

DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED
SCIENCES

**IMPLEMENTATION OF PROTECTION OF
ENDANGERED SPECIES AND THEIR
HABITATS TO THE INTEGRATED COASTAL
ZONE MANAGEMENT CONCEPT: A CASE
STUDY FOR THE MEDITERRANEAN MONK
SEAL (*MONACHUS MONACHUS*) IN FOÇA-
İZMİR**

by
Gökhan KABOĞLU

January, 2007
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İZMİR**

**A Thesis Submitted to the
Graduate School of Natural and Applied Sciences of Dokuz Eylül University
In Partial Fulfillment of the Requirements for the Degree of Master of Science
in the Institute of Marine Sciences and Technology, Coastal Zone Management
Program**

**by
Gökhan KABOĞLU**

**January, 2007
İZMİR**

M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled “**IMPLEMENTATION OF PROTECTION OF ENDANGERED SPECIES AND THEIR HABITATS TO THE INTEGRATED COASTAL ZONE MANAGEMENT CONCEPT: A CASE STUDY FOR THE MEDITERRANEAN MONK SEAL (*MONACHUS MONACHUS*) IN FOÇA-İZMİR**” completed by **GÖKHAN KABOĞLU** under supervision of **ASSOC. DR. KEMAL CAN BİZSEL** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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**IMPLEMENTATION OF PROTECTION OF ENDANGERED SPECIES AND
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İZMİR**

ABSTRACT

Foça is one of the remaining important habitats of the critically endangered Mediterranean Monk Seal. The human interaction of the species is a crucial dimension through the recovery of the species and its habitats. The interrelations and interactions are investigated in the study by the help of Geographic Information Systems (GIS). The thesis focuses on the area usage of the species and its interactions with human activities in order to examine the human pressure on the species. The aim is to present a methodological framework with spatial analysis in order to take conservation measures within integrated coastal zone management (ICZM) plans. Human activities are determined to overlap intensively with the coastal and marine habitats of the species and need to be regulated.

Keywords: ICZM, nature conservation, GIS, Mediterranean Monk Seal.

**NESLİ TEHLİKEDE OLAN TÜRLER VE YAŞAM ALANLARININ
KORUNMASININ BÜTÜNLEŞİK KIYI ALANLARI YÖNETİMİ KAVRAMI
İÇİNDE DEĞERLENDİRİLMESİ: FOÇA-İZMİR YÖRESİNDE AKDENİZ
KEŞİŞ FOKU (*MONACHUS MONACHUS*) İÇİN ÖRNEK BİR ÇALIŞMA**

ÖZ

Foça yöresi, nesli kritik derecede tehlike altında olan Akdeniz Keşiş Foku'nun kalan önemli yaşam alanlarından birisidir. Türün insanla olan etkileşimi popülasyonun ve yaşam alanlarının mevcut durumunun iyileştirilmesi için önemli bir mevzudur. Bu çalışmada, ilişkiler ve etkileşimler Coğrafi Bilgi Sistemleri (CBS) yardımıyla incelenmiştir. Tez, insanın tür üzerindeki baskısını incelemek için türün kullanım alanı ile bu alanın insan faaliyetleri ile olan etkileşimlerine odaklanmıştır. Amaç, tür koruma çalışmalarının bütünleşik kıyı alanı yönetimi (BKAY) planına dahil edilmesi için alansal analizlere dayanan bir yöntem sunmaktır. İnsan faaliyetlerinin türün kıyısız ve denizel yaşam alanları ile yoğun bir şekilde kesiştiği belirlenmiş ve bu faaliyetlerin düzenlenmesi gerektiği sonucuna varılmıştır.

Anahtar sözcükler: BKAY, doğa koruma, CBS, Akdeniz Keşiş Foku

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CHAPTER ONE

INTRODUCTION

1.1 General Introduction

At the Earth Summit on Environment and Development (Rio de Janeiro, 1992), the concept of “**sustainable development**” was agreed by the United Nations to be the global strategy for further human development (Guareport, 2000). Basically meaning “meeting the needs of humanity without compromising the needs of future generations”, sustainable development is structured on the intergovernmental, international and intergenerational equities. The concept of sustainable development is potentially an important shift in understanding relationships of humanity with nature and between people (Hopwood, Mellor & O’Brien, 2005).

Development, whether it is sustainable or not, mostly takes place in coastal zones. The reason is the high concentration of human population in coastal zones, and the needs of such a high population are met with a great number of human activities within coastal and marine areas. Since economic development is typically perceived as the necessary first step in a nation’s social development, coastlines often receive much economic development in the form of tourism and urban, agricultural, and industrial development. This development takes place in the approximately 10% of the Earth’s surface causing generally a high pressure on the coastal areas (Shi et al., 2001); thus threatens sustainability not locally but also globally because of the characteristics of coastal zones.

The human effect on coastal and marine environments is declared in Agenda 21 as, “despite national, sub-regional and global efforts, current approaches to the management of marine and coastal resources have not always been proved as capable of achieving sustainable development, and the coastal resources and coastal environment are being rapidly degraded and eroded in many parts of the world”. Hence, it recommends, “each coastal state should consider establishing, or where necessary strengthening, appropriate coordinating mechanisms for integrated

management and sustainable development of coastal and marine areas and their resources, at both local and national level". Achieving sustainable development is no doubt needs an integrated approach which takes all variables from social to ecological criteria into consideration. Integrated coastal zone (area) management (ICZM or ICAM) is now an internationally accepted paradigm as the best way to sustainable development in coastal and marine zones.

Nature conservation is one of the important issues of ICZM. The general approach has been to establish protected areas throughout the world to protect some natural (and cultural and historical) values. Protected areas are legally based natural resource management tools, and despite the oppositions, they should be perceived as a precautionary approach especially in the situations where lack of sustainable management or scientific gap is in case. Beyond emotional conservation, ICZM deals with ecosystem management, and considers endangered species and their degraded habitats as indicators of unhealthy ecosystems. For this reason, recovery of threatened wildlife is somehow an indicator of achieving sustainable development.

The aim of the thesis is to present a methodology for endangered species management in the context of ICZM. The case of Mediterranean Monk Seal (*Monachus monachus*, Hermann, 1779), one of the most endangered mammals throughout the world, is examined in Foça, İzmir. Geographic Information System (GIS) is used to obtain species-human interactions and to locate the human pressure on the species. The study area is of high importance not for only the remaining few number of species, but also for the tourism and fishery sectors. Thus, in addition to species specific management issues, conflicting areas and activities are also considered in order to obtain a holistic solution to the problem.

The methodology presented herein depends on analysis of zonal interactions. It is believed that an effective zonal analysis tool is developed using the capabilities of GIS. The approach is capable to give more reliable results with a greater number of appropriate datasets. For example, the land use layer is the weakest dataset when compared to others in the sense of reliability and should be studied more detailed by

adding new layers, such as human settlement, military, beach usage, etc. Similarly, some other navigational activities such as yachting, water sports and recreational (or sports) fishing should be analyzed and their zonal characteristics should be determined in order to view the realistic picture of the marine activities and their interactions with the species, in addition to fishing and tour boat activities. Besides all these, and may be more importantly, the economical criteria should be more comprehensive and complementary, for instance, inclusion of taxation properties of the activities to their net annual income and the number of people employed, in order to determine how much each activity contributes to local, regional and/or national income.

1.2 Theoretical Background

This part is intended to mention the concepts included in the thesis as background information. The literature review was performed to overview the subjects in a comprehensive manner from general topics to the detailed ones. The aim is to focus on the area of interest and to support the study and its methodology with literatures published up to date. The background information is presented under the following topics:

- **Integrated Coastal Zone Management;** basic concepts of ICZM are defined and major functions and tools used are mentioned.
- **Human on the Coast: Tourism and Fisheries;** coastal and marine tourism trends and their consequences on the environment are reviewed.
- **Nature Conservation;** nature conservation issues and endangerness of species together with human interaction and threats are discussed from the international point of view through conservation evolution and approaches.
- **Geographic Information Systems;** includes an overview of GIS fundamentals focusing on the terms used in the thesis, and special notes from the literature as a tool for ICZM and nature conservation.

- **The Mediterranean Monk Seal;** describes the status, threats and human interactions of the species together with biological and ecological characteristics.
- **Turkey: Status Quo on the Subjects;** the topics above are reviewed in the national scale.

1.2.1 Integrated Coastal Zone Management

The coastlines of the world, over 440000 km in length, represent one of the most dynamic natural environments and one of the most important contexts in which human activity, economy, ecology and geomorphology interact (Fabbri, 1998). It is a place of high priority of interest to people: more than half of the world's population inhabits at coasts and populations of coastal areas are growing faster than inland populations (Cicin-Sain & Knecht, 1998). The situation results in an increase in the variety and density of socio-economic activities such as fisheries, agriculture, mineral exploitation, industries, transportation, tourism and recreation; which turns round as negative impacts on the coastal environments and conflicts among users.

After the 1992 Earth Summit and 1993 World Coast Conference, Integrated Coastal Zone Management (ICZM) has become a highly accepted paradigm to manage land and coastal water resources (Uluocha, 2005 & Clark, 1997). Cicin-Sain & Knecht (1998) define **ICZM** as “a continuous and dynamic process by which decisions are made for the sustainable use, development, and protection of coastal and marine areas and resources” (Cicin-Sain & Knecht, 1998, p. 39). According to Clark (1997), ICZM recognizes that the coastal resources management situation is unique as it differs greatly from either land or water resources, being a combination of both (Figure 1.1). Linden (1997) states that ICZM is an ecologically and socially based approach to environmental management that is a significant departure from traditional sectoral approaches which have proven unable to deal with the complexity that characterizes the coastal area problems.

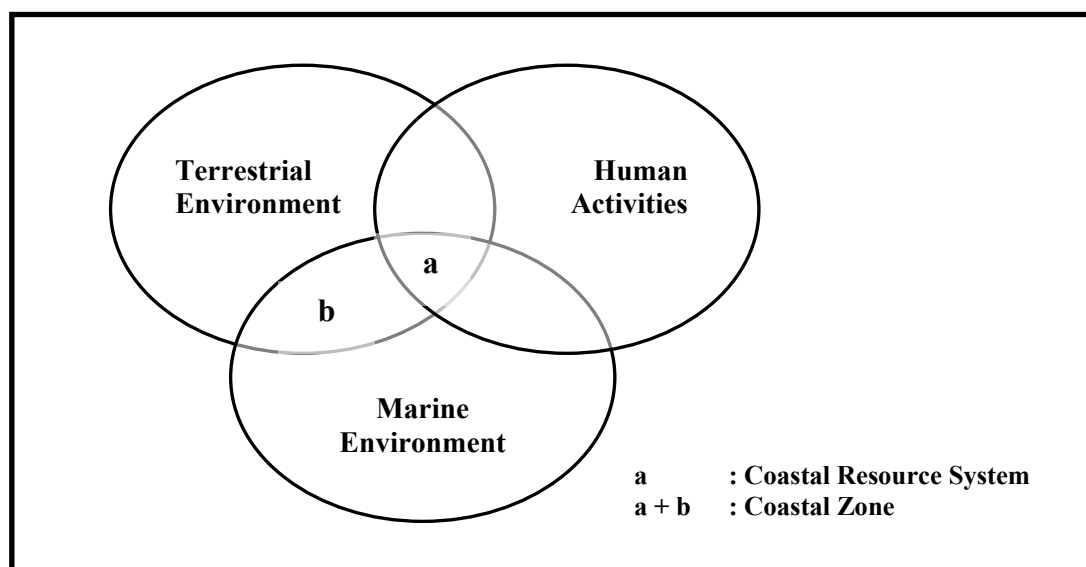


Figure 1.1 Relationship between coastal zone and coastal resource system (Scura, et al., 1992).

ICZM deals with a wide range of coastal area problems. Holland (1998) lists the issues of global character as biodiversity, sea level rise, atmospheric pollutants, aquaculture and ballast water; and the regional issues as transboundary pollution, regional cooperation and shared responsibilities. Although the list is complex, the issues are unique to the ICZM programs since each program has its own goals, and national, regional, social and economical aspects.

In the literature, there are several answers to the question what is being managed in ICZM. Cicin-Sain & Knecht (1998) answer that ICZM is concerned with area management and with interactions among various resources (Table 1.1) and activities in specific coastal and ocean areas.

Table 1.1 Classification of resources (Source: GUA Report, 2000).

	Time for regeneration	Environmental resources	Energy resources	Material resources
Renewable	< 1 year, controllable by humans	Agricultural products, (non permanent) pollution of water and air	Solar energy, water, ethanol	Salt
Semi-renewable	1-200 years, no human influence	Fish, forests, groundwater, (permanent) pollution of water and air	Geothermal energy, water, firewood	
Non-renewable	No economic relevance	Ozone, endangered fauna and flora	Oil, gas, coal, uranium	Minerals, soil

The crucial question may be where is being managed. The term **coastal zone** is defined by Sorenson and McCreary as “the interface or transition zone, specifically that part of the land affected by its proximity to the sea and that part of the ocean affected by its proximity to the land...an area in which processes depending on the interaction between land and sea are most intense” (Clark, 1996, p.1). French (1997) states that it is generally agreed that coastal zone includes the hinterland, the intertidal area, and the subtidal areas; and emphasizes that there is no overall view as to how much of the hinterland and sea should be included. According to Cicin-Sain & Knecht (1998) and Clark (1996), the landward and seaward boundaries of the coastal zone should be defined to meet the goals of the ICZM programs depending on the situation at hand (Figure 1.2).

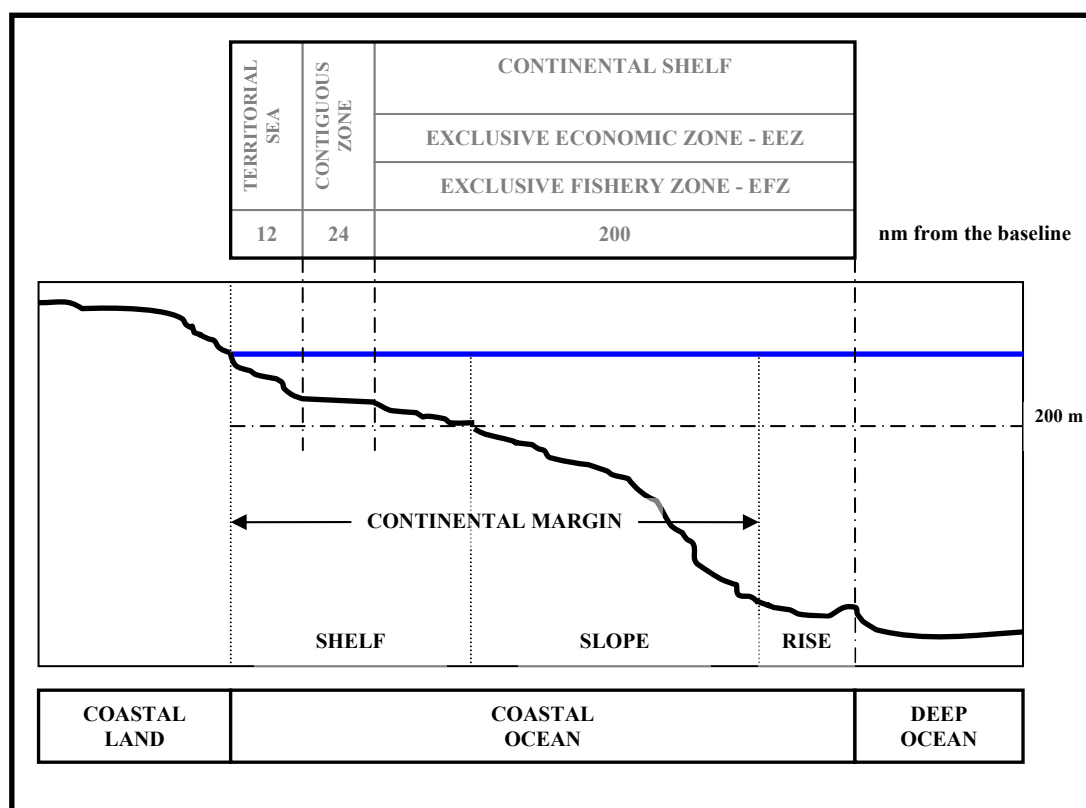


Figure 1.2 The physical and jurisdictional frameworks of coastal management (Vallega, 2005).

United Nations (UN) Ocean Economics and Technology Branch (1984) states that four criteria are generally used for defining the coastal area: physical criteria, administrative boundaries, arbitrary distances, and selected environmental units; additionally it is highlighted by UN that “no single criterion is universally applicable,

nor can one criterion meet all the requirements for an effective definition of the management area” (p. 12). In order to achieve sustainable development at global scale, the geographical coverage of the coastal management areas has been extended since 1972 UN Conference on the Human Environment; in the 2002 World Summit on Sustainable Development (WSSD) it is triggered to widen the geographical coverage, seawards covering extended jurisdictional zones, and landwards covering the river basins (Vallega, 2005).

An ICZM program may deal with a wide range of issues due to the goals of the program within a predefined coastal zone specific to that program (Table 1.2). The complexity of natural processes and the variety of human activities together with their consequences on the environment need more than the sectoral approach or harmonization. According to Cicin-Sain & Knecht (1998), the word **integrated** includes intersectoral integration, intergovernmental integration, spatial integration, science-management integration and international integration. Only such governance will may achieve sustainable development at local, regional, national and global scales which Agenda 21 calls nations to do so.

The dimensions of integration should be sustained through all processes of ICZM programs. When the programs around the world are reviewed, it is examined that many different ways of developing such programs are in evidence, reflecting each nation’s particular physical, socioeconomic, cultural and political conditions (Cicin-Sain & Knecht, 1998). Coccossis (2002) lists the **stages of an ICZM process** as *1. Initiation, 2. Analysis of existing situation, 3. Identification of conflicts/opportunities, 4. Identification of goals and alternative courses for action, 5. Development of strategy, 6. Implementation, and 7. Monitoring and evaluation.* There is a variety of instruments and methods (Table 1.3) used in these phases which can be employed depending on the scope and scale of the ICZM programs.

Table 1.2 Major functions and typical activities of ICZM (Adopted from Cicin-Sain & Knecht, 1998).

MAJOR FUNCTIONS OF ICZM	TYPICAL ICZM ACTIVITIES
Area Planning	studies of coastal environments and their uses, zoning of uses, anticipation of and planning for new uses, regulation of coastal development projects and their proximity to the shoreline, public education on the value of coastal and marine areas, regulation of public access to coastal and marine areas
Promotion of Economic Development	industrial & artisanal fisheries, mass tourism, ecotourism, marine aquaculture, marine transportation, port development, marine recreation, offshore minerals, ocean research, access to genetic resources
Stewardship of Resources	conduct of environmental & relative risk assessments, establishment and enforcement of environmental standards, protection and improvement of coastal water quality, establishment and management of coastal and marine protected areas, protection of marine biodiversity, conservation and restoration of coastal and marine environments
Conflict Resolution	studies of multiple uses and their interactions, applications of conflict resolution methods, mitigation of unavoidable adverse effects on some uses
Protection of Public Safety	reduction of vulnerability to natural disasters and global changes, regulation of development in high-risk areas, construction of coastal defense measures, creation of evacuation plans or other measures in case of coastal emergency
Proprietorship of Public Submerged Lands and Waters	establishment of leases and fees for use of publicly held coastal and marine resources and spaces, establishment of joint ventures to exploit non-renewable resources

Table 1.3 Tools of ICZM (+: most useful, √: useful) (Coccossis, 2002).

	Initiation	Analysis	Conflicts/ Opportunity	Goals	Strategy	Implementation	Monitoring & Evaluation
Data acqu.	+	+					
Data man.		+	√				+
Data util.		+					√
DSS		+	+	√	+		+
Scenarios		+	+	√	+		√
CCA		+	√	√			√
Regulation					+	+	√
Zoning					+	+	√
Econ. Instr.					+	+	√
Awareness	√				+	+	√
EIA						+	+
SEA		+	+				+
Econ. Eval.		+	+				+
Risk anal.	√	+					+
Conf. resol.	+			+		+	+

ICZM programs through its international evolution (See Appendix 1) must be well analyzed in order to raise the level of continuous coastal management process cycle. The experience gained up to date will highlight the achievements and lacks of ICZM processes. Thus, the issues like what more can be done for sustainable development, how legislations and institutions should be arranged, what capacity is needed, the need for innovative approaches and methodologies, appropriate use of tools and technologies, data management, zoning, conflict resolution, ecosystem management and economical instruments will be enlightened.

1.2.2 Human on the Coast: Fisheries and Tourism

The two of major coastal and marine human activities are fishing and tourism. Although these activities benefit from **use value** of coastal and marine resources, they are probable to harm both **use and non-use value** (Table 1.4) of some resources within coastal zones and the use value of other stakeholders. Direct and indirect damage of tourism and fisheries to the ecosystems, together with conflicts among different sectors and communities, have been resulted in negative pressure on the environment and some species throughout the world. These activities are also listed as top threats in the literature for the *M. monachus* as fishing may cause death by accidental catch (and also deliberate death) and depletion of food stocks and tourism may degrade habitat of the species.

Table 1.4 Resource value descriptions (Adopted from GUA Report, 2000).

USE VALUE	Direct use value	Outputs directly consumable
	Indirect use value	Functional benefits
	Option value	Direct and indirect future values
NON-USE VALUE	Existence value	Use and non use value of environmental legacy
	Bequest value	Value from knowledge of continued existence

Fishery is an important economical activity throughout world, which depends on the coastal area both directly (resource and space) and indirectly (e.g. factors

affecting biological productivity) (Willmann, 1998). The activity can be dependent on marine fisheries or inland (freshwater) fisheries as well as aquaculture. Fisheries are categorized by different levels of classification. On a broad level, capture fisheries can be classified as industrial, small-scale/artisanal and recreational whereas a more specific level includes reference to the fishing area, gear and the main target species such as North Sea herring purse seine fishery (Smith, 2006) (See Appendix 2 for fisheries definitions of FAO). On the other hand, IUCN Fisheries Working Group studied the industry under the categories such as demersal, large pelagic, small pelagic and artisanal fisheries in addition to aquaculture for the Mediterranean and the Black Sea.

