breeding of aquatic animals had increased, while since 2004, the statistic data has indicated a decreasing trend. The breeding of gilthead seabream (Sparus auratus) has been abandoned; now the breeding of molluscs and European seabass (Dicentrarchus labrax) prevails.

In the area of shellfish farms, regular water quality monitoring is being conducted in accordance with legislation. The assessment of water quality for the life and growth of marine shellfish and marine gastropods in recent years has indicated that the water at shellfish farms complies with the stipulated criteria.

3.1.7 Increasing pollution from ships and other vessels

From 1977 until 2006, the Office for the Protection of Coastal Waters took action in 656 cases, of which 307 involved oil pollution. The agent of pollution was known in 146 cases, and unknown in 510 cases. According to the collected data, it is apparent that releases of smaller amounts of oil into the sea prevail in Slovenia. In the light of the sensitivity of our sea, such pollution can have a negative impact on the marine environment, especially in comparison to the open sea.

The indicated data and facts in connection with the existing cases of release under the detection limit of the EU-standard (release of more than 7 tonnes) do not imply that in Slovenia or in the direct vicinity of our sea larger pollution cannot occur – at a global scale, the northern Adriatic is becoming one of the most important navigation routes for oil and its derivatives and other more or less dangerous substances. This can present a high risk to our sea due to possible larger and sudden releases of these substances (Sotlar 2007).

The introduction of non-indigenous and pathogenic species due to maritime transport constitutes a constant danger to the natural environment. The transfer of organisms through maritime transport can occur primarily due to the presence of organisms in ballast waters and related sediments. Organisms can also be transferred through attachment to the hull and other parts of a ship.

In the northern Adriatic, the occurrence of 46 species of non-indigenous organisms has been recorded. It is hard to prove the transfer of these organisms, although in numerous cases it can be connected to various carriers. Among the 46 indicated species in the Adriatic, 31 are connected to a ship as the carrier, of which 25 are connected with the ship's hull surface and 19 with ballast water.

The main part of the released amount of ballast water in the Slovenian sea is associated with the release of ballast water from ships in Luka Koper and its berths, and only a small quantity in the Izola shipyard. The Gulf of Trieste area is also influenced by the activities of Italian ports, especially ports in Trieste and Monfalcone (David et Jakomin 2003).

3.2 ENVIRONMENTAL LIMITS, VALUING ECOSYSTEM SERVICES

3.2.1 Semi-enclosed, shallow bay with a small volume and weak exchange of water mass

Slovenia is linked with European and global seas and is a maritime country, although our coast covers only 0.1% of the Mediterranean Sea coast. The Slovenian sea is part of the Gulf of Trieste. Nowadays, the sea is eroding the land in two larger bays: the Bays of Koper and Piran, and in two smaller bays: Strunjan and Portorož. An important characteristic of the Slovenian sea is its shallowness. This also accounts for its continental characteristics – rapid warming and cooling as well as ecological sensitivity (Orožen Adamič, Rejec Brancelj 1998). As is characteristic of the Gulf of Trieste, with an average depth of 18.7 meters, the depth in the Slovenian part is also very small. A 20-meter depth curve divides the gulf into its external and internal parts. In the external part, the sea reaches depths of 20 meters or more, while in its internal part the depth is mainly 10 meters or even less. Up to now, the greatest measured depth of the sea is at Punta Piran (Cape Madona) – 37.25 meters, due to which it was named "Underwater Triglav" (Orožen Adamič 2000). The Slovenian part of the Gulf of Trieste contains slightly less than 4 km3 of water (Radinja 1990). The prevailing sea current moves along the Slovenian coast in the direction of Trieste, where it turns and moves along the Italian coast towards the south. The average speed of the current is 0.8 knots (1.5 km/h). In the opposite direction, a weaker current appears periodically with a speed of 0.5 knots (0.9 km/h) (Orožen Adamič 1998). The sea currents are stronger near the capes due to the shape of the local relief. The prevailing direction of the currents depends upon the tide, which is the greatest in this part of the Adriatic. Due to smaller depths, the currents' direction and speed also depend on the weather, especially wind. The water mass dynamics of the inshore belt is also influenced by freshwater influents.

Modest effects – shallowness, small water volume and weak currents in the Slovenian part of the Gulf of Trieste – are also manifested in environmental sensitivity. The inflow of terrestrial water with large amounts of nutritious substances, some direct releases and releases from treatment plants have subsequently influenced the Slovenian sea. The most polluted area is the interior of the Gulf of Koper, to which the Rižana and Badaševica contribute their share with direct waste-water streams from settlements and industry (Rejec Brancelj 2003).