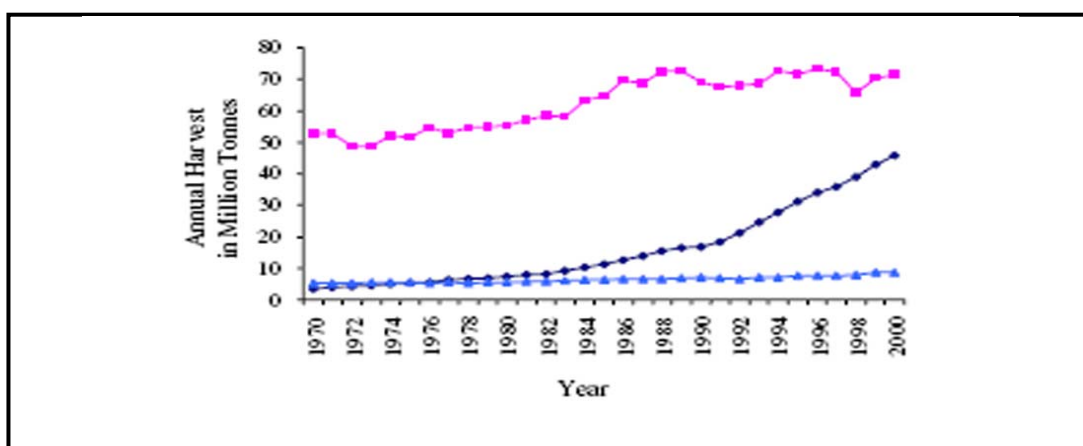


Figure 1.3 Trends in catches in marine and inland fisheries excluding recreational harvest (pink data: total marine harvest, light blue data: inland fisheries harvest, dark blue data: aquaculture) (Source: Cooke & Cowx, 2005; based on FAO 2002).

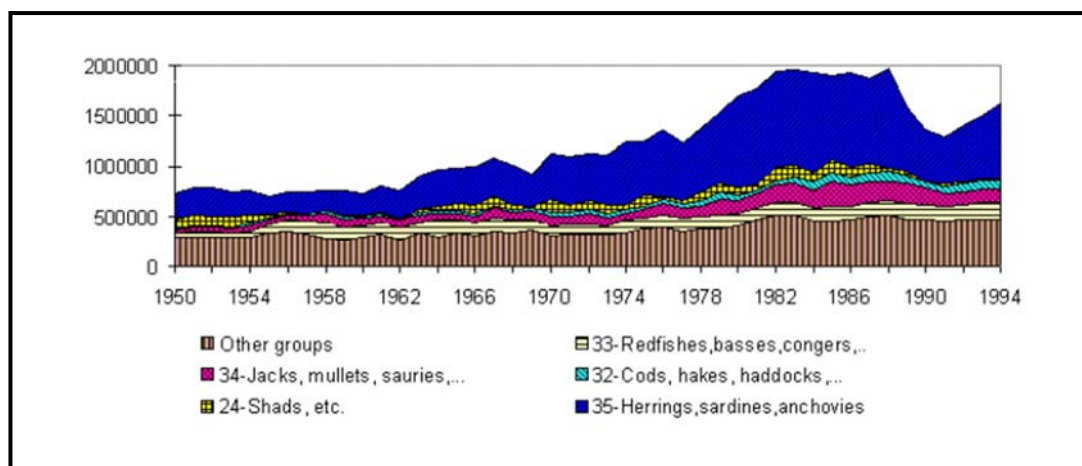


Figure 1.4 Landing trends of the main species in the Mediterranean and Black Sea (Source: IUCN Fisheries Working Group; based on Caddy 1997).

Global trends of the total annual catch in marine and freshwater fisheries are generally on the increase (Figure 1.3 & 1.4, See also Appendix 3), but according to Cooke & Cowx (2005) these mask the true situation: the main commercial fisheries are subject to intense exploitation and catch-per-unit-effort is declining in many fisheries. Jennings, Kaiser & Reynolds (2001) state that the increasing intensity of fishing throughout the world has had impacts on the marine ecosystem other than those on target species and these impacts are now the focus of many research and management programs. The Food and Agriculture Organization (FAO) estimated in 2002 that 47% of fish stocks are exploited to their maximum sustainable threshold, a further 18% are over-exploited, and 10% are depleted.

The fact that only 25% of the world's fish stocks are away from depletion risk makes fisheries management a crucial issue in sustainable management of marine resources. According to Jennings, Kaiser & Reynolds, fisheries are managed because uncontrolled fishing has undesirable consequences such as fishery collapse, economic inefficiency, loss of employment, habitat loss or decreases in the abundance of rare species. Jones, Fitzgerald & Sale (2005) state that different faunas and different fisheries bring up different questions and approaches. Thus, each fishery management should consider specific objectives to that fishery and indicators that show whether a management objective has been met (See Appendix 4 for a list of objectives and their possible indicators) and should be based on a knowledge system with appropriate information data (See Appendix 5 for schematic representation of a fisheries knowledge system and fisheries information data). Fisheries management is performed with some regulating tools such as zonation, gear type regulation, etc. (Table 1.5).

Fisheries compete within themselves and with other human activities for resources, space and political support (Willmann, 1998 & Garcia, 2005). Only a few number of these interactions are synergistic, they are generally antagonistic and result in conflicts among sectors. The major impacts of the activity on the ecosystem in addition to overexploitation are the destruction of the marine bottom and benthos communities and by-catch of marine mammals and turtles (IUCN Fisheries Working

Group). The conflict resolution and biodiversity issues need an integrated ecosystem approach for the sustainability of the sector.

Table 1.5 Comparison of tools to regulate fishing practices in commercial and recreational fisheries.

Regulatory tool	Commercial fisheries	Recreational fisheries
Closed areas	Protected areas and nursery habitats	Protected areas and nursery habitats
Closed season	linked to spawning periods or vulnerable periods during migration	Usually linked to spawning periods
Catch limit	Quotas	Bag limit
Effort regulation	Licensing	Partially in some jurisdictions (e.g., UK)
Type of gear (See Appendix 6 for gear types)	To minimize damage to stocks through, for example, mesh size or highly efficient, destructive gears	Usually only in specialist fisheries
Size of fish	Minimum size limits usually linked to size at maturity	Minimum size retained in some fisheries
Species of fish	Quotas	At specific times and in specific places
Code of conduct	FAO CCRF	National guidelines in some countries; international guidelines linked to FAO CCRF in preparation

Tourism is defined as “the activities of persons who travel to and stay in places which are distinct from their usual place of abode for a period of less than 12 consecutive months, for leisure, business or other reasons” (Eurostat, 2002). The parameters such as net annual income, economic growth-Gross Domestic Product (GDP), tourist arrivals, accommodation supply, tourism demand, overnight stays, purpose of visit, means of transport, international tourism expenditures, employment, international tourism receipts, etc. define the economical and social characteristics of tourism activities (Eurostat, 1999, 2002, 2003; & UNWTO, 2006). Tourism demand depends above all strongly on the economical conditions in major generating markets, and according to the statistical data of World Tourism Organization (UNWTO) and International Monetary Fund (IMF), the growth of international tourism arrivals significantly outpaces growth of economic output (Figure 1.5 & 1.6). Whether it is inbound, outbound or domestic tourism, much of the destinations are through the coastal zones (63% for European holidaymakers).

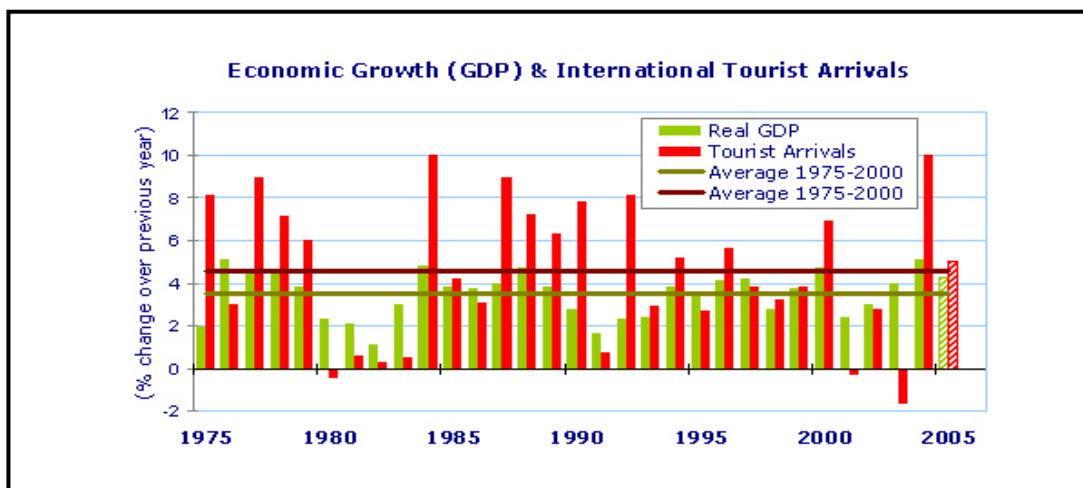


Figure 1.5 Economic growth (GDP) and international arrivals (Source: UNWTO & IMF, 2006).

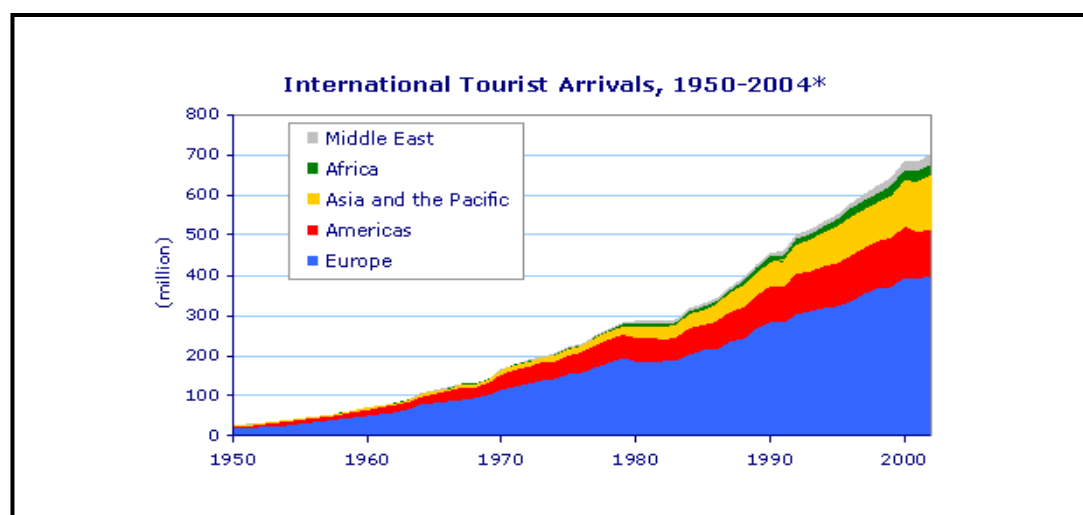


Figure 1.6 International tourist arrivals by years (Source: UNWTO, 2006).

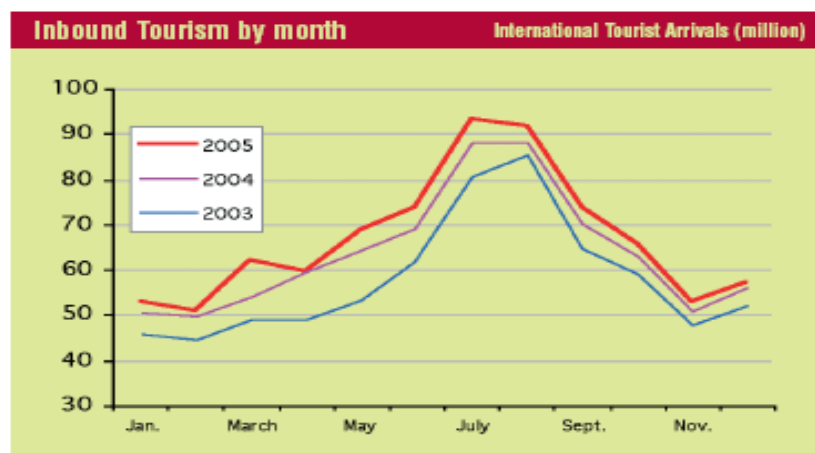


Figure 1.7 International tourist arrivals by months (Source: UNWTO, 2006).

“The concept of **coastal tourism** embraces the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and the offshore coastal waters. These include coastal tourism development (accommodation, restaurants, food industry, and second homes), and the infrastructure supporting coastal development (e.g. retail businesses, marinas, and activity suppliers). Also included are tourism activities such as recreational boating, coast- and marine-based ecotourism, cruises, swimming, recreational fishing, snorkeling and diving” (Hall, 2001). Hotels and similar establishments are the most usual form of accommodation in seaside resorts. Because of their particular spatial planning and their power to attract tourists, coastal regions generally have very high concentrations of this type of establishment (Eurostat, 2002).

The high demand in the tourism industry inevitably causes pressure on the coastal environments, which are in fact the capital of tourism. There are direct and indirect impacts of tourism on the natural resources. The fact that tourism is very much a seasonal activity (Figure 1.7) has a direct impact on the environment: tourism booms at summer months and coastal destinations subject to high concentration of human activities in small fragile coastal areas. When the infrastructure of the industry such as roads, airports, ports, marinas, etc. is considered, tourism may be indirectly responsible, but hotels and other leisure complexes are directly responsible for ecosystem disruption and for the decline of underground water supplies (Eurostat, 2002 & European Commission General Tourism Unit, 2000). Rapid urbanization, speculative building, and the massive and seasonal influx of people bring also serious pollution problems, coastal erosion and increased energy consumption.

Fisheries and tourism may have negative effects on the coastal environment like any other coast and marine dependent activity without appropriate management (See Appendix 7 for GESAMP’s report for the action against marine environmental damage), but they are likely to be affected much more and rapidly than other sectors.

1.2.3 Nature Conservation

Despite international efforts to reduce human impact on the environment (See Appendix 8 for international conventions on nature conservation) for almost hundred years, there are only a few ecosystems in the world today in which humans do not have either a direct or indirect effect. According to Tivy & O'Hare (1992), the reason for the state is the role of humans in the ecosystem: humans are ecologically dominants, humans are tool making animals, humans are robber animals, humans are agents of evolution, humans are dirty animals, and humans are animals with a sustained rate of population growth.

The Jakarta Mandate of the Convention on Biological Diversity (CBD) “encourages the use of integrated marine and coastal area management as the most suitable framework for addressing human impacts on marine and coastal biological diversity and for promoting conservation and sustainable use of this biodiversity, and encourages Parties to establish and/or strengthen, where appropriate, institutional, administrative, and legislative arrangements for the development of integrated management of marine and coastal areas, and their integration within national development plans” (UNEP, 1995b). The ICZM function **stewardship of resources** (Table 1.2) deals with the activities concerning the protection of marine biodiversity and conservation and restoration of coastal and marine environments which the Jakarta Mandate calls the nations to do so. Olsen (2000) implies that ICZM may succeed environmental protection and sustainable development through ecosystem governance as it struggles with optimal, long-term utilization of ecosystems, and equity in the distribution of resources not only within a given society but also across regions and across generations. The fragile balance that exists between the marine and coastal environments is just one part of a complex equation, and according to Dauvin et.al. (2004) the concept of ICZM links social and economic dynamics, based on the originality of the marine zone, and spatial dynamics, as recreated in terms of planned development. Nature conservation and natural resource management appears to be one of the most important and attracting issues of coastal area managers for the sustainability of natural wealth.

Conservation is the effort to maintain the natural and cultural values which are renewable or semi-renewable resources in character. The World Conservation Union (IUCN) defined the term **conservation** as “the preservation and management of the living world, the natural environment of humanity, and the earth’s renewable resources on which rests the foundation of human civilization” (Preamble IUCN-Constitution, International Environmental Law 948:75). Van Heijnsbergen (1997) states that conservation as a term includes the meanings of the terms “protection and preservation”, and additionally the concept *management* under the name of wise and informed administration of natural resources. Rolston’s (1994) approach to the conservation is more philosophical. He argues that conservation is through balancing values such as natural, biodiversity, cultural, integrity and health values (See Appendix 9 for Rolston’s rules to balance values). In addition to Rolston, Lane (2001) also implies that there are intrinsic or biocentric values (so as agreed in the United Nations World Charter for Nature) rather than anthropocentric values (Rio Declaration has an anthropocentric preamble).

What are these values conserved against? Beyond the natural and geophysical changes which are long term processes, the nature is conserved against human effect on the environment which can change ecosystem in a considerably short period of time. Thus, first the threats must be identified clearly in order to conserve the nature. After a survey of 43 of the world’s most endangered protected areas in 1980s, IUCN (1984) generated the following Top Ten threats: 1. inadequate resource management, 2. human encroachment, 3. change in water regime (including hydro development), 4. poaching, 5. adjacent land development, 6. inappropriate internal development, 7. mining and prospecting, 8. live stock conflicts, 9. military activity, and 10. forestry activities.

There are some tools used to conserve the nature against these threats. Among them, protected areas seem to be the most effective management tool to achieve the protection and sustainable use of natural resources. IUCN has defined a **protected area** (PA) as “an area 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” (IUCN, 1994a).

The definition of PA brings about the term biological diversity (Figure 1.8; see also Appendix 10 for Key Biodiversity Issues for Protected Areas). Whatever the establishment aim of the PA is (e.g. to protect single species or to recover fisheries), it serves to conserve biological diversity. The priority of protected areas is protection and it also aims to arrange human activities within and in the surrounding area, which in turn makes protected area an area management technique and a wise use concept for natural and cultural resources (Kaboğlu, Güçlüsoy & Bizsel, 2005).

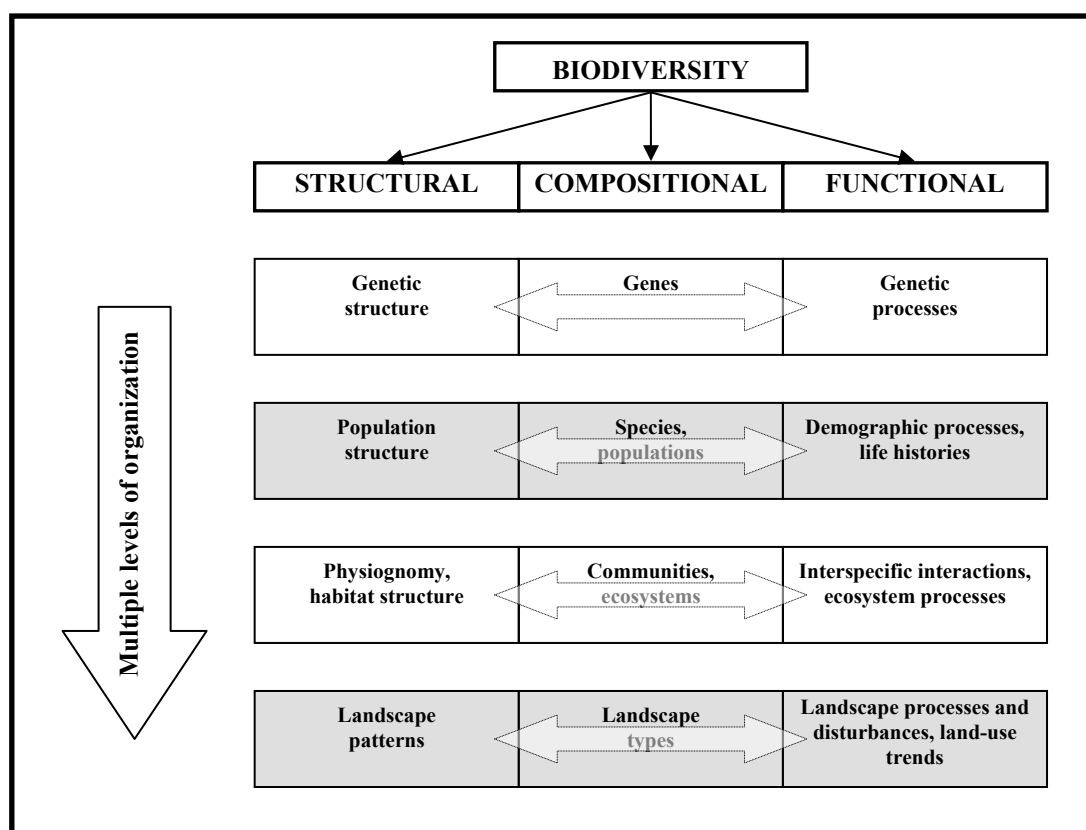


Figure 1.8 Compositional, functional and structural biodiversity (All biodiversity elements at each level of organization are interconnected) (adopted from Noss, 1990).

The importance of protected areas is emphasized by international conventions and programs such as the Convention on Biological Diversity (CBD), the World Heritage Convention (WHC), the Ramsar Convention on Wetlands, the United Nations Law

of the Sea Convention (UNCLOS), UNESCO's Man and the Biosphere (MAB) Program of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the global program of the World Commission of Protected Areas (WCPA). Together these agreements and programs are the backbone of international policy on the establishment and management of protected areas for biodiversity conservation and the sustainable use of natural and cultural resources (IUCN, 1998).

There are different categories of PAs throughout the world. Each nation has developed some different management objectives and regulations. Although the situation has ended in various types of PAs, there are now some international efforts to universalize the characteristics and structures of PAs. Generally accepted approach is to adopt national categories to the ones that IUCN WCPA has defined in 1994. IUCN has categorized the PAs into six according to their primary management objectives (Table 1.6. Also see Appendix 11 for detailed information):

1. **Category I. Strict Nature Reserve/Wilderness Area:** protected area managed mainly for science or wilderness protection;
2. **Category II. National Park:** protected area managed mainly for ecosystem protection and recreation;
3. **Category III. Natural Monument:** protected area managed mainly for conservation of specific natural features;
4. **Category IV. Habitat/Species Management Area:** protected area managed mainly for conservation through management intervention;
5. **Category V. Protected Landscape/ Seascape:** protected area managed mainly for landscape/seascape conservation and recreation;
6. **Category VI. Managed Resource Protected Area:** protected area managed mainly for the sustainable use of natural ecosystems (IUCN, 1994).

Moreover, IUCN calls nations to build up a “national system of protected areas” referring to the Articles 8(a) and (b) of CBD which are (a) *Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity; and (b) Develop, where necessary, guidelines for the selection,*

establishment and management of protected areas where special measures need to be taken to conserve biological diversity. The reason is that a system approach improves the probability of substantial progress in conservation. It also promotes a truly integrated approach to linking conservation with other human endeavors (IUCN, 1998).

Table 1.6 Matrix of management objectives and IUCN protected area management categories (IUCN, 1994). (1: primary objective, 2: secondary objective, 3: potentially applicable objective, -: not applicable)

Management Objectives	IUCN Protected Area Management Category						
	Ia	Ib	II	III	IV	V	VI
Scientific research	1	3	2	2	2	2	3
Wilderness protection	2	1	2	3	3	-	2
Preservation of species and genetic diversity	1	2	1	1	1	2	1
Maintenance of environmental services	2	1	1	-	1	2	1
Protection of specific natural and cultural features	-	-	2	1	3	1	3
Tourism and recreation	-	2	1	1	3	1	3
Education	-	2	2	2	3		
Sustainable use of resources from natural ecosystems	-	3	3	-	2	2	1
Maintenance of cultural and traditional attributes	-	-	-	-	-	1	2

Huber et al. (2003) state that environmental processes and ecological systems are strongly influenced by social and economic systems in coastal zones and list, the most serious problems facing the marine and coastal environment at the global level, apart from threats arising from predicted climate change as:

- the destruction of habitats, and their physical alteration;
- overfishing and the effects of fishing on the environment;
- the effects of sewage and chemicals on human health and the environment;
- increasing eutrophication;
- changes to hydrology and the flow of sediments.

Marine Protected Area (MPA) is another area management tool in coastal and marine environments. IUCN has defined an **MPA** as “any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (1988, reaffirmed in 1994). An MPA may be categorized in any of the six management categories mentioned above, or it may be designed as a biosphere reserve as well as other protected areas. (A **biosphere reserve** is “a protected area of representative environments, internationally recognized for their conservation value and for providing the scientific knowledge, skills and human values to support sustainable development” (UNESCO, 1987 in IUCN, 1999), and generally covers a larger area than PAs.) IUCN also states that some MPAs are established for only fisheries management in some countries.

Zonation is an important task in PA designation and, according to Salm & Clark (1984), it is important to select core and buffer areas appropriate for each specific PA. Natural value of ecological attributes is the main criteria in defining core and buffer zones and the aim of this approach is to determine no-entry and no-take zones where any activity involving the extraction of natural resources is prohibited (IUCN, 2003) as a result of precautionary principle, and to regulate human activities in the surrounding buffer zones.

The threatened wildlife is an important issue which sometimes triggers the designation of PAs. IUCN studies endangered in the Red List of Threatened Species under various categories and criteria (Figure 1.9, see also Appendix 12 for the definitions of the categories and Appendix 13 for the definitions of the terms used in criteria) and this “Red List” is widely recognized and accepted internationally. A taxon is defined as **Critically Endangered** in the Red List when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (See Appendix 14 for critically endangered species criteria), and it is therefore considered to be facing an extremely high risk of extinction in the wild (IUCN, 2006).

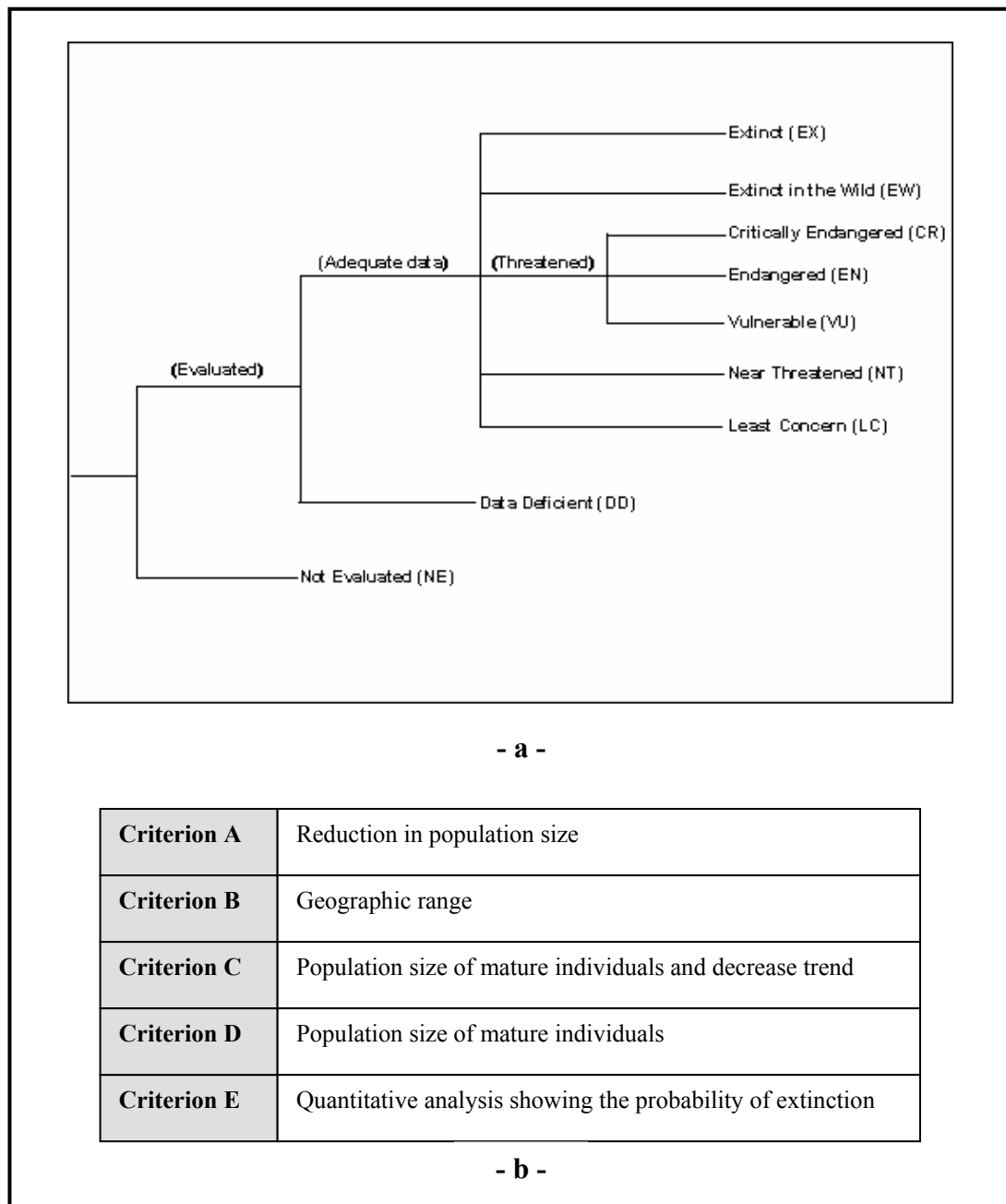


Figure 1.9 IUCN Red List Categories (a) and Criteria (b) (Source: IUCN: 2006).

The management of PAs and endangered species issues need an integrated ecosystem approach which only not considers the ecological values but also human interference. The **ecosystem approach** can be regarded as a strategy for the management of land, water and living resources that promotes biodiversity conservation and sustainable use in an equitable way. At the heart of the approach is the awareness that, without the effective management of ecosystems, there can be no

economic development that generates sustainable human and social welfare; equally, without the full engagement of diverse sectors in the economy and society in the management of ecosystems, there can be no effective biodiversity conservation. In that sense, the ecosystem approach is a framework for holistic decision-making and action (Bennett & Mulongoy, 2006).

1.2.3.1 Notes from the Literature on Nature Conservation

- McLean & Stræde (2003) state according to their questionnaire results that 83% of the respondents replied that in general it was important to have protected areas for the sake of nature conservation, less than 2% of the respondents thought that it was not important, while 15% could not answer. Generally, humans talk it on the word, if their economic income is not affected from the PA: Stoll-Kleemann (2001) states that a particularly problematic aspect of designating a protected area is that nature conservation regulations are perceived as restricting personal rights and private property rights and that this situation have resulted in opposition to PAs in Germany.
- Wang (2004) state that the Committee on the Scientific Basis for Ecosystem Management (CSBFEM) of the Ecological Society of America defined ecosystem approach as the management based on the “best understanding of the ecological interactions and processes necessary to sustain ecosystem structure and function.” The CSBFEM outlined the major elements of ecosystem management as follows: 1) long-term sustainability as fundamental value; 2) clear, operational goals; 3) sound ecological models and understanding; 4) understanding complexity and interconnectedness; 5) recognition of the dynamic character of ecosystems; 6) attention to context and scale; 7) acknowledgment of humans as ecosystem components, and 8) commitment to adaptability and accountability.
- According to Ortigosa et al. (2000), it is increasingly important to understand the habitat requirements of endangered species, delineate the remaining suitable habitat, and effectively manage these units of habitat for the species’ survival.

Unfortunately, even though extinction processes are widely known, wildlife conservation policies in land planning and management practice have been rarely based on formalized and transparent considerations. However, habitat-based modeling techniques that can identify remaining potential habitat and predict spatial habitat suitability are now available.

- Fisher et al. (2001) state referring to Audubon (2001) that in a recent review of 69 worldwide marine reserves, scientists have discovered that protected areas produce bigger fish and a greater diversity of species, and restore plummeting fish populations. Population densities are 91% higher in marine reserves than in unprotected areas, the average animal is 31% larger, and species diversity is 23% higher. Even more encouraging is that these changes seem to occur within 2 ± 4 years and last for decades. However, perhaps the most important finding is the benefit to waters outside a reserve. Fish larvae are reseeding adjacent, overexploited waters. This finding has led to suggestions that marine reserves should be designed with a series of loosely connected 'no-take' zones that can restock the waters in between them.
- Depending on his literature review, Lane (2001) states that in the field of protected area management, a field that is largely unrelated to the theorizing of urban and regional planners, managers have, after a century-long experiment in land and resource conservation, proved that decentralized, participatory approaches are the most effective management strategies. While the planning theorists have advocated for participation, shared responsibility, and empowerment, protected areas managers have shown that their "cooperative management" model works. In a variety of institutional, economic, and cultural settings, comanagement provides a compelling proof for these new directions in planning theory.
- Leitmann (1998) state that promoting environmentally sensitive social and economic development among communities adjacent to protected areas can be an

effective means of reducing pressure on the protected area itself, especially if the well-being of the communities is clearly linked to preservation of the natural site.

- Frascchetti et al. (2004) concluded in their study that the design of MPAs should be based on scientific criteria, preferably with the goal of covering the main components of regional diversity, and stated that habitats occur as a mosaic of interconnected units and this distribution pattern must be considered in conservation policies. They also highlighted that the effectiveness of marine reserve is directly proportional to their size referring to the studies of Edgar and Barrett (1999) which found significant increases in the number and density of fish, invertebrates and algal species in the largest reserves studied.
- Kerr & Deguise (2004) state that numbers of species at risk increase with the extent of human-modified area. Habitat loss relates very strongly to the number of species at risk per ecozone and is a severe obstacle to endangered species recovery in the most biologically imperiled regions.

1.2.4 Geographic Information Systems

Information handling and management systems have become an important component of life in the last decades. “Effective formulation and implementation of any strategies, policies and plans are highly dependent on accurate, comprehensive and timely information” (Juppenlatz & Tian, 1996, p. 3). Like any other discipline, Coastal Zone Management (CZM) and Ecology need to make use of Information Technology (IT) more frequently as issues become more complex and data volume to be analyzed increases.

Data to be used in planning and implementation of CZM issues related to Ecology will probably have a geographical component. This makes Geographic Information Systems (GIS) an important tool in obtaining information from geographically referenced data. According to Johnston (1998), although a GIS is conventionally used to portray features on the Earth’s surface, data management and analysis

capabilities can be used in any spatial data. This enables future modeling of problems as well as the current status definition by GIS. As hardware and software capabilities increase parallel to developing IT, the application of GIS as a decision making support system will become much wider in Natural Resource Management.

Juppenlatz & Tian (1996) state that the first system to be called a GIS is the 'Canadian Geographic Information System' (CGIS) which was developed in 1962. Since then, there have been numerous definitions for GIS. The Association for Geographic Information defines **GIS** as "a computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth's surface" in the online GIS dictionary. Furthermore, GIS should be perceived as an integrated assembly of computer hardware, software, geographic data and personnel geared towards a particular set of purposes (Nath, Bolte, Ross, & Manjarrez, 2000). There are also some other terms used for GIS such as Land Information System, Spatial Information System, Resource Information System, Spatial Data Management and Analysis System, Image Based Information System, etc. (Goodchild, 1997).

GIS hardware is similar to any other computer system. As shown in Figure 1.10, the major hardware peripherals include computer, digitizer, scanner, plotter, printer and backup units. GIS software must consist of functional components to input, manage, process and analyze geographic data. A GIS includes special functions that work on geographic information such as display on the screen, edit, change, transform, geographic calculations (measure distances, areas, etc.), and combine maps of the same area together, etc. (Goodchild, 1997).

"GIS is related to, and often linked with, other types of software that are distinguished by data used and analysis performed" (Johnston, 1998, p.3). Johnston lists the related systems as image processing systems, statistical programs, database management systems (DBMS) and Computer Aided Design (CAD) systems (Figure 1.11).

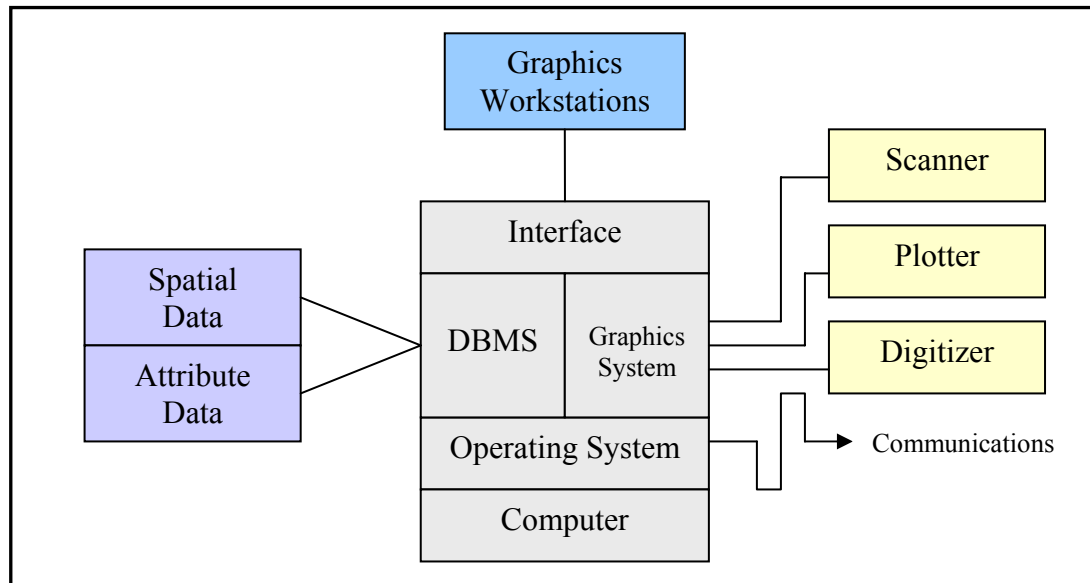


Figure 1.10 The physical components of GIS.

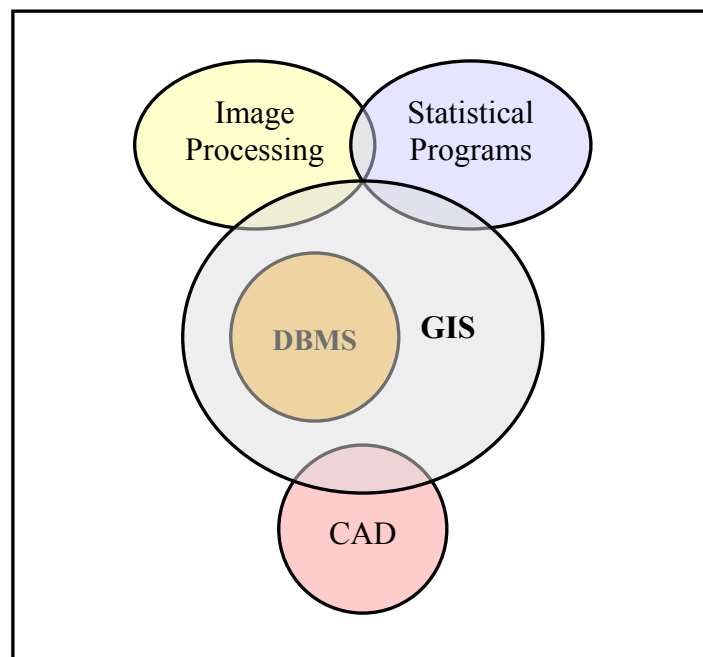


Figure 1.11 Relationships between GIS and related computer systems.

An **image processing system** analyzes digital images by performing operations on the pixels of satellite imagery each of which contain digital spectral data. **Statistical programs** perform more advanced analysis whereas most GIS can perform only basic statistical operations such as sums, means, minimum and maximum values. **DBMS** is a system designed for management purposes, and it

provides facilities to organize a database and allow shared access and control of the database (Juppenlatz & Tian, 1996). According to Johnston (1998), a GIS contains DBMS functions, but a DBMS lacks the spatial query and display capabilities of a GIS. On the other hand, “**CAD systems** were designed initially for drafting plans of technical objects, but have been used for geographic applications” (Johnston, 1998, p.3). GIS is distinguished from such systems with the ability to integrate spatial and attribute data, the ability to perform integrated data analysis operations, and the ability to manage geographic (spatial and attribute) data (Goodchild, 1997).

The nature of GIS and the relations between other computer systems result in many disciplines to be involved in GIS. Goodchild (1997) lists the disciplines of GIS science as Remote Sensing, Geodesy, Photogrammetry, Surveying, Cartography, Computer Science, Mathematics and Statistics. Additionally, disciplines such as Geology, Oceanography, Agriculture, Biology, Ecology, Environmental Science, Geography, Geophysics, Sociology, Civil Engineering, Geodesy, Geomatics, Petroleum, City and Region Planning, Mining, Archaeology, Political Science and Anthropology are all potential users of GIS (Goodchild, 1997).

The traditions of Cartography are fundamentally important to GIS (Goodchild, Kemp & Rhind, 1990) since maps are often a form of GIS input or output (Johnston, 1997). According to the International Cartographic Association, a **map** is a representation, normally to scale and on a flat medium, of a selection of material or abstract features on, or in relation to, the surface of the Earth. Olson (1998) state that maps are the representations of features, distributions and spaces most readily and universally identified with Geography.

In practice, maps can be divided into two types: topographic and thematic maps. Goodchild, Kemp & Rhind define **topographic map** as a reference tool, showing the outlines of selected natural and man-made features of the Earth. “Topography” refers to the shape of the surface, represented by contours and/or shading, but topographic maps also show roads and other prominent features. On the other hand, **thematic**

map is a tool to communicate geographical concepts (e.g. distribution of population densities), it shows distribution or pattern.

“The management, analysis and reporting of all GIS data requires that it be carefully referenced by position on the Earth’s surface” (Foote, 1998). GIS applications may include mapping locations, quantities or densities, finding distances, mapping and monitoring change (Escobar et al., 1999). According to Foote, mispositioned data can disrupt and even invalidate a GIS dataset and all modeling based upon that dataset. Therefore, GIS builders and users should be engaged in basics of mapping such as scale, coordinate systems, latitude and longitude, the shape of the Earth, projections, etc.

Accurate referencing of geographic location is fundamental to all GIS. **Coordinates** are used to identify locations on the Earth’s surface, and are based on the measurements of displacement from a given location (Goodchild & Kemp, 1997). “**Coordinate system** is a reference system used to measure horizontal and vertical distances on a planimetric map. A coordinate system is usually defined by a map projection, a spheroid of reference, a datum, one or more standard parallels, a central meridian, and possible shifts in the x- and y-directions to locate x,y positions of point, line and area features” (ESRI GIS Glossary, 1996). Many different coordinate systems are used to record location. Some systems such as latitude and longitude are global systems that can be used to record position anywhere on the Earth’s surface, and other systems are regional or local in coverage and intended to provide accurate positioning over smaller areas (Foote, 1998). In a GIS, a common coordinate system is used to spatially register geographic data for the same area (Escobar et al., 1999). Foote states that the system of locational reference used in a particular GIS project will depend on the purpose of the project and how the positions of the source data have been recorded.

Coordinate systems can be studied under two main groups: basic coordinate systems and Earth coordinate geometry (global reference systems and regional systems) (Dana, 1997). **Basic coordinate systems** are based on orthogonal axes, and

include **plane coordinate systems** which are two-dimensional systems defined with respect to a single plane, and **three dimensional systems** which are defined with respect to two orthogonal planes. Basic coordinate systems can either be Cartesian or polar.