The catchment area of Adriatic rivers with the sea is classified in the aquatic area of the Adriatic Sea. The surface of the catchment area is 1,509.1 km2, which comprises approximately 7.5% of the territory of the Republic of Slovenia (Bernot 1990). The length of all water courses in the catchment area of Adriatic rivers is 1,499.0 km, or 5.1% of the length of all water courses in Slovenia. A little more than two thirds of the catchment area surface (71%) are covered by forests. Agricultural land spreads over 26% of the catchment area. Wetlands are also present in this part of Slovenia; however, the share is small.

The coast is intertwined with natural, tourist and various levels of construction and urban as well as industrial areas, which burden the coastal sea to various degrees. Important traditional economic activities in the coastal area are agriculture, salt-making in salt-pans, shipbuilding and fishery, which are all profoundly connected with natural resources. These activities have shaped the traditional terraced landscape pattern of the Slovenian coastal area, which is still preserved in some areas.

3.2.2 Water quality for the life and growth of marine shellfish and gastropods is appropriate

Water quality assessment for the life and growth of marine shellfish and marine gastropods for the 2003–2005 period indicated that the water complied with regulation criteria at all three sampling sites. The basic physical-chemical parameters did not derogate from the stipulated limit values, the same as faecal coliform and the content of halogenated organic substances. Heavy metals in water were present at all sampling sites; however, the concentration was low and below the limit value at all sites (Ambrožič et al. 2007).

3.2.3 Chlorophyll-*a* in the coastal sea indicates over-pollution

The northern Adriatic, which also encompasses the Slovenian coastal sea, belongs to the most productive part of the Mediterranean Sea. The consequences of water over-pollution by nutritional substances are visible in the phytoplankton bloom, exceptional algal bloom, demersal oxygen deficiency, destruction of demersal organisms, occurrence of toxic algal species, production of mucilaginous aggregates and increased coverage of the sea bed with fast-growing green algae.

The greater part of the Gulf of Trieste, especially its eastern Slovenian part, is primarily a poor marine ecosystem with nutritional substances with lesser signs of over-pollution. This is especially obvious in smaller semi-enclosed bays, into which municipal sewage water is being discharged. Considering the average annual value of sea transparency and chlorophyll-***a*** under 2.5 μg/l, the Slovenian coastal sea can be classified according to the OECD classification as a poor coastal zone with nutritional substances. The measured concentration is fairly variable, but within the framework of similar values. The highest values have been measured in the colder part of the year in periods of typical seasonal highs of phytoplankton. The results indicate a concentration decrease of chlorophyll-*a* in the 1997–2005 period and consequently a decrease in over-pollution at selected monitoring stations.

In comparison with the assessed indicators in the Baltic and North Seas, the values in the Slovenian sea are low; however, according to the selected locations in the European part of the Mediterranean Sea, they exceed the average and are significantly higher (Čermelj 2006a).

3.2.4 Improving chemical and trophic state of the sea

In the 2003–2005 period, metal analysis in the water and sediments and analysis of priority substances and indicative parameters in the water were carried out at selected sampling sites on

the sea. The results indicate that the content of priority substances and indicative parameters in the water remained below the detection limit of the implemented analytical methods, and below the limit value stipulated in the national chemical regulations. The content of heavy metals was determined at all sites; however, the acquired values did not exceed the limit values. On the basis of the analysis results, the chemical state at all sampling sites in the sea during the 2003–2005 period was solid.

The trophic condition of the sea in the period since 2000 has been gradually improving. The best trophic condition of the sea was indicated at the southern part of the Gulf of Trieste, and it was also similar at the basic sampling site in the centre of the Gulf. A slightly worse state was recorded at the sampling site in the centre of Piran Bay, and the worst at the sampling site in Koper Bay (Ambrožič et al. 2007a).

3.2.5 Oxygen in the demersal layer has been appearing only exceptionally

The frequency of the appearance of low concentrations of oxygen in the demersal layer in the coastal and marine environment of the Gulf of Trieste does not indicate a definite trend. In the period from 1989 to 2005, an oxygen deficiency had periodically appeared in the central part of the Gulf in late summer and autumn, namely in 1989, 1990, 1994, 1995, 2000 and 2001 (Figures 57-1 and 57-2). In the south-eastern part of the Gulf, the deficiency appeared in the same period only twice, in 1989 and 1990. At all test sites, oxygen deficiencies reached less than 3% of all measured values. At depths of less than 20 m, oxygen deficiencies have not been recorded (Čermelj 2006).