However, the Earth's spherical shape is more difficult to describe than a plane surface. "**Earth-based reference systems** are based on various models for the size and shape of the Earth" (Dana, 1997). Dana states that Earth shapes are represented in many systems by a sphere but, precise positioning reference systems are based on an ellipsoidal Earth and complex gravity models. The **geographic grid** (Figure 1.12a) is a spherical coordinate system with latitudes and longitudes used for determining the locations of surface features (Kirvan, 1997). **Parallels of latitude** are all small circles except for the equator, and **meridians of longitude** are halves of great circles, connecting one pole to the other. A **great circle** is a circle formed by passing a plane through the exact center of a sphere whereas a **small circle** is produced by passing a plane through any part of the sphere other than the center (Figure 1.12b) (Kirvan, 1997). Great circles are used in the calculation of distance between two points on a sphere.

The most commonly used coordinate system today is the **latitude, longitude and height system** (Dana, 1997). It is a global system that uses *the Prime Meridian* and *the Equator* as reference planes to define latitude and longitude.

To make precise distance and direction measurements, ellipsoidal Earth models are needed (Dana, 1997). Ellipsoidal Earth models use **reference ellipsoids** which are defined by either semi-major (equatorial radius) and semi-minor (polar radius) axes, or the relationship between the semi-major axis and the flattening of the ellipsoid (Figure 1.13).

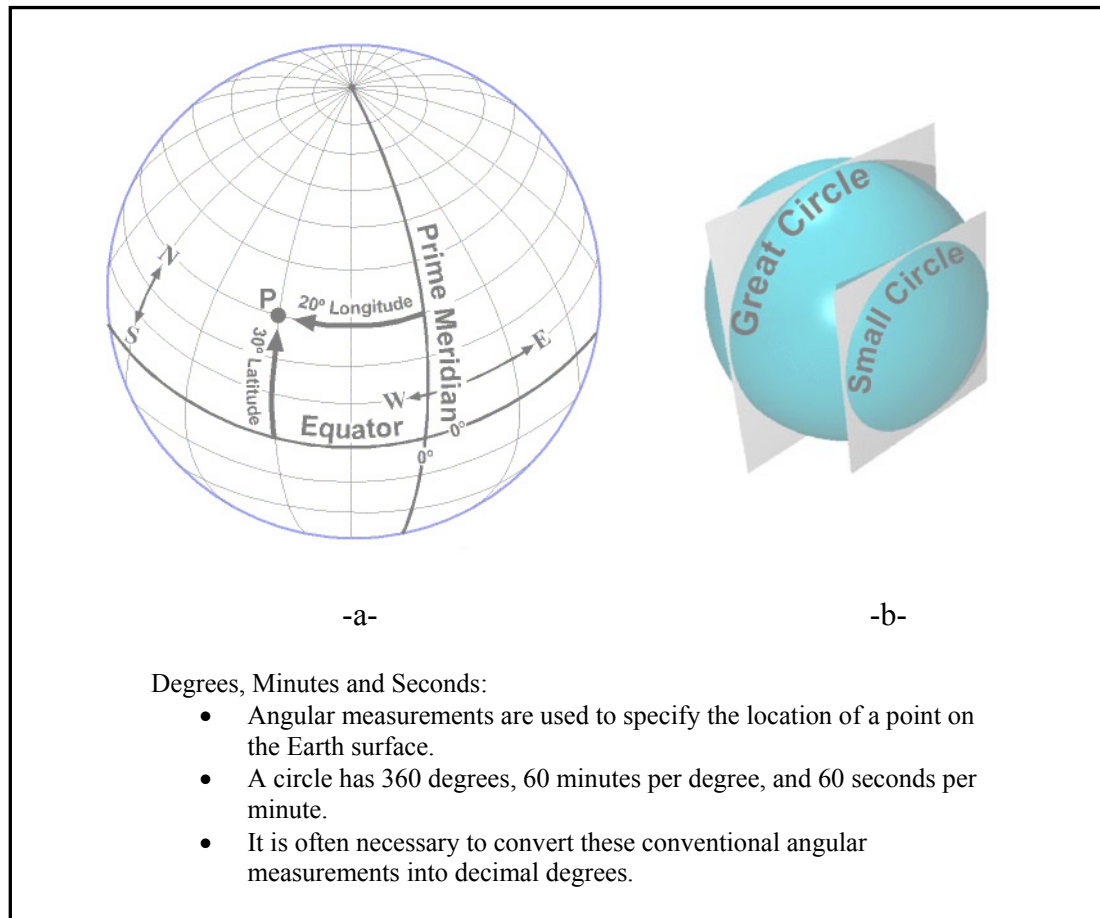


Figure 1.12 a) The geographic grid, b) Great and small circles.

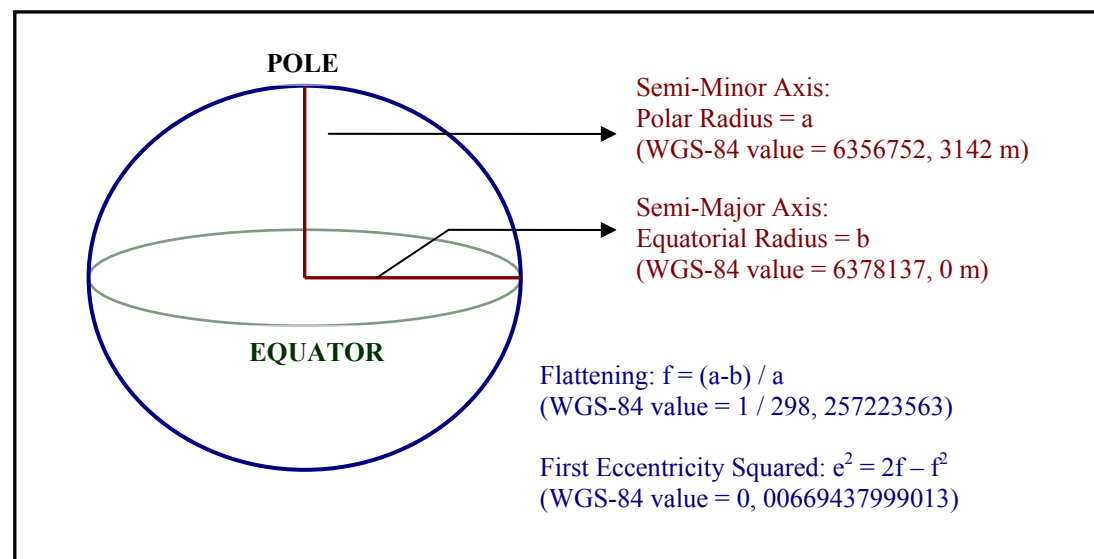


Figure 1.13 Ellipsoidal parameters.

Precise positioning must also account for irregularities (Figure 1.14a) in the Earth's surface due to factors in addition to polar flattening (Dana, 1997). **Geodetic latitude, longitude and height** (Figure 1.14b) are based on an ellipsoidal Earth and consider the irregularities. Dana states that while *topographic and sea-level models* attempt to model the physical variations of the surface, *gravity models and geoids* are used to represent local variations in gravity that change the local definition of a surface. **Geodetic datums** define the reference systems that describe the size and shape of the Earth, and the origin and the orientation of the coordinate systems used to map the Earth. According to Dana, referencing geodetic coordinates to the wrong datum can result in position errors of hundreds of meters. Earth Centered, Earth Fixed (ECEF) Cartesian coordinates can also be used to define three dimensional positions as a global system (Dana, 1997). ECEF X, Y, Z coordinates are defined with respect to the center of mass of the reference ellipsoid (Figure 1.14c).

“Spatial analysis requires conversion of features on the Earth's surface to a two-dimensional coordinate system” (Chou, 1996, p.91). All spatial data stored in a GIS are associated with a map projection, either implicitly (so-called unprojected data stored with raw longitude, latitude coordinates) or explicitly (where the data have been transformed into a known map projection) (Dodson, 1998). Goodchild, Kemp & Chmill state that **map projection** is concerned with the transformation of features on the Earth's surface onto a flat projection surface; mathematically, it is a process of transforming global location (latitude, Φ and longitude, λ) to a planar position (x, y) or (r, Θ).

There are numerous map projections, each with different properties with regard to the preservation of shape, area, distance and direction (Johnston, 1998). All these properties can not be kept undistorted in a single projection (Goodchild, Kemp & Chmill, 1997). According to Chou, map projection is the procedure for transforming the location data from a sphere to a **developable surface** which can be represented on a completely flat surface. There are three basic projection surfaces: planar (azimuthal), cylindrical and conical projection surfaces (Figure 1.15).

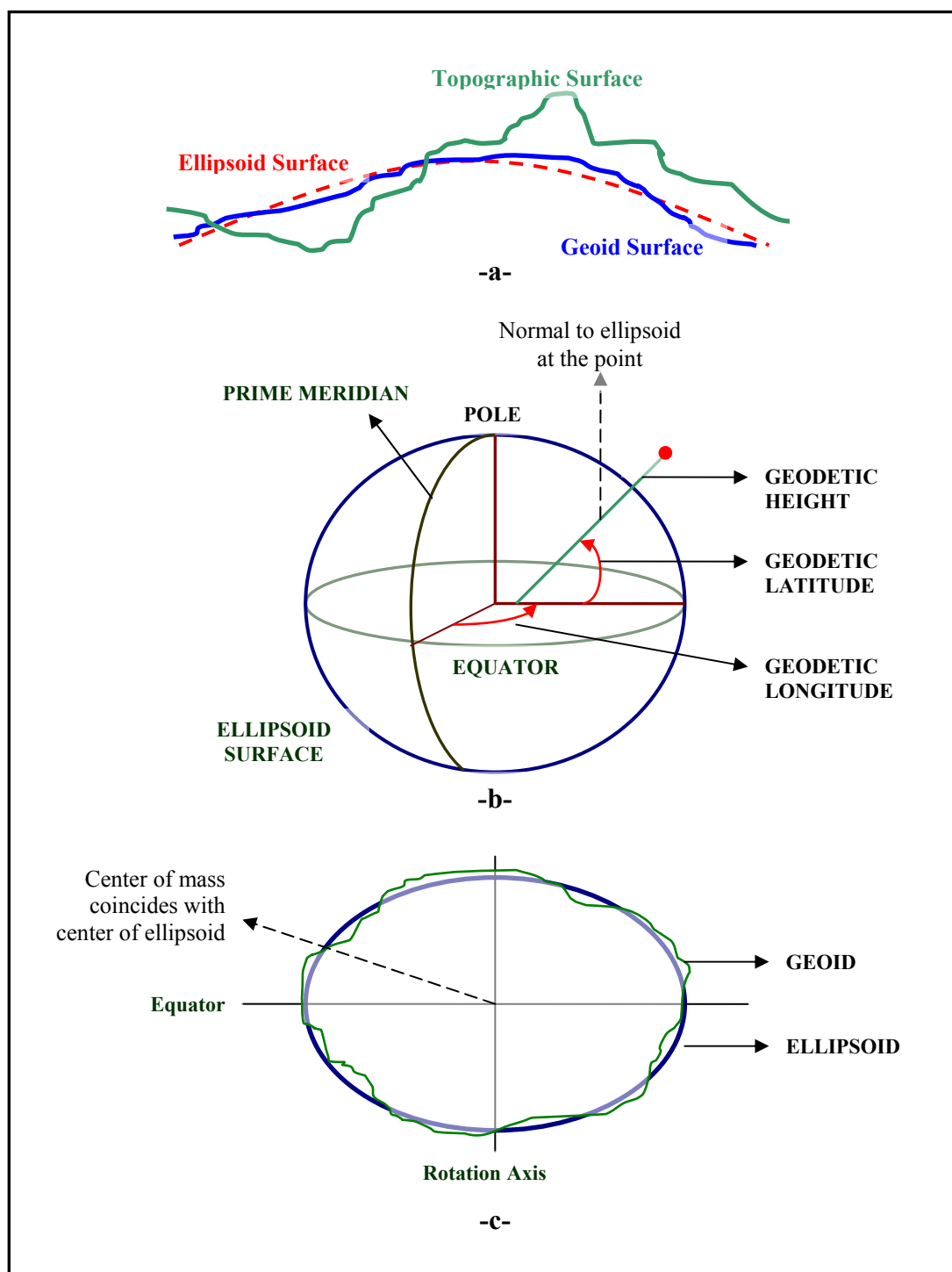


Figure 1.14 a) Earth surfaces, b) Geodetic latitude, longitude and height, c) ECEF system.

If the developable surface touches the globe, the projection is called **tangent projection** (Goodchild, Kemp & Chmill, 1997). As can be seen in Figure 1.15, the azimuthal surface touches the globe at a point which is called **point of tangency**, and cylindrical and conical surfaces touch the globe around a line which is called **line of**

tangency. The amount of distortion increases radially towards the edge of the projection surface; contact areas are free from scale and distortion. It is possible to increase contact with the globe using **secant projections**; the surface cuts the globe instead of touching. Goodchild, Kemp & Chmill also state that increasing the area of contact minimizes the amount of distortion within a particular area in secant projections.

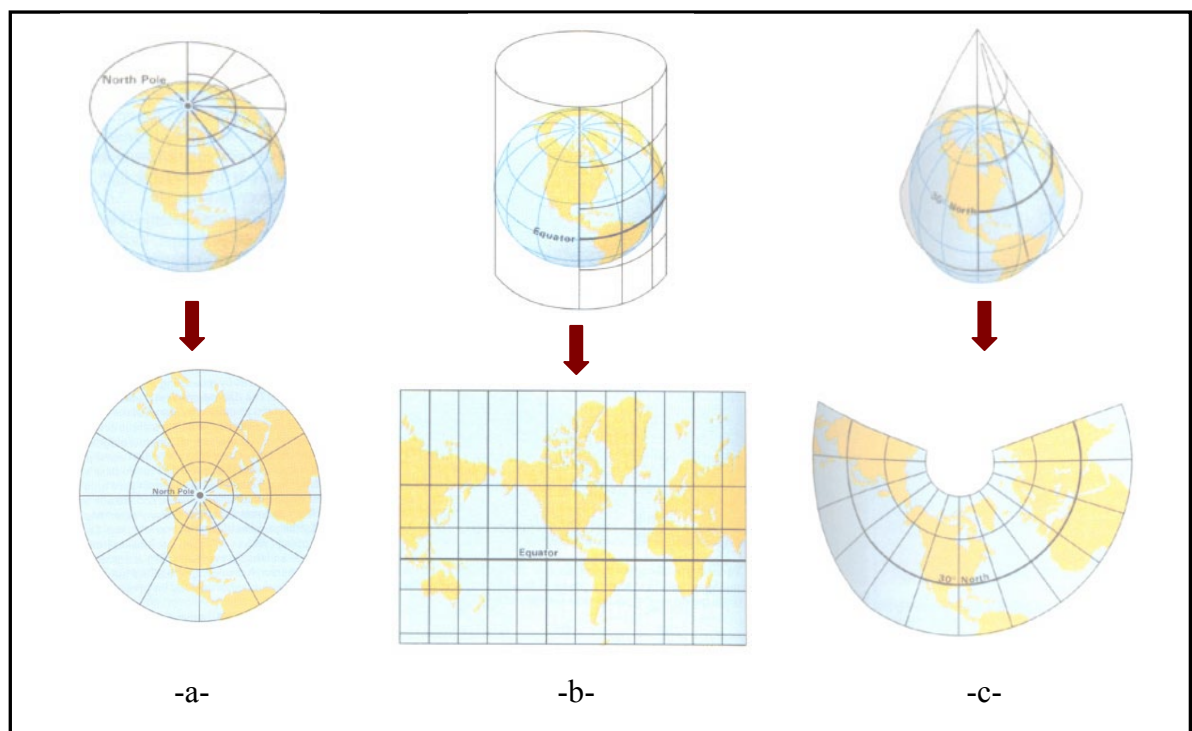


Figure 1.15 Basic projection surfaces: a) Azimuthal, b) Cylindrical, and c) Conical projection surface.

Projections can also be classified by the geometric property that they preserve (Figure 1.16) (Dodson, 1998). **Conformal projections** preserve local shapes, **equal-area (equivalent) projections** preserve areas, **equidistant projections** preserve length along certain directions and **azimuthal projections** preserve directions from all locations to one or two points.

When defining a projection for a GIS dataset, the type of projection must be specified along with a number of parameters which describe how the projection is implemented (Dodson, 1998). Dodson lists these parameters as units, scale, scale factor, standard lines, origin, false easting/northing, ellipsoid and datum. Since input

maps may be in different projections in a GIS, transformation of maps may be required (Goodchild, Kemp & Chmill, 1997). Thus, the projection parameters together with mathematical functions of projections are needed in a GIS.

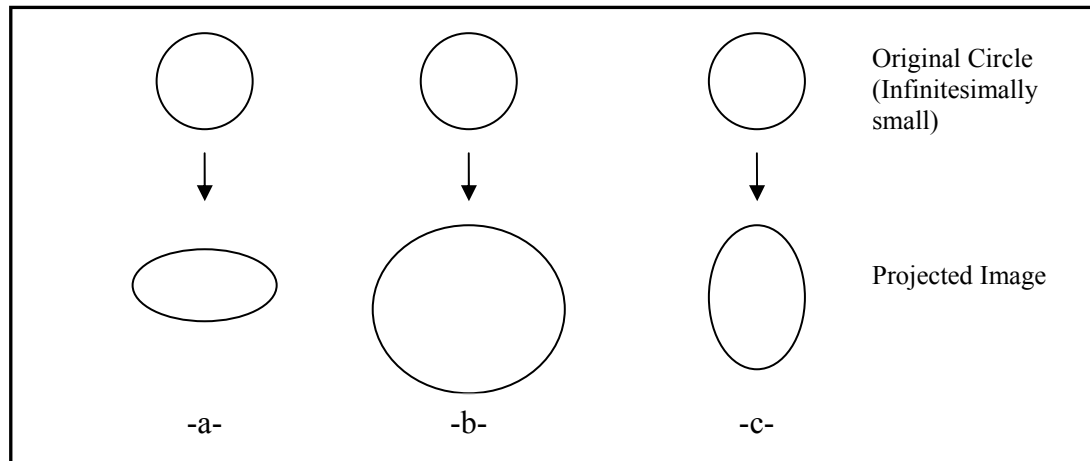


Figure 1.16 Distortions in map projections: a) Same area, b) Same shape, and c) Same width.

In GIS, geographic data is in digital form. **Digital geographic information** uses numbers to represent numerical values, graphics and text (Goodchild, 1997). Data is represented as sequences of bits (0 or 1), graphics are converted to coordinates, and texts are converted to numeric codes such as ASCII (American Standard Code for Information Interchange) (Jacobson, 1998).

Geographic data has three components: spatial data, attribute data and time (Juppenlatz & Tian, 1996). Juppenlatz & Tian define **spatial data** as “the data pertaining to the locational aspects of geographical features together with their spatial dimensions”. The term ‘geographic’ has to do with the Earth whereas ‘spatial’ has to do with any multi-dimensional frame (Goodchild, 1997). ‘Geographic’ is a subset of ‘spatial’ and the term ‘geospatial’ is sometimes used. **Attribute data** is the non-spatial characteristics –description, measurement and classification– of the geographic features. Consequently, “attribute data has descriptive, quantitative and qualitative aspects” (Juppenlatz & Tian, 1996). Geographic information can change over time. **Time** is a factor that can be included in a GIS to cope with the problems of monitoring change in attributes and in location of objects (Juppenlatz & Tian, 1996).

GIS applications have a wide variety of domain. The situation results in different approaches in representing spatial and non-spatial data (Adam & Gangopadhyay, 1998). According to Adam & Gangopadhyay, there are two major types of representation methods for spatial data: field and object based representations. “**Field-based representation** methods capture the spatial variation of attribute data” since “**object-based representation** methods associate attribute data with individual objects” (Adam & Gangopadhyay, 1998, p. 7-8). The suitability of the method depends on the data requirement of an application. Hence, Adam & Gangopadhyay divided GIS applications into field-based and object-based applications depending on the predominance of the type of representation method used (Figure 1.17).

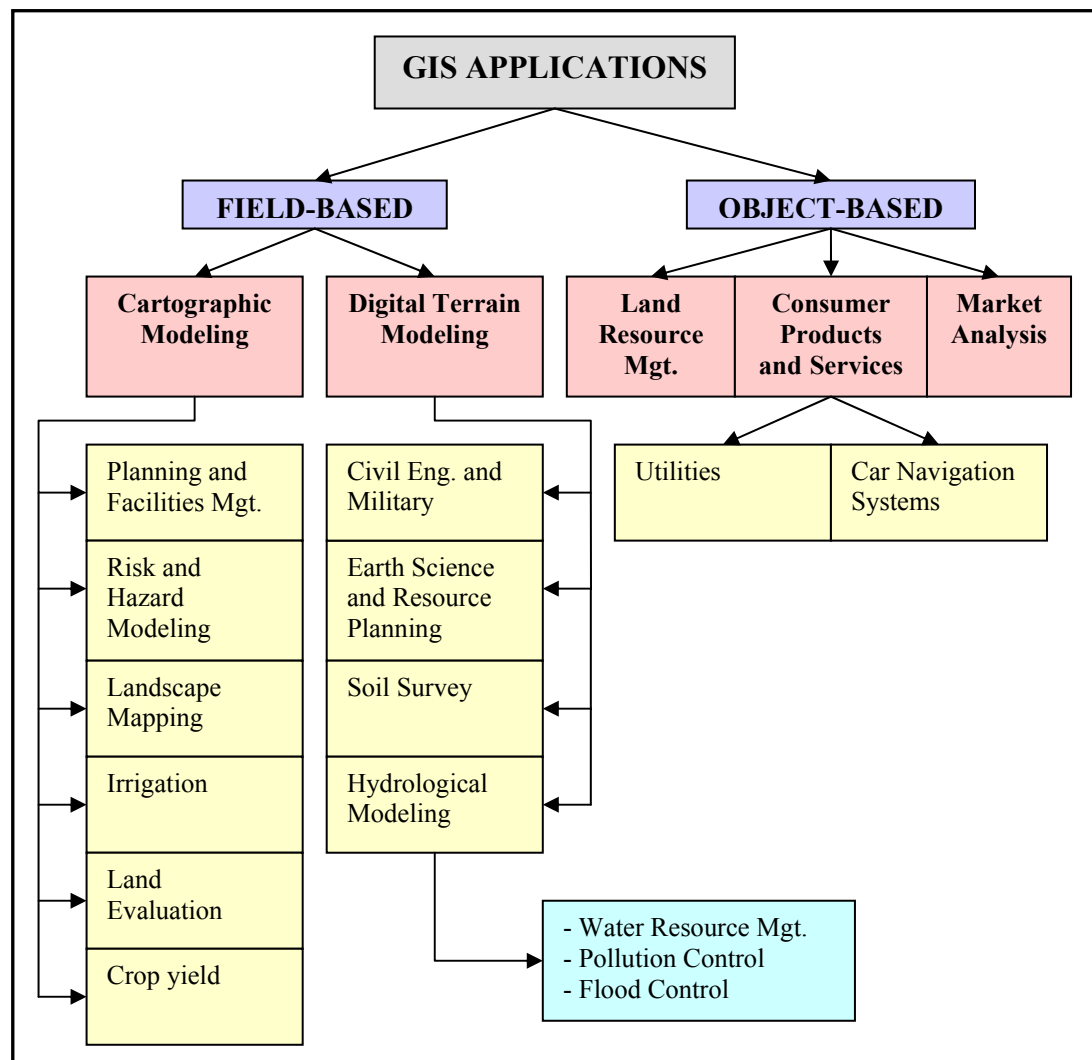


Figure 1.17 Classification of GIS Applications.

In GIS, geographic data are treated as different layers (Johnston, 1998). The number of data layers and features handled in each data layer may differ in GIS applications due to project issues. A **data layer** consists of logically related geographic features and their attributes (Douven, Buurman & Kiswara, 2003). The organizing principle of data layers may be to group similar feature types (Figure 1.18). Each layer is registered positionally to other layers through a common coordinate system. In principle, the number of layers is unlimited, restrictions being imposed only by storage space. GIS integrates data sets allowing for the establishment of a more complete picture of the problem at hand (Juppenlatz & Tian, 1996).

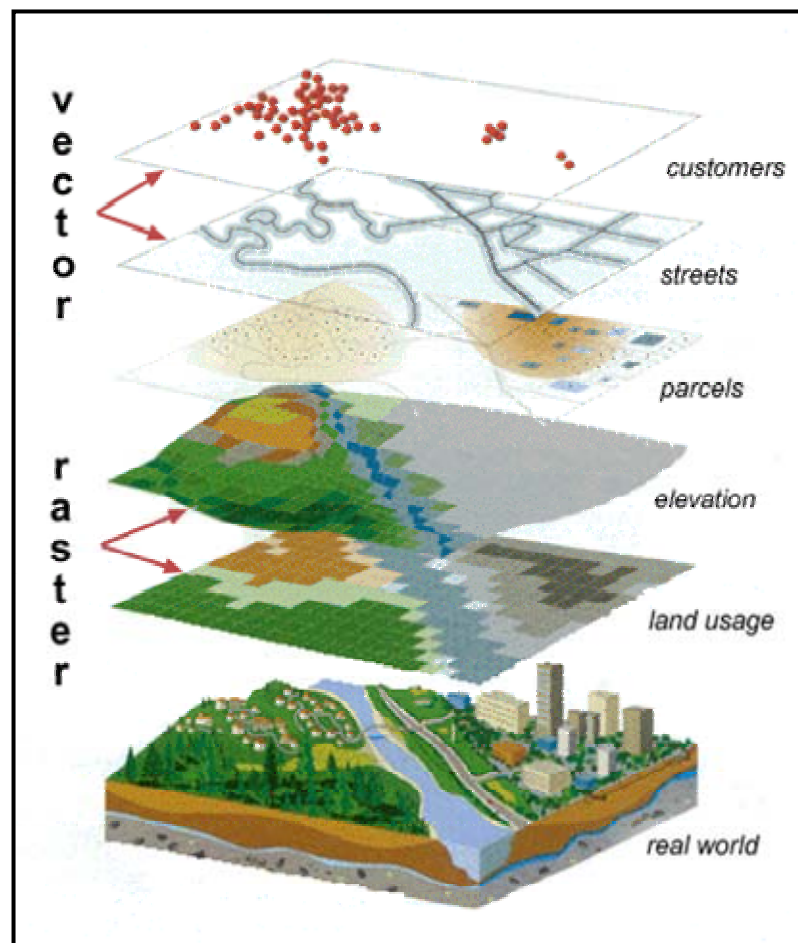


Figure 1.18 The concept of layers (Source: ESRI).

According to Goodchild (1997), any GIS application will ideally consist of the following stages: problem definition, software and hardware acquisition, data acquisition and input, database creation, analysis, and interpreting and presenting the results. Additionally, identifying project requirements, formulating specifications and developing the analytical framework are the preprocesses of GIS applications (Nath, Bolte, Ross, & Manjarrez, 2000) and should be considered before creating the GIS and performing the analysis.

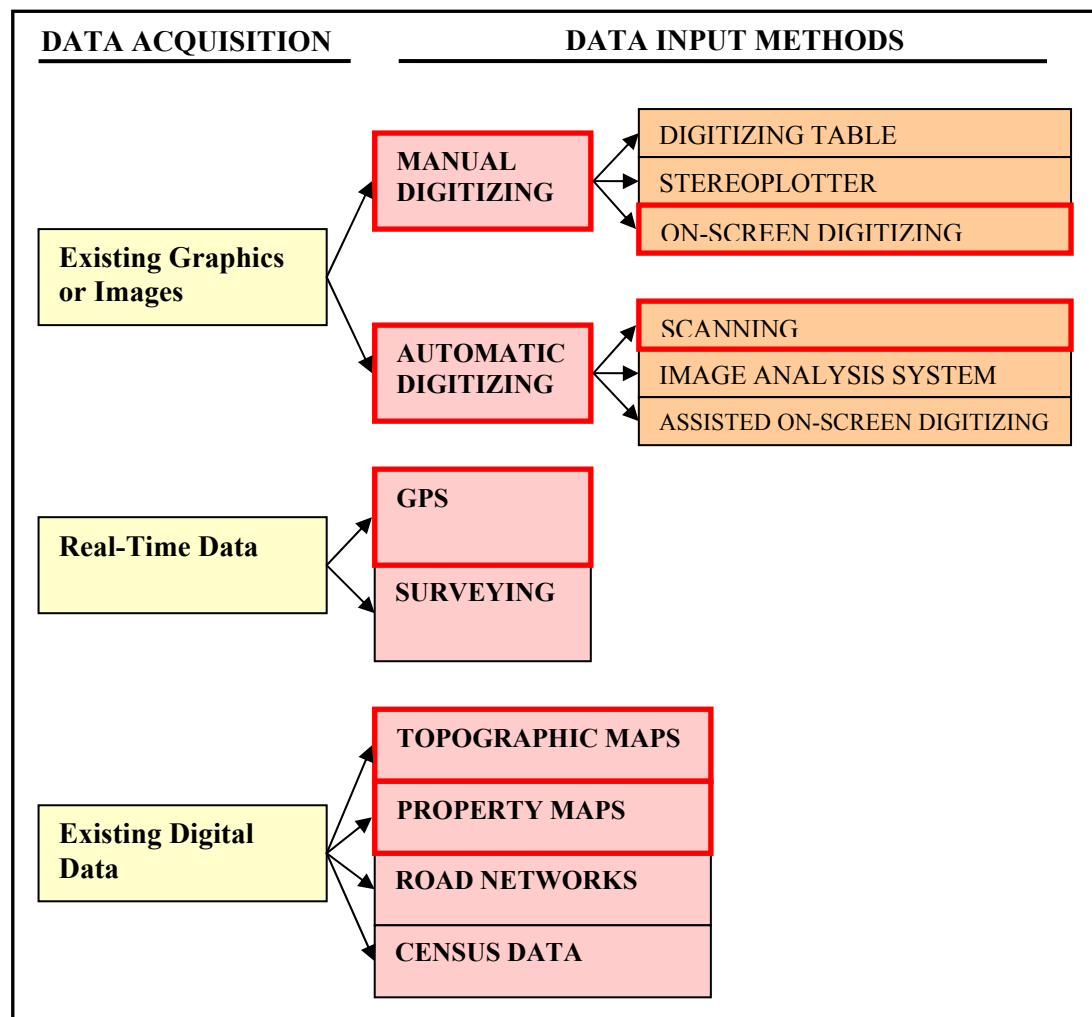


Figure 1.19 Data entry to GIS (methods represented with red-bordered boxes were used in the thesis).

GIS hardware and software are worthless to specialists without appropriate data (Johnston, 1998). Data relevant to the purpose of application may be acquired from existing graphics or images, by real time data acquisition methods or from an existing digital data (Figure 1.19). An important point is that “data collection and the

maintenance of databases remains the most expensive and time consuming aspect of setting up a major GIS facility” (Escobar et al., 1999). Goodchild, Kemp & Star state that data input may cost up to 80% of GIS projects, and whatever the form or format the data are, tools are needed to transform spatial data of various types into digital format. The variation in data acquisition results in different data input methods, thus new hardware components may be needed (Figure 1.19). Escobar et al. defines **data input** as the operation of encoding data for inclusion into a database. “Locational data is encoded as coordinates on a particular coordinate system”, and “attribute data is often obtained and stored in tables” (Goodchild, Kemp & Star, 1990). Then, one can benefit the advantages of digital data over analogue data which were explained by Escobar et al. as easy update, transfer, maintenance, analysis and relatively small storage space requirement.

“**Digitizing** is the transformation of information from analog format to digital format, so that it can be stored and displayed with a computer” (Escobar et al., 1999). Digitizing can be manual, semi-automated (automatically recorded while manually following a line), or fully automated (line following). According to Goodchild, Kemp & Star, criteria for choosing the modes of data input are the type of data source, the database model of the GIS, the density of data and expected applications of the GIS implementation. The advantages and disadvantages of data input methods should be considered before digitizing, and the optimum method may be chosen by taking economy, time and human and hardware capacity into consideration.

There are two modes of digitizing: point-mode and stream-mode (Escobar et al., 1999). In **point-mode digitizing** (Figure 1.20a), the digitizing operator specifically selects and encodes the points deemed critical to represent the geomorphology of the line or significant coordinate pairs. On the other hand, in **stream-mode digitizing** (Figure 1.20b), the digitizing device automatically selects points on a distance or time parameter, which sometimes generates an unnecessary high density of coordinate pairs. As Escobar et al. states, the resolution of coordinate data is dependent on the mode of digitizing.

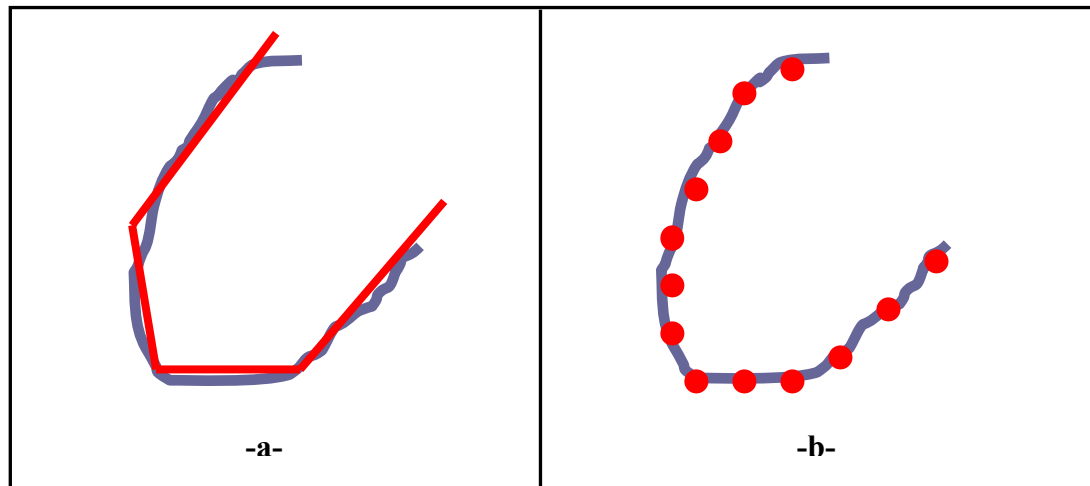


Figure 1.20 Modes of digitizing: **a) Point-mode digitizing**, **b) Stream-mode digitizing** (Point-mode digitizing was used in the thesis).

“**On-screen digitizing** is an interactive process in which a map is created using previously digitized of scanned information” (Escobar et al., 1999). This technique may be used to trace features from a scanned map or image to create new layers or themes. The user creates the map layer up on the screen with the mouse and typically with referenced information as a background.

Another data input method is to make use of photogrammetry techniques. Juppenlatz & Tian defines **photogrammetry** as the art, science and technology of obtaining reliable information about physical objects and the land environment through the processes of recording, measuring and interpreting photographic images, and analyzing patterns of recorded radiant electromagnetic energy and other phenomena. Sequences of photographs are taken from a moving aircraft equipped with a special metric camera (UNESCO Training Module on GIS, 1999). Escobar et al. state that the whole area is covered by aerial photographs usually with a 60% overlap along each flight line and a 20% overlap between flight lines (Figure 1.21a).

In photogrammetric data capture, the vector and raster data are produced by various instruments and methods. “Stereoscopic plotting instruments (stereoplotters) have been the primary means of generating elevation data for topographic maps during the twentieth century” (Johnston, 1998). **Stereoplotter** is a

photogrammetric instrument that allows operators to delineate features and to extract contour lines from pairs of photographs called a **stereopair** (Figure 1.21b).

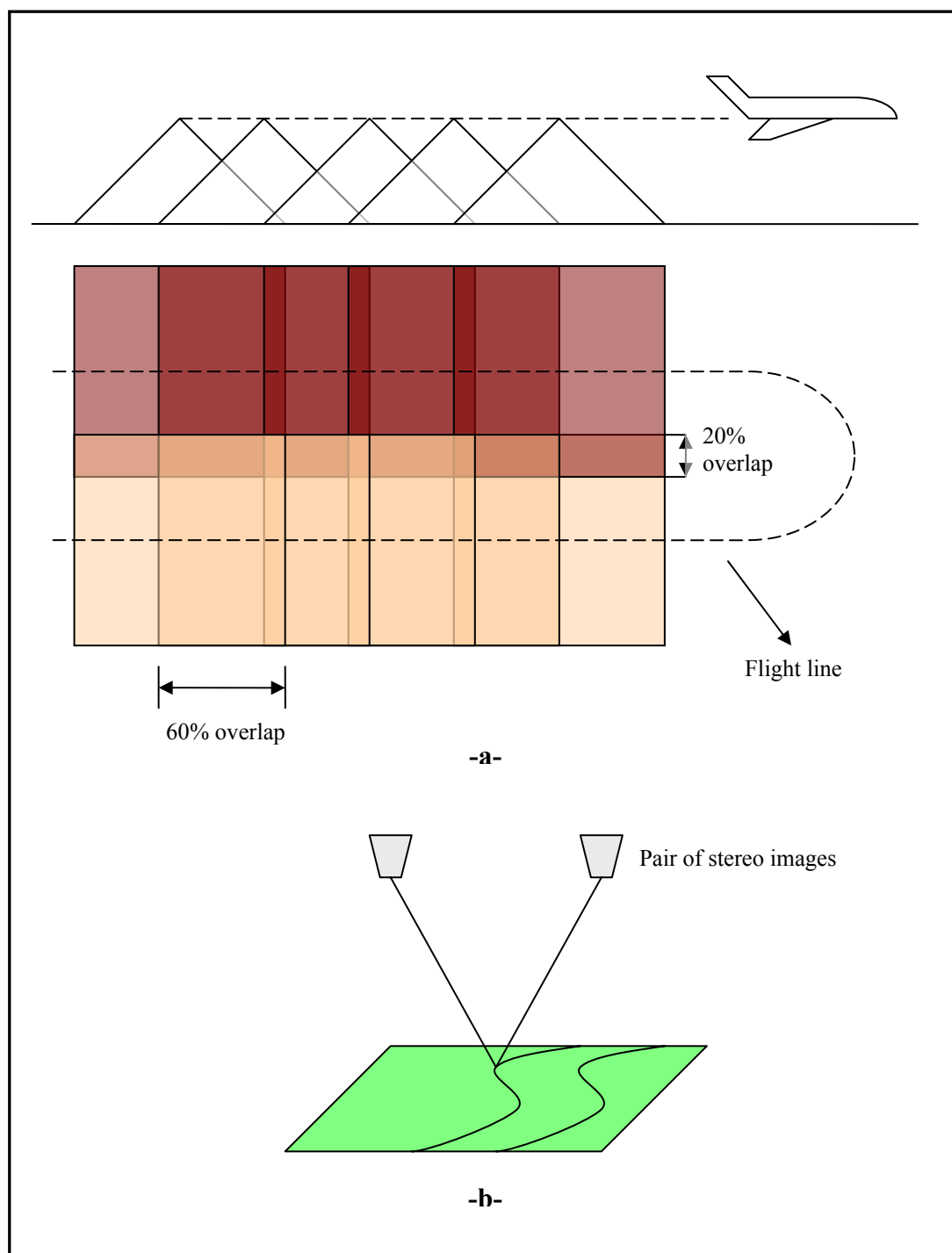


Figure 1.21 Mapping by photogrammetry: a) Aerial photogrammetry and overlapping, **b) Stereopairs** (Stereopairs of ASTER satellite image was used in the thesis).

Another approach is to use a **scanner** to convert the analogue map into a computer-readable form automatically (Escobar et al., 1999). Maps are often scanned in order to use digital image data as a background for other (vector) map data, or to convert scanned data to vector data for use in a vector GIS. Goodchild, Kemp & Star state that video or electromechanical scanners can be used in scanning systems, and one common class of scanners involves attaching the graphic to a drum in order to create column of pixels from the graphic. The accuracy of data produced by scanning depends mostly on the currency and the accuracy of the original map (UNESCO Training Module on GIS, 1999).

A **digital image analysis system** (DIAS) is also a data input tool which consists of the computer hardware and the image processing/analysis software necessary to analyze remotely sensed images. The typical functions included in DIASs are preprocessing, display and enhancement, information extraction, image and cartographic map composition, and integrated image analysis and GIS. According to Escobar et al., **remote sensing** instruments rely upon the detection of energy emitted from, or reflected by, the object under consideration. The satellite image is received by antennas placed on the Earth's surface (Figure 1.22). The captured digital image is a numerical representation of pictorial information, that is each pixel (picture element) has a numerical value (Juppenlatz & Tian, 1996). There are various land observation satellites each having sensors of different characteristics such as Landsat, SPOT HRV, IKONOS, etc.

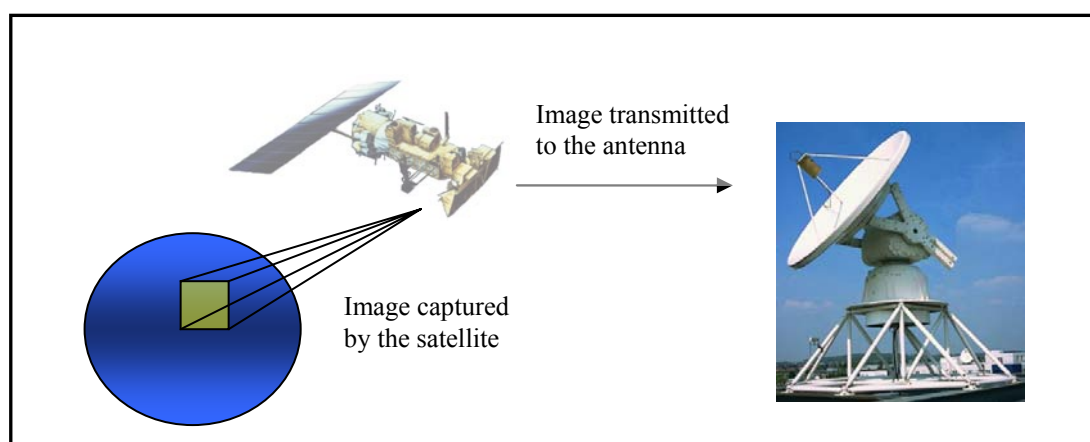


Figure 1.22 Data capture in remote sensing.

Global Positioning System (GPS) is a real-time data entry method which is a set of hardware and software designed to determine accurate locations on the Earth using signals received from selected satellites (Escobar et al., 1999). It is a navigation system based on a constellation of 24 satellites (NAVSTAR) orbiting the Earth at 20,200 km altitude with 3 operational spares, 6 orbital planes, 55 degree inclinations and 12 hour of orbit time (UNESCO Training Module on GIS, 1999 & Escobar et al., 1999). The ground system consists of a receiver connected to an antenna, and over a period of time, the system is able to determine its location in 3-D space (Goodchild, Kemp & Star, 1990). At least four satellites are needed to determine three position dimensions and time (Figure 1.23). Escobar et al. state that the computer software has four primary functions: pre-planning, post-processing correction of the raw satellite data, display/editing of the data, and converting/exporting of the data. Although GPS accuracies are order 5 to 10 meters with standard equipment, **Differential GPS (DGPS)** techniques offer accuracies up to one centimeter (Goodchild, Kemp & Star, 1990). The idea behind the differential positioning (Figure 1.23) is to correct bias errors at one location with measured bias errors at a known position (Dana, 1997).