3.2.6 Underwater noise has been increasing with increasing maritime transport

Marine animals are highly exposed to underwater noise generated by boats, ships and other vessels that emit a wide spectrum of noise into the environment. Excessive underwater noise reduces the orientation capability of underwater animals, while in the long run it also influences reproduction and survival by causing stress, reducing animals' ability to find food, forcing them to leave their habitats, and even causing physical injuries.

The research has indicated that the noise level in seas has been increasing primarily as a consequence of increasing maritime transport. Ship transport causes underwater noise at frequencies in the spectrum used by marine animals for communication over long distances. The number of underwater noise sources is high. In the area of the Slovenian sea, this primarily derives from ship transport, including tourist and other vessels.

3.2.7 Protected areas are important for the preservation of biodiversity in coastal and marine areas

The first efforts to protect the sea date back to 1990, when the Strunjan Nature Reserve was established as part of Strunjan Landscape Park. It incorporates the 4-km-long northern coast of the Strunjan Peninsula with a 200-meter belt of coastal sea between the bays of San Simon

and Strunjan. The most picturesque part of the reserve are the 80-meter-high cliffs, which happen to be among the highest flysch cliffs in the Adriatic. In the same year, Cape Madona with a 200-meter belt of underwater flora and fauna was protected as a natural monument. In 1991, Debeli Rtič, with its shallow sea and smaller underwater ridge, also became a natural monument. The Škocjanski zatok (Škocjan Inlet) is also a nature reserve, while certain smaller areas are protected by Natura 2000, such as Sv. Nikolaj (Ankaran) and the underwater meadows with posidonia seagrass (Posidonia oceanica) at Žusterna (Medobčinski zavod 1999). The largest protected area are the Sečovlje Salt-pans.

Sečovelje Salt-pans are the only surviving part of the former lively salt production activity on the margins of the Gulf of Trieste – the wide, vast flat alluvial plains along the effluents of inshore rivers, no over-inflow of freshwater from land, favourable climatic conditions and favourable transport connections with the interior enabled the development of salt production from Servola, Aquilinia, Muggia, Koper, Izola, Strunjan and Lucija to Sečovlje (Rejec Brancelj 1991). The salt production area was surrounded on all sides by a 3-meter-high dike, strengthened by rocks and supported by clay. The land side contained a deep trench, which collected freshwater from the interior area. On the marine side, sea water was released into the salt-pans, which was controlled by release through pools that had a gradually lower bed in the direction of the sea. Where it was necessary, water was collected with the assistance of wooden pumps driven by the wind. The circulation of water from pan to pan made the water denser, and at density of between 26‰ and 30‰, table salt was extracted in the form of small crystals. Salt was collected from the pans using special rakes. The Sečovelje salt-pans were among the largest in Istra. In the middle of the 19th century, 493 salt houses could be counted in the area of the pans, where inhabitants of Piran, mostly of Italian nationality, lived seasonally. Farmers from the immediate vicinity came to the salt evaporation ponds, firstly as helpers and later as salt-makers, not earlier than at the turn of the 20th century. Evidence of the former lively economic activity in this area can be seen in one of the salt houses, which has been turned into the Museum of Salt-making. In recent years, the Sečoveljske Soline Landscape Park has served as a model of cooperation between the economy and nature protection.

4. DISCUSSION

The Slovenian sea is an exceptional natural resource for numerous activities, such as tourism, transport, production of food and other goods that are sometimes excluded from the use of the sea and inshore land.

The unique importance of the Slovenian sea is also evident by virtue of the fact that numerous legislative documents from various sectors limit the use of the sea and inshore land under various legal regimes. The drafting of rules, which are then implemented through various regulations, stipulates the method of enjoyment of the allocated rights of use and related obligations.

In general, a legal regime concerning natural or built (dike, in-fill, excavation, etc.) national assets is in force for the sea, the purpose of which is to enable general use by any person to

the same degree and under the same conditions. Individual regulations control this general use for the benefit of everyone. The legislation on marine fishery stipulates the areas of fishing reserves (Strunjan and Portorož), where primarily fishery and navigation speed are limited, and areas where the water quality is suitable for the life and growth of marine shellfish and marine gastropods – basically, areas where shellfish farms are already functioning or are being developed.