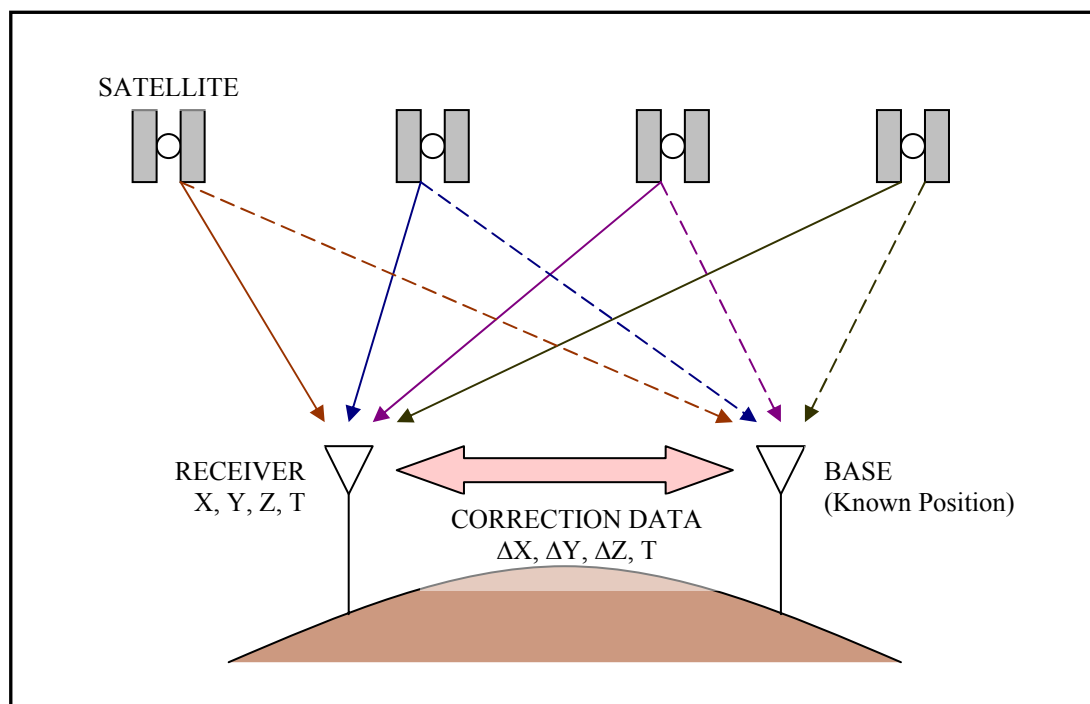


Figure 1.23 GPS (straight arrows) and DGPS (both straight and dashed arrows) using four satellites.

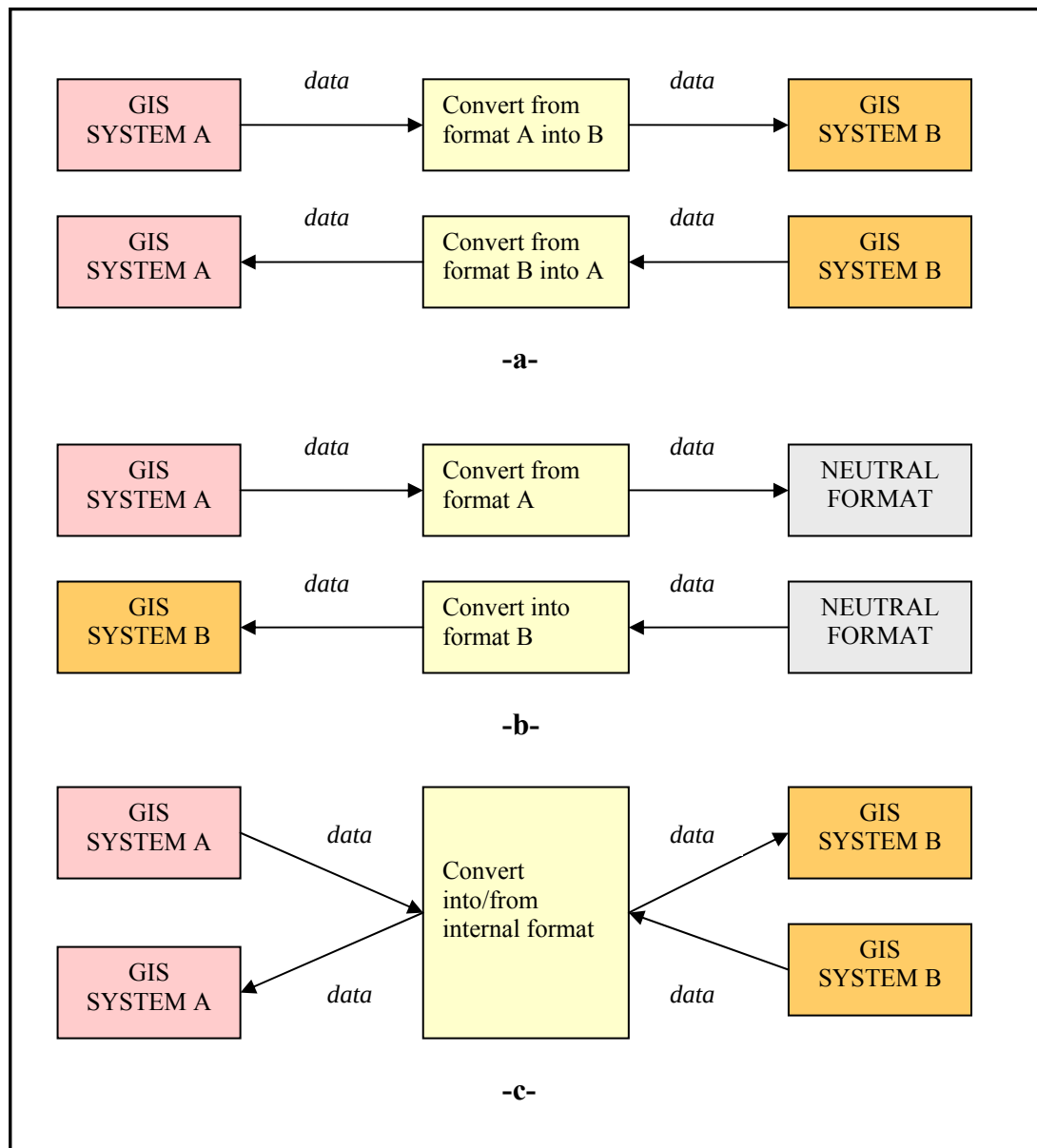


Figure 1.24 Data conversion: a) Direct data translation, b) Data exchange through neutral data format, c) Data translation via switchyard.

Data may further be obtained from other existing digital sources such as any other digitized map or database. In order to transfer data from other sources, the format of data must be compatible with the GIS software. “Most GIS packages now contain a suite of software algorithms that will perform the necessary data transfers” (Escobar et al., 1999). Goodchild, Kemp & Star state that a good GIS can accept and generate datasets in a wide range of standard formats such as DXF (Drawing Exchange File), SDTS (Australian Spatial Data Transfer Standard), JPEG files and VPF (Vector

Product Format Data). The conversion of data may be performed in three ways: direct data translation (Figure 1.24a), data exchange through neutral data format (Figure 1.24b) and data translation via switchyard (Figure 1.24c) (UNESCO Training Module on GIS, 1999). The data obtained from other sources should contain meta-data, that is data about the data, or a sort of data quality report from the provider. Another important point for data input from other existing sources is the map characteristics: projection, scale, detail, accuracy and resolution of the existing maps. Integration of data will need to consider the compatibility or conversion (where needed) of these characteristics.

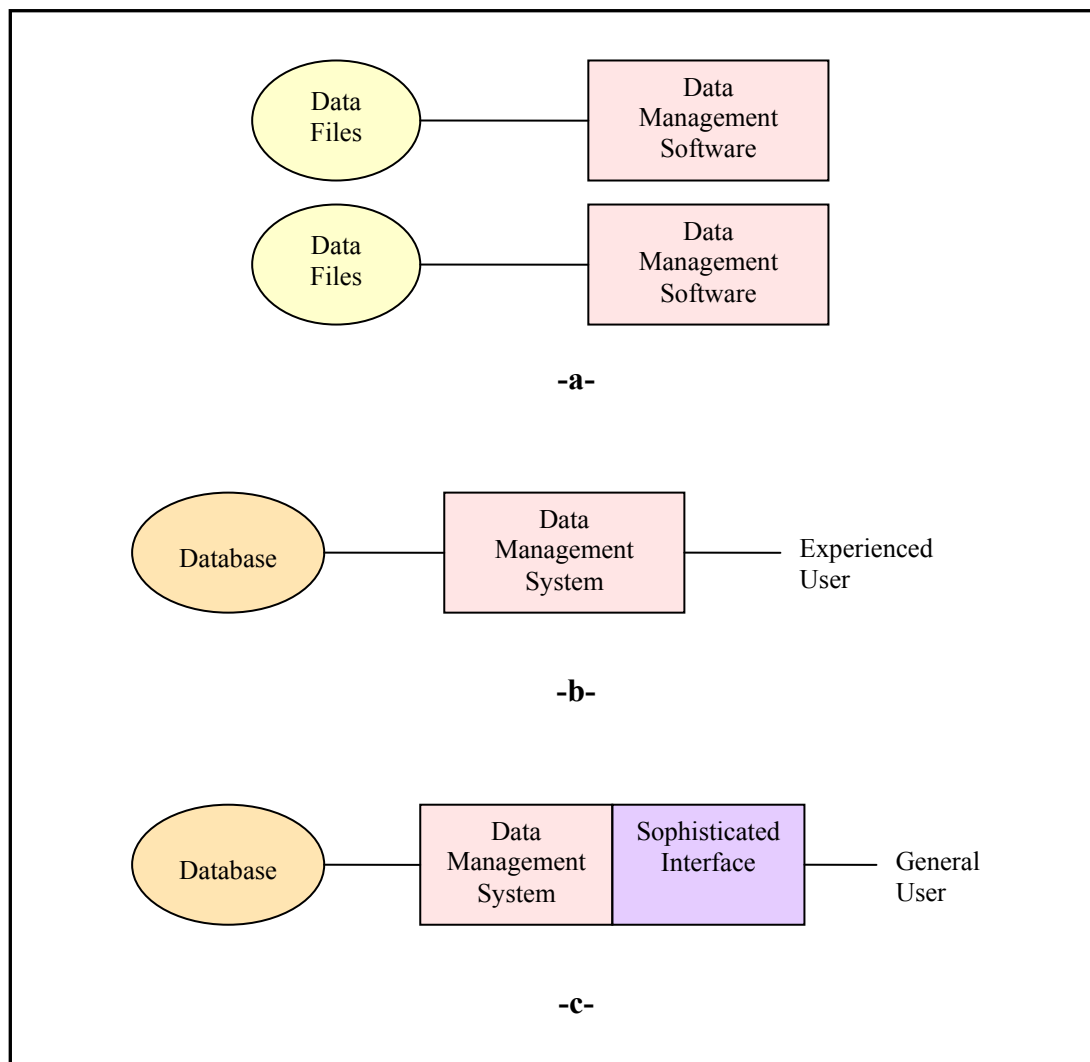


Figure 1.24 Data management evolution: a) First generation data management, b) Second generation data management, c) Third generation data management.

Data capture and data integration in GIS bring about database issues (Adam & Gangopadhyay, 1998). Elmasri & Navathe (1989) define **database** as a collection of related data with the following implicit properties: it is a logically coherent collection of data with some inherent meaning; it is designed, built and populated with data for a specific purpose; it represents some aspect of the real world. Database systems originated in the late 1950s and early 1960s largely by the research and development of IBM Corporation (Goodchild, Kemp & White, 1990), and since then database capabilities have been increased through first, second and third generation data management systems (Figure 1.25).

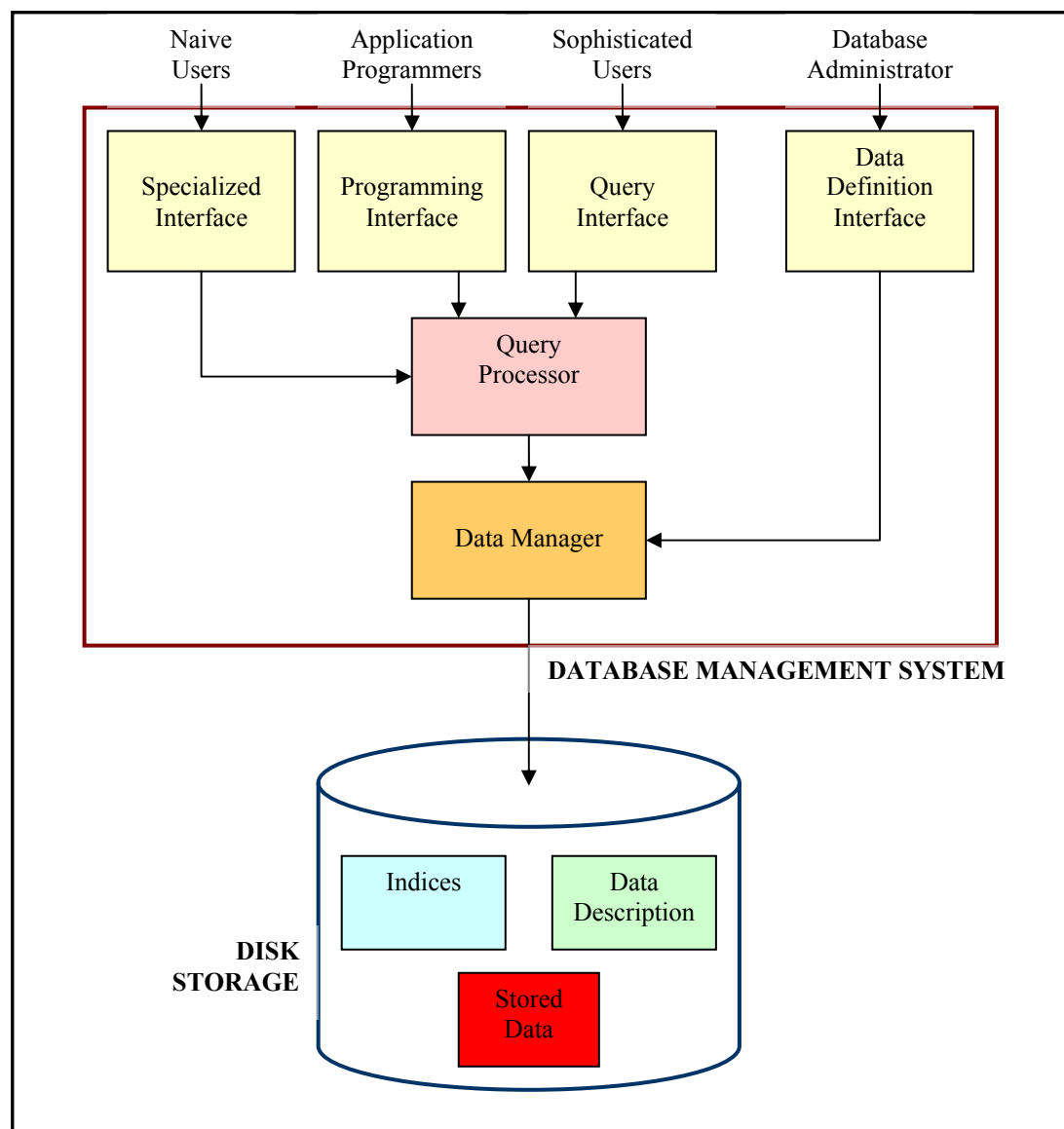


Figure 1.26 Components of a DBMS.

Today, organizing and managing large volumes of data are performed using more complex database management systems (DBMS) (Meyer, 1997). A **DBMS** (Figure 1.26) is a collection of programs that enables users to create and maintain a database (Elmasri & Navathe, 1989). Goodchild, Kemp & White list the advantages of DBMSs as reducing data redundancy, allowing data sharing and recovery, providing data security, maintaining data integrity and consistency, enforcing standards, providing data independence, and providing efficient data manipulation environments.

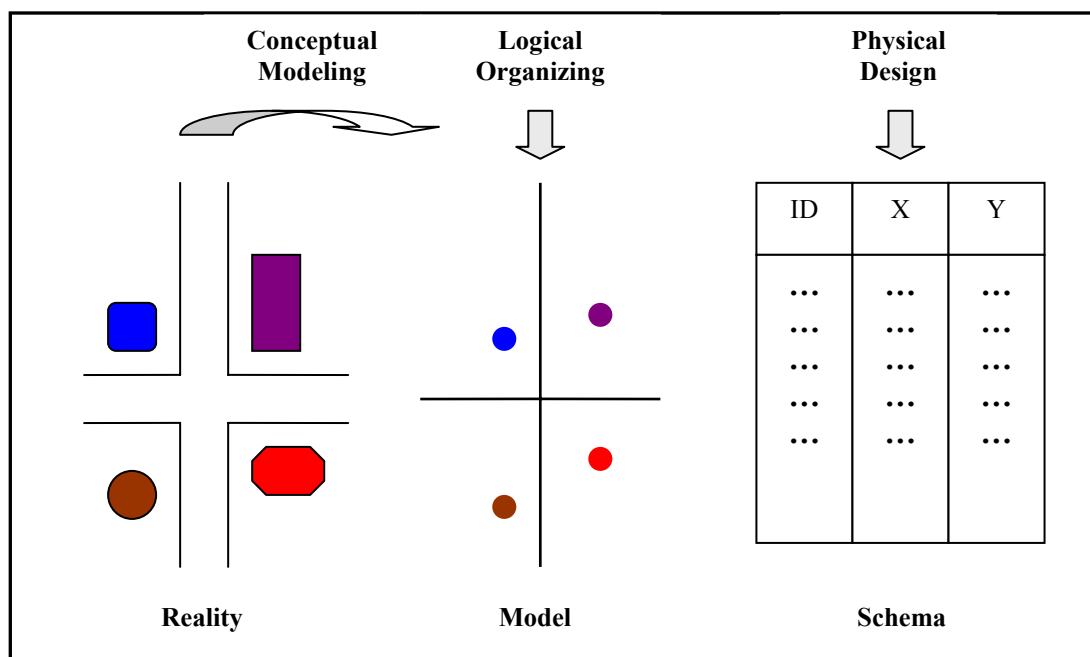


Figure 1.27 Database modeling stages.

GIS is a spatial database which is a collection of spatially referenced data that acts as a model of reality (Goodchild, Kemp & Nyerges, 1990). Yeung (1998) describes data modeling as “the process of defining real world phenomena or geographic features of interest in terms of their characteristics and their relationships with one another”. According to Yeung, **database design stages** are *conceptual database design*, *logical database design* and *physical database design* (Figure 1.27). **Conceptual data modeling** is defining in broad and generic terms the scope and requirements of a database (Yeung, 1998). DBMS-independent concepts are used to describe data at a high level. Yeung describes **logical data modeling** as specifying the user’s view of the database with a clear definition of attributes and relationships.

The conceptual schema is transformed (mapped) from the high-level data model into the implementation data model of a DBMS at this stage. Finally, **physical data modeling** is specifying internal storage structure and file organization of the database. This step includes choosing specific storage structures and file organizations for the database, and mapping the implementation model schema to internal file structures chosen.

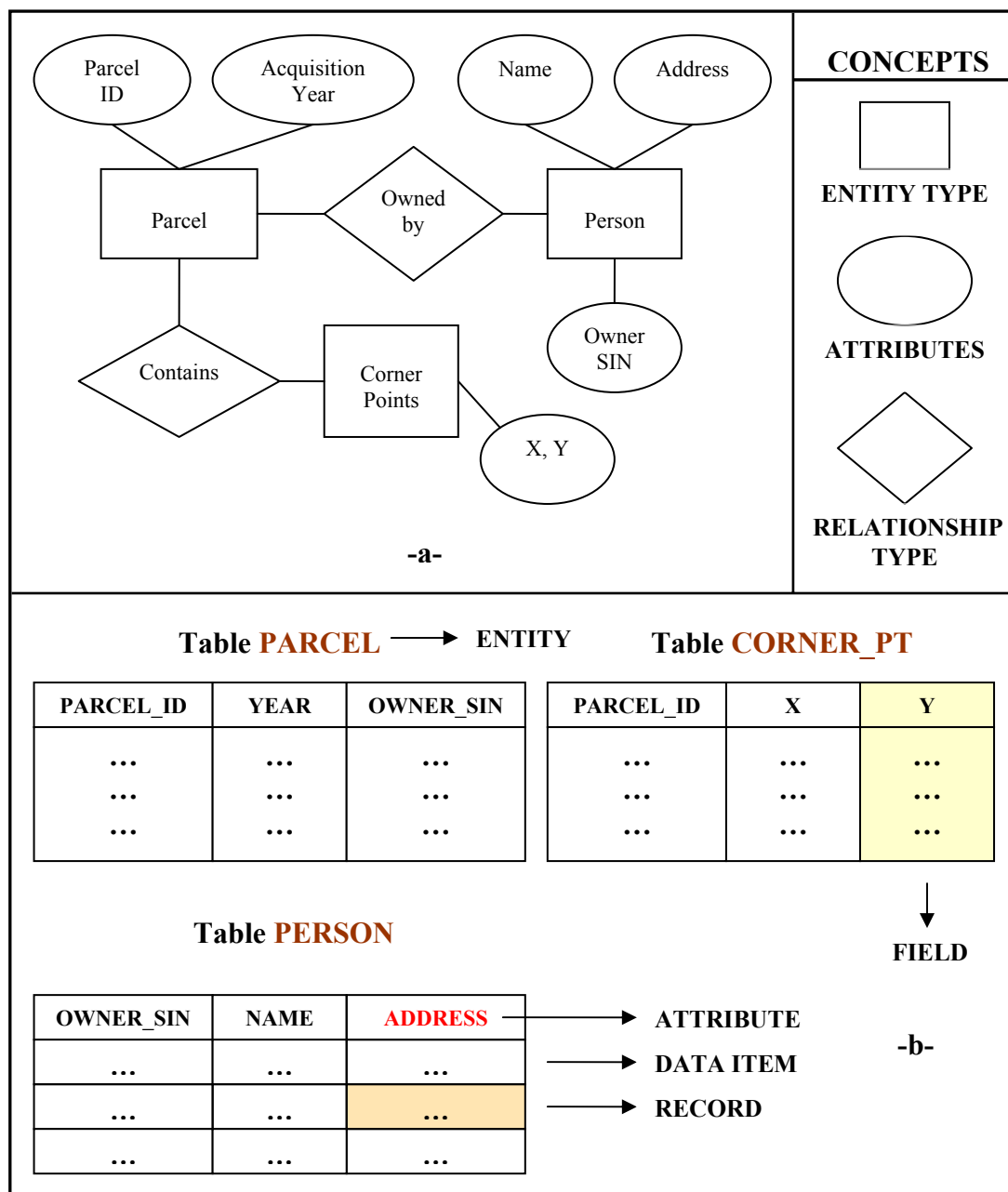


Figure 1.28 Information organization in parcel example: a) Graphical data schema, b) **Tabular data schema** (tabular data schema was used in the thesis).

For making such a model work in a computerized environment, it must be made more precise, and this leads to data schemas (Bartelme, 1996). Bartelme describes a **data schema** as a comprehensive description of the structure and the contents of data and of rules to be observed when dealing with such data. Data schemas can be expressed in a formalized way, textually, graphically and in tabular form.

Graphical and tabular data schemas (Figure 1.28) use a more structured language to describe data organization, but they differ in the language used and in the concepts used to describe data. Table-based one is more easily interpreted by computer systems, thus it is more convenient for GIS applications. The most basic element of information organization of descriptive data is **data item** which represents an *occurrence* or *instance* of a particular characteristic pertaining to an entity (Yeung, 1998). A table consists of a fixed number of fields for storing attributes. Each record in a table must be unique and must have the same number of fields. A record can not reference another table as a unit, but it can cross-reference records in other tables.

There are several models for databases. Goodchild, Kemp & White list the models as tabular (flat file), hierarchical, network and relational databases. **Flat file models** store data in a single table, thus these files have no relationships that can be built with other files and searching for data may be time consuming (UNESCO Training Module on GIS, 1999). **Hierarchical data models** (Figure 1.29a), on the other hand, keep track of the different record types, their attributes and the hierarchical relationships between them (Goodchild, Kemp & White, 1990). Records are linked to each other by a key field in a hierarchy of files. Queries are restricted to existing hierarchy. The **network data model** (Figure 1.29b), which is also known as CODASYL (Conference on Data System Languages), provides concepts to describe data in a network manner. According to Goodchild, Kemp & White, the objective of this model is to separate data structure from physical storage and eliminate unnecessary duplication of data. Goodchild, Kemp & White state that **relational data model** (Figure 1.29c) is the most popular DBMS model for GIS. A relation takes the form of a table which is composed of rows (also called *tuples*) and

columns. In this model, flexible approach to linkages between records comes closest to modeling the complexity of spatial relationships between objects.

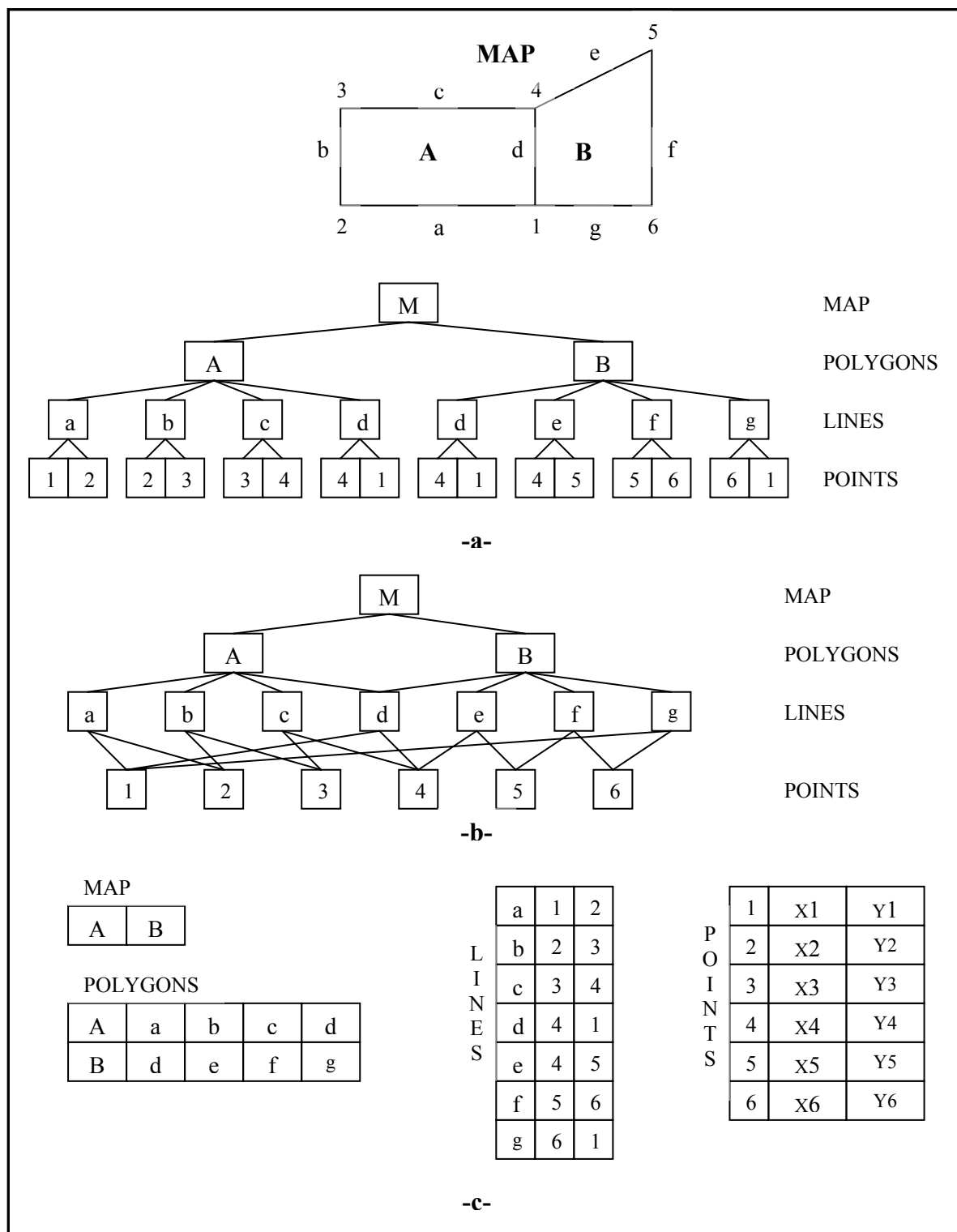


Figure 1.29 Database models: a) Hierarchical data model, b) Network data model, c) **Relational data model** (relational data model was used in the thesis).

The relational data model brings out the concepts of domain, atomic values, keys and normalization (Yeung, 1998). For each attribute, there is a set of permissible values called its **domain**. The domain can be specified by a data type plus some constraints. Each data value in a relation must be atomic. An **atomic value** is an indivisible item and is a basic unit for retrieval.

One or several of the attributes that uniquely identify a tuple form the **key**. Tuples from one relation can be linked to tuples of other relations through the key. Yeung implies that **normalization** of the relations is always done in order to enforce database integrity. A relation is said to be in a *certain normal form* if it satisfies a prescribed set of conditions. As a minimum, a relation in the relational database has to satisfy the conditions of the first, second and third normal forms. **First normal form** (1NF) eliminates repeating attributes, **second normal form** (2NF) eliminates data dependent on part of a multi-valued key, and **third normal form** (3NF) eliminates data not dependent on the key.

The accuracy of a GIS depends on the data input methods and database building processes. Accuracy of a GIS covers concerns for data quality, error, uncertainty, scale, resolution and precision in spatial data and affects the way in which it can be used and interpreted (Goodchild, Kemp & Chrisman, 1990).

Components of data quality are listed as positional accuracy, attribute accuracy, logical consistency, completeness and lineage by Goodchild, Kemp & Chrisman. **Positional accuracy** is the closeness of locational information (coordinates) to the true position, and it can be tested by using an independent source of higher accuracy (e.g. a larger scale map), by using internal evidence (unclosed polygons, overshoots, undershoots are indications of inaccuracy), or by computing accuracy from knowledge of the errors introduced by different sources. On the other hand, **attribute accuracy** is the closeness of attribute values to their true value. Attribute accuracy must be analyzed in different ways depending on the nature of data, and it can be tested by a misclassification matrix. **Logical consistency** refers to the internal consistency of the data structure, particularly applies to topological consistency.

Completeness concerns the degree to which the data exhausts the universe of possible items, and **lineage** is a record of the data sources and of the operations which created the database. According to Goodchild, Kemp & Chrisman, error is introduced at almost every step of database creation. The errors in a GIS database may be positional measurement error, attribute error, compilation error and processing error. Since there are so many diverse sources of error, it is probably not possible to measure the error introduced at each step independently. Thus, accuracy assessment is needed in GIS applications, and it should be useful to perform accuracy assessment according to data quality reports to standardize the information.

Managing the errors in a GIS is possible with editing to some degree. **Editing** is correcting errors within, or modifying, a computer file, a geographic data set, or a tabular file containing attribute data (ESRI GIS Glossary, 1996). Editing is needed in GIS applications for the following reasons: data may be incomplete or double; data may be in wrong place or digitized incorrectly; data may be at wrong scale; data may be distorted; data may require filtering or thinning; data may be linked to wrong non-spatial data; or non-spatial data may be incomplete or incorrect.

1.2.4.1 Notes from the Literature on GIS Applications

- Uluocha (2005) states that about 80% of the overall data needed to undertake coastal management is space-related and continues that integrated coastal zone management is mostly a space-related activity; no meaningful management decision can be made towards this end without the use of relevant, adequate and well-managed geospatial information. The GIS technology eminently qualifies as a veritable tool for handling geo-referenced data for coastal area management. In combination with remote sensing techniques, GIS can be effectively used to establish zonation schemes which consider coastal processes (geological, physical, chemical, biological), land uses, water uses and environmental impact of human activities. Fedra & Feoli (1998) also state that CZM, by definition, is spatial management that is the distribution and allocation of space, ultimately of parcels of land, (with or without water covering it) to alternative uses or

activities, or the control of processes that in turn may affect space, such as emissions and continues that to solve conflicts and/or find optimal solutions the integration of recent tools such as (GIS), Image Processing Systems, Remote Sensing, with Data Management, Data Analysis and Modeling, looks to be a promising exercise.

- Salem (2003) argues that biosystematic data of all kinds arising from national inventory programs first need to be incorporated into national GIS databases and made accessible to the widest possible audience, e.g. scientists, health workers, crop protection specialists, ecologists and conservationists, decision makers and local people. The addition of the geographic dimension to the database in the form of GISs, provides another perspective to the data, and contributes effectively to enhancing the conservation of biodiversity by providing integration of information in spatial overlays that are readily available on soft media (i.e. maps and images) for analysis and interpretation, and viewing.
- Franklin et al. used GIS to improve spatially-explicit fisheries management decision-making by analyzing the distribution, abundance, and habitat preference of fishes and fishers. They also highlight that the integration of GIS technology with appropriate sampling design and analysis of region-wide data sets represents an attempt to create a more holistic or ecosystem approach to fisheries management and the investigation of essential fish habitat.
- Thompson et al. (2004) list the use of GIS according to their literature review as mapping and classification of ecological resources, predicting and mapping potential habitats, predicting the spatial distribution of nesting sites, developing habitat suitability models for species using land cover information, assessment of the levels of decline of nesting habitats, managing landscapes to the benefit of habitat expansion programs for rare habitats with which threatened wildlife and modeling multi-species avian conservation scenarios.

- Akçakaya (1996) states that habitat loss and fragmentation are among the most common threats facing endangered species, making GIS-based evaluations an essential component of population viability analyses which addresses prediction of future abundance, risk of extinction, or chance of recovery of the endangered species.
- Riede (2000) states that a careful scientific assessment of baseline data is the prerequisite for species conservation and GIS provide the methodology to predict the effect of larger development projects, intensified land use or climatic change on certain species, instead of documenting population declines with hindsight.
- Asch (2003) states that it is possible to divide the usage of GIS technology as applied to marine reserve management into five broad categories, which include: 1.) the creation of baseline datasets; 2.) institutional development; 3.) the establishment of new marine reserves and/or the delineation of zones within an existing reserve network; 4) monitoring and scientific research in support of reserve management, and; 5.) adaptive management.

1.2.5 The Mediterranean Monk Seal

By the mid-70s, IUCN considered the Mediterranean monk seal (Figure 1.30), *Monachus monachus* (Hermann, 1779), to be one of world's twelve most endangered species (Karamanlidis & Johnson, 2002). The Mediterranean monk seal is also Europe's most endangered marine mammal and it is protected by the Barcelona (Fourth protocol species), Bern (Appendix II), Biodiversity (Eligible species), Bonn (Appendix I and II) and CITES (Appendix I) Conventions (Güçlüsoy et.al, 2004). Although it was once known to inhabit at most of the Mediterranean basin, the Black Sea, the Sea of Marmara, and the Atlantic coast of Northwest Africa, the species disappeared from much of its former range during the latter half of the 20th century. According to Massicot (2005), current population is distributed to the waters and coasts of Algeria, Bulgaria, France, Greece, Italy, Libya, Malta, Mauritania,

Morocco, Portugal (Madeira, Desertas Islands), Romania, Russia, Serbia and Montenegro, Spain (Canary Islands), Tunisia and Turkey (Figure 1.31).



Figure 1.30 The Mediterranean Monk Seal.

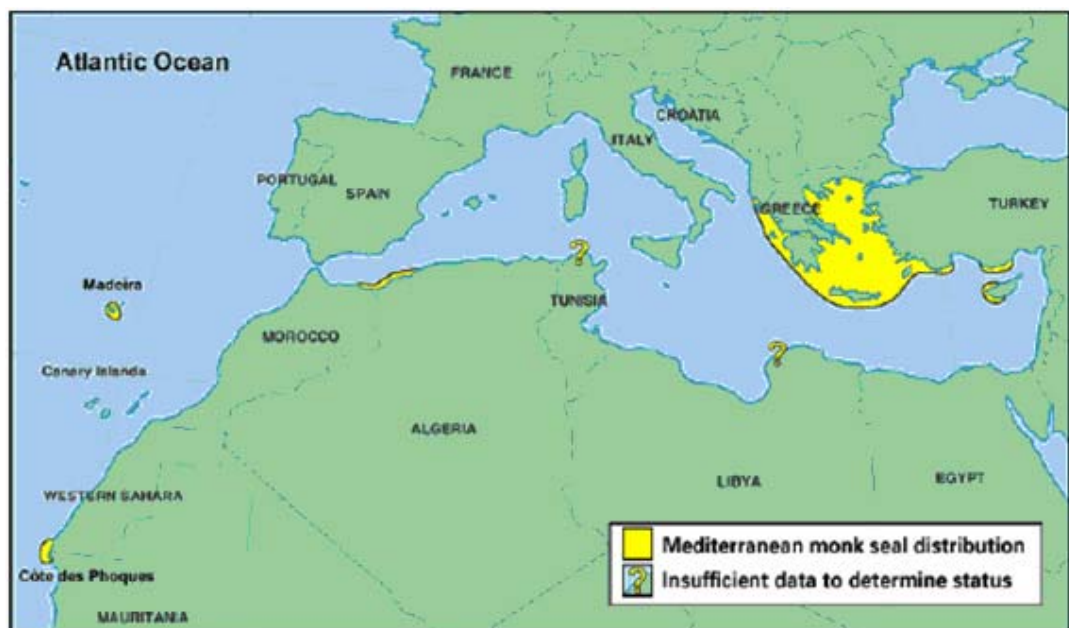


Figure 1.31 Distribution of Mediterranean Monk Seal (Source: Kırac et.al, 2002).

It may be extinct in Albania, Cyprus, Georgia, Lebanon, Syria and Ukraine (IUCN, 2004). The exact population of the species is not known. The population estimates vary from 350 to 1000 individuals. Sergeant et.al. (2003) estimate the population to be between 500 and 1000, and they state that population is still declining. Gücü et.al. (2003) also state that the population consists of 600 to 1000 individuals whereas according to Karamanlidis et.al. (2004) the number of individuals is less than 500.

M. monachus is a member of phocidae family (See Table 1.7 for the taxonomy of the species) and according to IUCN (1988) is amongst the largest species of seals: it exhibits a nose-to-tail length of 250 to 300 cm and has an average weight of 240 kg (male) and 300 kg (female). Sexual maturity is probably reached at 5 to 6 years of age and the life span is estimated at 20-30 years (IUCN, 1988). The species generally feeds on fish and octopus (Table 1.8 lists the diet of the species) from coastal waters, not deeper than 70 m (IUCN, 1988; referring to Lloze, 1978; Verriopoulos, 1984; Marchessaux, 1985). An adult seal is estimated to consume 3%-4% of its weight each day (12 kg/day). The home range of individuals is estimated to be 40 km by Berkes (1978) and IUCN (1988), and 37-56 km by Gücü & Ok (2004). Dive durations are generally short (by phocid seal standards); Kıraç et.al (2002) recorded an 18.00 minutes dive as the longest recorded for this species.

Table 1.7 Taxonomy of *M. monachus* (IUCN, 2004).

Kingdom	ANIMALIA
Phylum	CHORDATA
Class	MAMMALIA
Order	CARNIVORA
Family	PHOCIDAE
Common Name/s	MEDITERRANEAN MONK SEAL (E) PHOQUE-MOINE MÉDITERRANÉEN (F)
Species Authority	Hermann, 1779

Table 1.8 List of fishes, cephalopods and crustaceans found in the stomach contents of monk seals (IUCN, 1988).

Fishes	<i>Boops boops</i>	<i>Dentex canariensis</i>	<i>Mullus surmuletus</i>
	<i>Mugil cephalus</i>	<i>Sardina pilchardus</i>	<i>Anguilla anguilla</i>
	<i>Muraena helena</i>	<i>Platichthys flesus</i>	<i>Sprattus sprattus</i>
	<i>Trachurus trachurus</i>	<i>Sparus sp.</i>	<i>Raja sp.</i>
	<i>Epino phelus guaza</i>	<i>Mustelus mustelus</i>	<i>Dicentrarchus labrax</i>
Cephalopods	<i>Octopus vulgaris</i>		
Crustaceans	<i>Palinurus sp.</i>		

The Mediterranean monk seal is a coastal species. It prefers rocky archipelagoes or cliffbound mainland coasts which contain caves with sufficient haul-out areas (Massicot, 2005 & Güçlüsoy et al., 2000). They are mostly found in waters around very inaccessible caves (IUCN, 1988): *M. monachus* tries to minimize the interactions with humans and uses shelter structured areas for breeding and nesting. The births are known to take place in caves mostly between May and December, with a peak in September-October (IUCN, 1988).

The threats that the species meet is listed by IUCN (2004) as habitat loss/degradation, invasive alien species - pathogens/parasites, harvesting, accidental mortality and intrinsic factors - restricted range. The existence or extinction of the species depends on the measures taken against these threats in the suitable habitats as well as current habitats.

1.2.6 Turkey: Status Quo on the Subjects

Being located on the Anatolian Peninsula and the Terrace Peninsula, Turkey has borders to the Mediterranean Sea, the Aegean Sea and the Black Sea, and has the inland sea, the Sea of Marmara. Although Turkey is a coastal nation (See Appendix 15 for the country profile) with 8333 kilometers of coastline, ICZM concept has not been developed well. The national laws related to the coastal zone issues are **Harbors Law** (14.04.1923), **Forestry Law** (31.08.1956), **Fisheries Law** (22.03.1971), **Tourism Incentives Law** (12.03.1982), **Law for Protection of**

Cultural and Natural Wealth (21.07.1983), **Environmental Law** (09.08.1983), **National Parks Law** (09.08.1983), **Bosphorus Law** (18.11.1983), **Settlements Law** (03.05.1985), **Council of Ministers' Decree for Establishment of Agency for Specially Protected Areas** (19.10.1989), and **Shore Law** (04.04.1990) (Özhan, 1996).

Fisheries being one of the four main subsectors of agriculture in Turkey, it has great importance in contributing to human nutrition, providing raw material for the industrial sector, and creating employment possibilities. Turkey, with its favourable geographical position between the Black Sea and Mediterranean Sea, has access to the fish resources of both of these water bodies. The country is also endowed with rich inland waters and river systems, with significant capture fishery and aquaculture potential. Fish landings in 1996, including aquaculture production, show Turkey, with annual production of 551 642 t, to be one of the important fishing countries in the region. However, the fisheries sector still represents only a minor part of overall agricultural production, at 0.4% of National Gross Income (FAO, 2006) (See national fisheries data in Appendix 16).

Tourism sector is in a gradual increase since 2000 and reached to about 17 million foreigner visitors in 2004 with an income around \$12 billion (State Institute of Statistics, 2004). About 65% of the foreigner arrivals takes place between June and October (See Appendix 17 for national tourism data). Especially after the Tourism Incentives Law in 1982, mass tourism and secondary housing has created serious environmental problems.

Although protection efforts go back 1950s in Turkey, legal, institutional and governmental arrangements have mostly occurred since 1980s. Accepting the international conventions on environment (Table 1.9), together with the related E.U. directives, has also increased the awareness on environment protection and accelerated the arrangements in the country. Ecological, historical and cultural features are protected under twelve national categories. Ministry of Environment and Forestry, Ministry of Culture and Tourism and Ministry of Agriculture are

responsible for designation, legislation, regulation or punishment related to protected areas. Twelve of the protected areas may be classified as coastal or marine protected areas in the country.