Areas for nature conservation and protection of cultural heritage are protected by various acts (for instance, nature reserve, landscape park, archaeological area, planned nature conservation area, ecologically important area, and Natura 2000 areas). Examples of larger protected areas are: Sečoveljske Soline Landscape Park, Strunjan Landscape Park, Škocjanski Zatok Nature Reserve and Cape Madona and Debeli Rtič natural monuments. The marine ecosystem is constantly endangered due to lively marine activities, either due to the introduction of non-indigenous species or due to intentional or uncontrolled releases from ships.

The use of the sea in the greater part of Koper Bay and in certain important smaller areas near other coastal settlements is governed by legal regimes in accordance with the maritime code (navigation routes, port of public transport, local port, etc.), which primarily refers to unobstructed navigation and other limited uses (bathing, fishery, etc.). Maritime transport has been increasing; as already mentioned, annual transhipment through Luka Koper reached 14 million tonnes in 2006. Transport is the one of the most limiting functions to access to the sea as a national asset – along 12% of the coast such access is not possible due to special protection regimes (customs piers, Luka Koper). A legal regime of bathing waters and bathing areas is in force for safe bathing in the sea, whereby special attention is devoted to water quality.

Environmental objectives oblige us to provide good water status and protection of the marine environment. One of the most effective tools for this is the preparation of a management plan for the coastal area with international cooperation. This surpasses the traditional sectoral approach and establishes cooperation by all interested parties. Successful steps in this direction have already been taken with the preparation of the coastal zone management programme within the framework of the CAMP Slovenia project. The following has been prepared: spatial development concept for the Southern Primorska region and spatial arrangement of the coastal zone, management of the protected nature areas, a regional strategy for the sustainable development of tourism, a regional programme for environmental protection and sensitivity maps of the Slovenian coast (Kušar 2007).

5. SUMMARY

The increasing use of the coastal zone and sea, increasing urbanisation and population growth, increasing tourist visits and a greater number of tourist vessels and maritime transport require special attention in the coastal and marine environment management. Weakening of marine ecosystems causes a loss of biodiversity, as well as the ecosystems'

decreasing stability and resistance. Furthermore, this also erodes the quality of human life in the coastal areas.

The importance of Integrated Coastal Zone Management is that land developers take into account the stress and impacts that their plans could have on the coast and marine ecosystem, and propose the most appropriate developmental solutions. The project takes, as its basis, measures to reduce pressures from land and maritime activities that affect the marine ecosystem. The research was oriented at the collection of data at the level of pollution of the sea from various substances and their sources. The effects of pollution on the marine environment and organisms were explored, and changes over time in the status of the marine environment were investigated. Afterwards, the collected data measures for environmental improvement were determined and the effectiveness of interventions was monitored. A lack of coordination in coastal zone management was ascertained. During the next steps, cooperation between ministries, regional and local authorities was aligned. The involvement of various stakeholders in the process of the regional programme of sustainable development preparation was of great relevance as well.

POVZETEK

Povečana raba obalnega pasu in morja, vse večja urbanizacija in rast prebivalstva, nenehno povečevanje števila turistov ter morskih prometnih in turističnih plovil, vse to terja posebno pozornost v upravljanju obalnega in morskega okolja. Posledica oslabitve morskih ekosistemov je izguba biotske raznovrstnosti, z njo pa tudi njihova vse manjša uravnoteženost in odpornost. Poleg tega pa to tudi načenja kakovost človekovega življenja v obalnih območjih.

Pri celovitem upravljanju obalnega pasu je pomembno, da lastniki zemljišč upoštevajo, kako negativno lahko njihovi načrtovani projekti vplivajo na življenje v tem pasu in morskem ekosistemu, in da predlagajo takšne razvojne rešitve, ki najbolj ustrezajo obstoječim razmeram. Vsekakor pa je treba že v začetku uvajati ukrepe, ki bodo zmanjšali pritiske s kopnega in iz različnih morskih dejavnosti, ki imajo močan vpliv na morski ekosistem. Raziskave so bile usmerjene k zbiranju podatkov glede onesnaževanja morja zaradi različnih snovi in njihovih virov. Raziskani so bili učinki onesnaževanja na organizme v morskem okolju in preučevane dolgoročnejše spremembe v stanju morskega okolja. Pozneje so bili zbrani podatki o ukrepih za izboljšanje okolja in nato spremljana njihova učinkovitost. Ugotovljeno je bilo pomanjkljivo usklajevanje pri upravljanju obalnega pasu. V naslednjih korakih je bilo usklajeno sodelovanje med ministrstvi, regionalnimi in lokalnimi oblastmi. Zelo pomembna je bila tudi udeležba različnih zainteresiranih javnosti v procesu priprave regionalnega programa za trajnostni razvoj.

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