Table 1.9 International conventions on environment and protection ratified by Turkey.

Name of convention	Date	Ratification of Turkey
Convention on the Conservation of Birds	1950	1966
Barcelona Convention	1975	1976
World Heritage Convention	1975	1983
Bern Convention	1976	1984
MARPOL Convention	1973	1990
Basel Convention	1989	1994
Ramsar Convention	1971	1994
Convention on the Protection of the Black Sea Against Pollution	1992	1994
Convention on Biological Diversity (CBD)	1992	1996
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1973	1996

State Planning Organization (DPT) and the World Bank began to prepare “The Turkish National Biodiversity Strategic Action Plan” to form the strategies of conservation and sustainable use of natural resources in 1995. The preparation of the action plan was finished in 2001 by the participation of experts from universities, public organizations, research and education institutions, NGOs and private sector. It is prepared on the assumptions that: *1. Biodiversity is the biological basic of sustainable development; 2. Biodiversity is under threat; 3. Conservation of biodiversity is a shared responsibility; 4. Biodiversity is related to the future prosperity; and 5. Turkey contributes globally to the efforts to conserve biodiversity.* In the strategy, six major goals are defined and the strategy to achieve these goals are identified (Table 1.10, see also proposals of the report in Appendix 18).

Although there are attempts to make use of GIS in the government bodies and municipalities, the use of GIS is generally limited to academic studies because of insufficient human capacity, and is away from being used as an effective tool for management purposes in the country. The initiatives were started to construct the

Turkish National GIS (TUCBS) in 2005 by the General Directorate of Deed and Cadastral. TUCBS is designated as a network of data and service providers where geographical data and services are planned to be used jointly.

Table 1.10 National goals and identified strategies to achieve biodiversity conservation (Adopted from Turkish National Biodiversity Strategic Action Plan).

Goal	Strategy
Conservation and Sustainable Use	Ecological planning and management: conservation of wild flora and fauna, completion of protected areas network, restoration and rehabilitation of species and ecosystems, development and implementation of integrated resource management mechanisms, precautions to exotic or introduced species, development and implementation of measures against the human impact on the environment
Ecological Management	a) Development of ecological management: research, traditional knowledge, inventories b) Increasing the resource management capability: data and information management, integrated planning and ecological management, environmental impact assessments and urgent planning, education c) Monitoring
Education and Awareness	Increasing the efforts on biodiversity education and public awareness and spreading these efforts to whole country
Promotions and Legal Arrangements	Developing promotions and related legislations which support biodiversity and sustainable use of biological resources
International Cooperation	International cooperation for conservation of biodiversity, sustainable use of biological resources and equity in sharing benefits of genetic resources
Implementation	Implement the strategy using capacity, if needed provide capacity building

Beginning with the studies of Mursaloğlu in 1960s (See Appendix 19 for monk seal conservation in Turkey), with the triggering force of NGOs such as SAD-AFAG, public awareness on the Mediterranean Monk Seal was increased in 1990s. Some protected areas and fishery regulation zones have been established on the basis of protection of the species, and a national action plan for the conservation of the Mediterranean Monk Seal in the Aegean and Mediterranean Seas was prepared (Appendix 20).

CHAPTER TWO

MATERIAL AND METHOD

2.1 Study Area

The study area is within the Foça municipal administrative area. Foça is one of the 28 districts of İzmir. It is surrounded by Menemen district from the east, Çandarlı Bay from the north, Aegean Sea from the west and İzmir Bay from the south (Figure 2.1). The district has an area of 228 km² (İzmir Chamber of Commerce-İTO, 1999), and a coastline of about 60 km between the outfall of Gediz River and Çandarlı Bay, excluding the islands and islets. The dominant climate of the region is the Mediterranean climate.

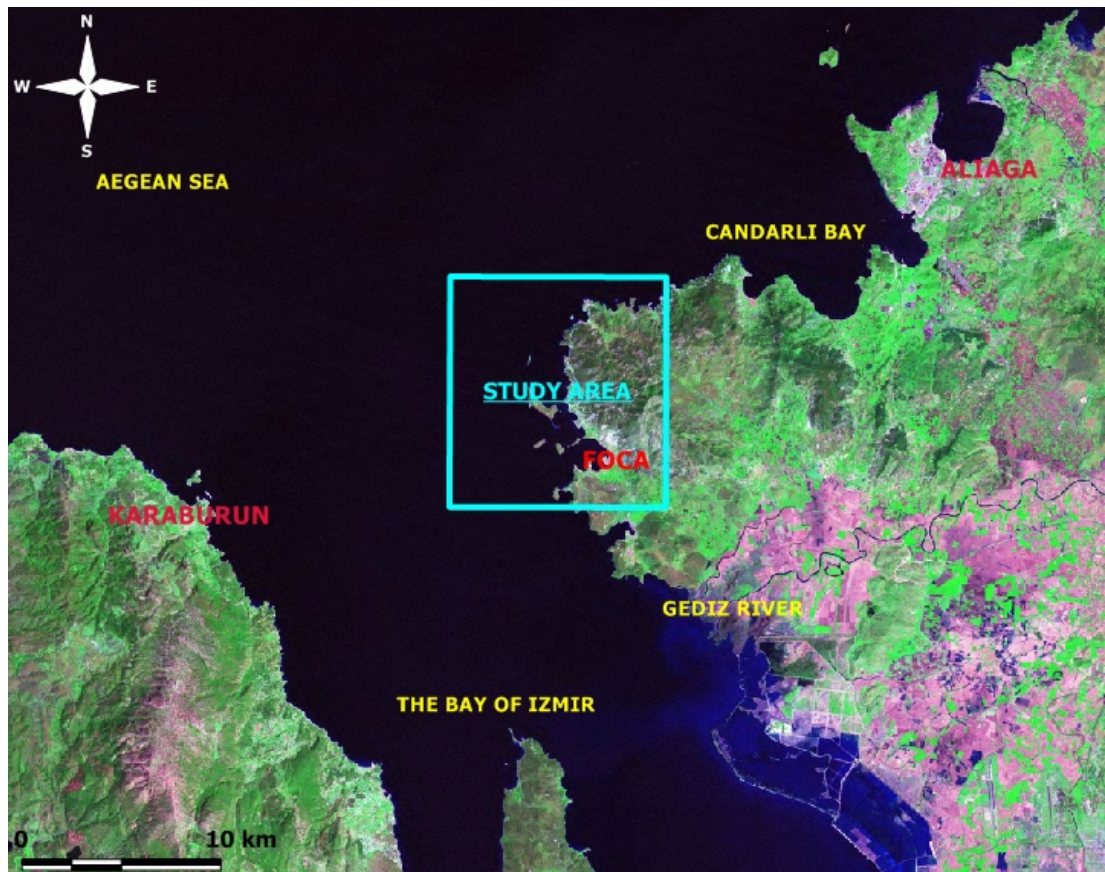


Figure 2.1 The location of the study area within İzmir province (map output by Manifold 6.5 software; background is the Landsat satellite image of the year 2000 with 30m resolution).

In 1940s, initiatives to economic development were begun in the district and in 1950s, military units were begun to be located in the area. The main economical sectors in the region are agriculture, fisheries, tourism, and stockbreeding. Commercial and industrial activities mainly depend on these sectors (İTO, 1999).

The study area includes the western and northwestern coasts of Foça from the south of the Deveboynu Cape to the Beyaz Cape, as well as İncir, Fener, Orak, Metalik, Hayırsız and Güvercin Islands which are very important for the Mediterranean Monk Seal as they include caves and rocky shelters (Figure 2.2). Foça SPA, which was established mainly for the protection of the Mediterranean Monk Seal, is within the study area. The boundaries of the study area are $38^{\circ} 45' 7.6''$ (4,289,289 m.) to the north, $38^{\circ} 38' 50.2''$ (4,277,688 m.) to the south, $26^{\circ} 39' 46.7''$ (470,673 m.) to the west, and $26^{\circ} 47' 17.1''$ (481,586 m.) to the east in the UTM WGS84 projection system. The study area has an area of 125.8 km² and a perimeter of 44.9 km. The east-west and north-south directions are 10.86 and 11.58 kilometers, respectively.

A grid system was created for the study area consisting of 750 grid cells, 30 cells at east-west direction and 25 cells at north-south direction (Figure 2.3). Each grid cell has the dimension of $15'' \times 15''$ (x and y dimensions are 360 m. and 460 m., respectively), and the area of a grid cell is 0.1678 km².

The reason for the need of such a grid system is that the Mediterranean Monk Seal sightings are generally reported as location descriptions by the public; the geographic information of species sightings can not be obtained as coordinates (Savaş et. al., 2006). The aim is to perform zonal analysis using area objects that are coarse enough to locate the species sighting data and fine enough to locate human activities data using the grid system.

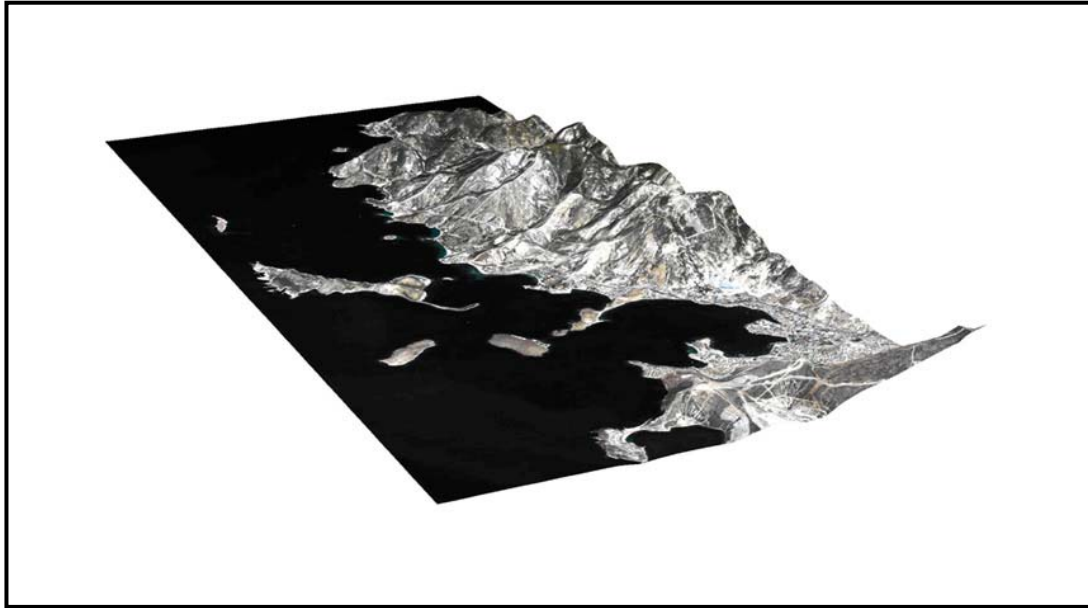


Figure 2.2 Three-dimensional view of Foça mainland and archipelago (map output by RSI Envi 4.0 software; obtained by superimposing Aster and Quickbird satellite images of the year 2005).

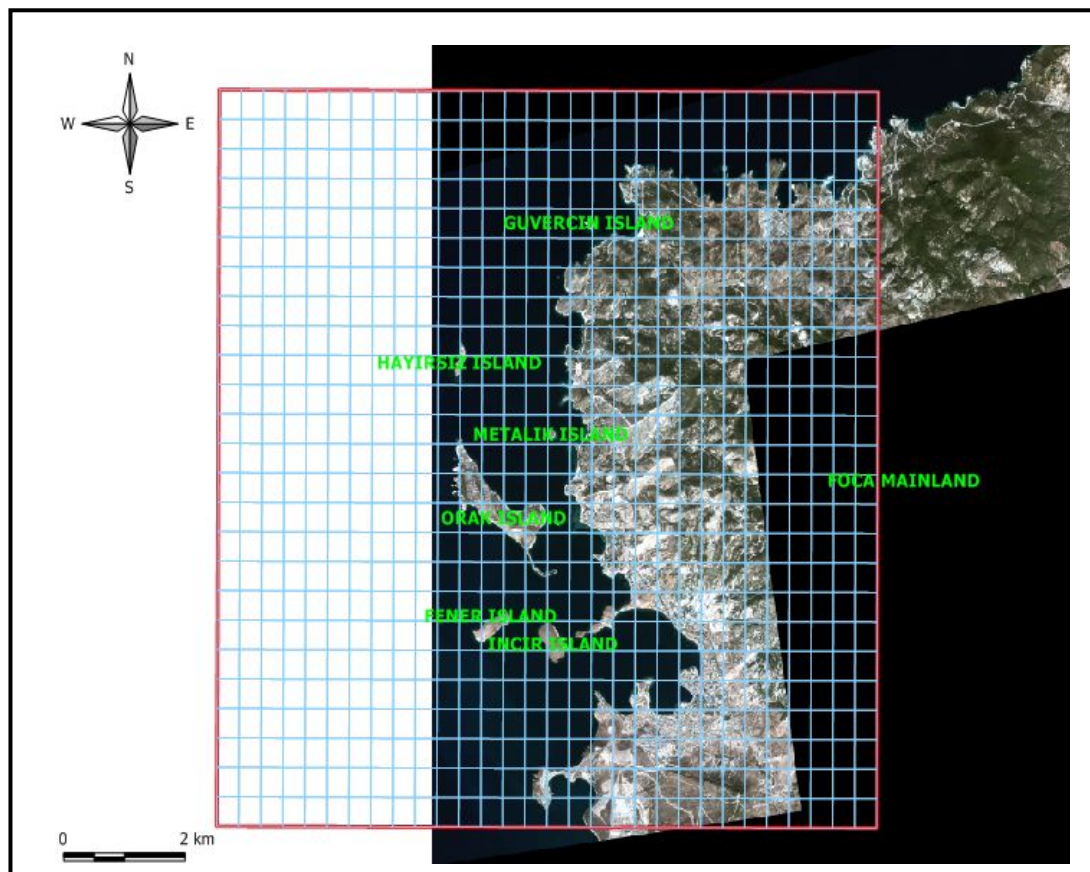


Figure 2.3 The grid system of the study area (map output by Manifold 6.5 software; background is the Quickbird satellite image of the year 2005 with 60cm resolution).

2.2 The Material

Erdas Imagine software package 8.7 was used for the processing of the satellite images for the preparation of the background, RSI Envi software package 4.0 for three-dimensional demonstrations, AutodeskMap software package 2004 for on-screen digitizing, MapInfo Professional software package 8.0 and Manifold software package 6.5 for GIS data input, analysis and output, and Adobe Photoshop for image preparation and output.

The hardware used in the thesis consists of three configurations: 1. 2.21 GHz processor, 4 GB of RAM, 320 GB of hard disk, 256 MB of graphics card, 19" monitor; 2. 2.4 GHz processor, 1 GB of RAM, 80 GB of hard disk, 256 MB of graphics card, 17" monitor; and 3. 3 GHz processor, 2 GB of RAM, 120 GB of hard disk, 64 MB of graphics card, 21" monitor.

The Quickbird satellite imagery of date October 14, 2005 was used as background in GIS digitizing. Digital Globe Inc. launched the Quickbird satellite at October 18, 2001. The sensor has five bands: blue, green, red, near-infrared, and panchromatic (NASA). The spatial resolutions of the panchromatic and multispectral imaging sensors are 60cm and 2,4m respectively at nadir angle (Digital Globe).

The ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) satellite imagery of date October 9, 2005 was used for three-dimensional demonstration of the study area. The ASTER satellite was launched by NASA and Japan's Ministry of International Trade and Ministry in December 1999. The visible and near infrared (VNIR), short wave infrared (SWIR), and thermal infrared (TIR) sensors have 14 channels (CREASO, 2005). The spatial resolutions of VNIR, SWIR and TIR sensors are 15, 30 and 90 meters, respectively (NASA, 2005).

The 1/5000 scaled Master Land Use maps of Foça with were used as base map in digitizing the sit areas and the features included in the tourism layer.

2.3 The Data

There are three main datasets in the thesis: existing zonal structure, the Mediterranean Monk Seal, and human activities (tourism, fisheries, and touring boats). The feature types for each dataset were selected according to the representativeness of related data, mappability and presentability criteria.

The existing zonal structure was created by mapping the layers of management zones such as the Foça SPA, the SIT areas, and no entry and regulation zones. Satellite imagery and Master Land Use map data were supplied by the municipality; and as mentioned in the previous section, were used as background to create the related GIS layers.

The Mediterranean Monk Seal dataset consists of the sighting data, cave locations, and observation points. SAD-AFAG provided all the related data, and located the sightings into the grid system.

Human activities dataset includes the data about tourism, fisheries, touring boats and land use. Tourism foundations data were supplied from the District Directorate of the Ministry of Culture and Tourism and the Foça Municipality, and the marine activities data were supplied from the District Directorate of the Ministry of Agriculture, Foça Port Directorate and the Foça Municipality. Land use map is obtained by mapping all land use zones from the Quickbird satellite image.

In order to fill data gaps and to obtain zonal usage, questionnaires (See Appendix 21 for the original questionnaires) were made with the local stakeholders. Fisheries and tour boat activity areas are produced using the information gathered from fishermen respondents.

2.4 The Method

The methodology of the thesis (Table 2.1) is similar to the one that Goodchild (1997) defined for any GIS application: problem definition, software and hardware acquisition, data acquisition and input, database creation, analysis, and interpreting and presenting the results.

Table 2.1 The methodology of the thesis.

STAGE	PROCESS	MATERIAL & TOOLS
1. Problem Definition		
<i>What may be the management objectives to sustain endangered Mediterranean Monk Seal and its habitat recovery in Foça? How much and where do human activities form pressure upon Monachus monachus?</i>	- Literature review - Overview of the related concepts - Analysis of the status quo in the study area - Inventorying existing data and maps - Definition of data gaps - Method description	- Literature - Existing data and maps - Existing regulations and legislations
2. Software and Hardware Selection		
	- Hardware selection - Selection of the appropriate software according to the capabilities	- Hardware as possible as of high capabilities listed in Section 2.2 - Erdas Imagine & RSI Envi - AutodeskMap - MapInfo & Manifold - Adobe Photoshop
3. Data Acquisition		
	- Acquisition of existing data - Field study	- Literature - Existing data and maps - Questionnaires - Observations
4. Building the GIS Environment		
	- Definition of datasets - Design of the GIS structure - Definition of GIS layers - Spatial and attribute data entry	- GIS-CAD integration - Spatial and attribute data types
5. Analysis		
	- Overlay - Query - Object attributes - Geographic measurements - Buffer analysis - Thematic mapping	- MapInfo & Manifold
6. Output		
	- Results - Discussion - Conclusions and recommendations	- Maps - Graphs - Tables

2.4.1 Field Study

A 45-day of field study was performed at the site. The aim was to make observations for mapping necessary objects to the GIS environment and to make questionnaires with the local stakeholders. Questionnaires were made in September 2004 (12 days), November 2004 (15 days), and June 2005 (13 days). In addition to the observations during these periods, 5 days of observation was made in the study area in spring and summer months of 2006. Observations depend on the site walk to take notes concerning datasets and to map the objects, especially to correct the locations of the buildings that are mapped in the tourism layer. On the other hand, the questionnaires focus on the area usage data and interactions with open-ended and closed-ended questions. 28 fishermen, 8 touring boat owners, and 31 respondents from tourism facilities were questioned, and they were also asked to reply some questions other than area usage and interactions such as boat or foundation information, their social and economical state and the problems they met or the conflicts they live. The composition of respondents and response rates are given in Table 2.2.

Table 2.2 The composition of respondents and response rates (2004 data).

	Composition (respondent number/target number)	Number of respondents (N _R)	Number of target groups (N _T)	Questionnaire success (N _R / N _T ×100)	Number of persons asked to be questioned (N _q)	Response rate (N _R / N _q ×100)
Fishermen	- Artisanal: 18/53 - Trawl: 8/24 - Purse-seine: 2	28	77	36.4 %	35	80.0 %
Tourism Related Respondents	- Lodging places: 18/41 - Restaurants: 6/37 - Café and pubs: 7/39	31	117	26.5 %	36	86.1 %
Tour Boat Owners	8/13	8	13	61.5 %	9	88.9 %
Marine Farm	1/1	1	1	100 %	1	100 %

2.4.2 Building the GIS Environment

The vector data model was used to represent geographic features in the datasets. The vector model is a geo-relational, feature-based model which stores features as point, line or polygon geometric elements (Bartelme, 1996). It was preferred because of its superiority in object operations such as calculating geographic measurements and object attributes on the raster data model (Dickinson, 1997). Moreover, it is more presentable to the decision makers since representation of the geographic space is more reminiscent of the familiar analog map (DeMers, 2005).

Each dataset has a number of layers consisting of similar feature types. The designation of the GIS layers (Figure 2.4) was made considering the mappable data in vector form. The layers can be grouped as digitized and derived layers: digitized layers are the ones created by on-screen digitizing over the satellite image or Master Land Use map, whereas the derived layers were obtained by using any existing digitized layer.

The database component of GIS structure (Figure 2.5) is relational database in which each geographic object is one tuple (row) of the corresponding relation, and querying is SQL-based (Rigaux, Scholl & Voisard, 2002). The data types of the attributes (column) in the tables forming the database are character, integer, small integer, float, decimal, date or logical (MapInfo data types). Like layers, the tables can also be grouped as created tables and derived tables. The created tables are the ones that belong to the digitized layers or imported data, while derived ones were obtained by queries or any other analysis.

The satellite image and the Master Land Use maps are the only raster components of the GIS structure which were used as base maps at the background. The format of the Quickbird image and the prosperity maps are Geographic Tagged Image File Format (GeoTIFF) and Tagged Image File Format (TIFF) respectively.

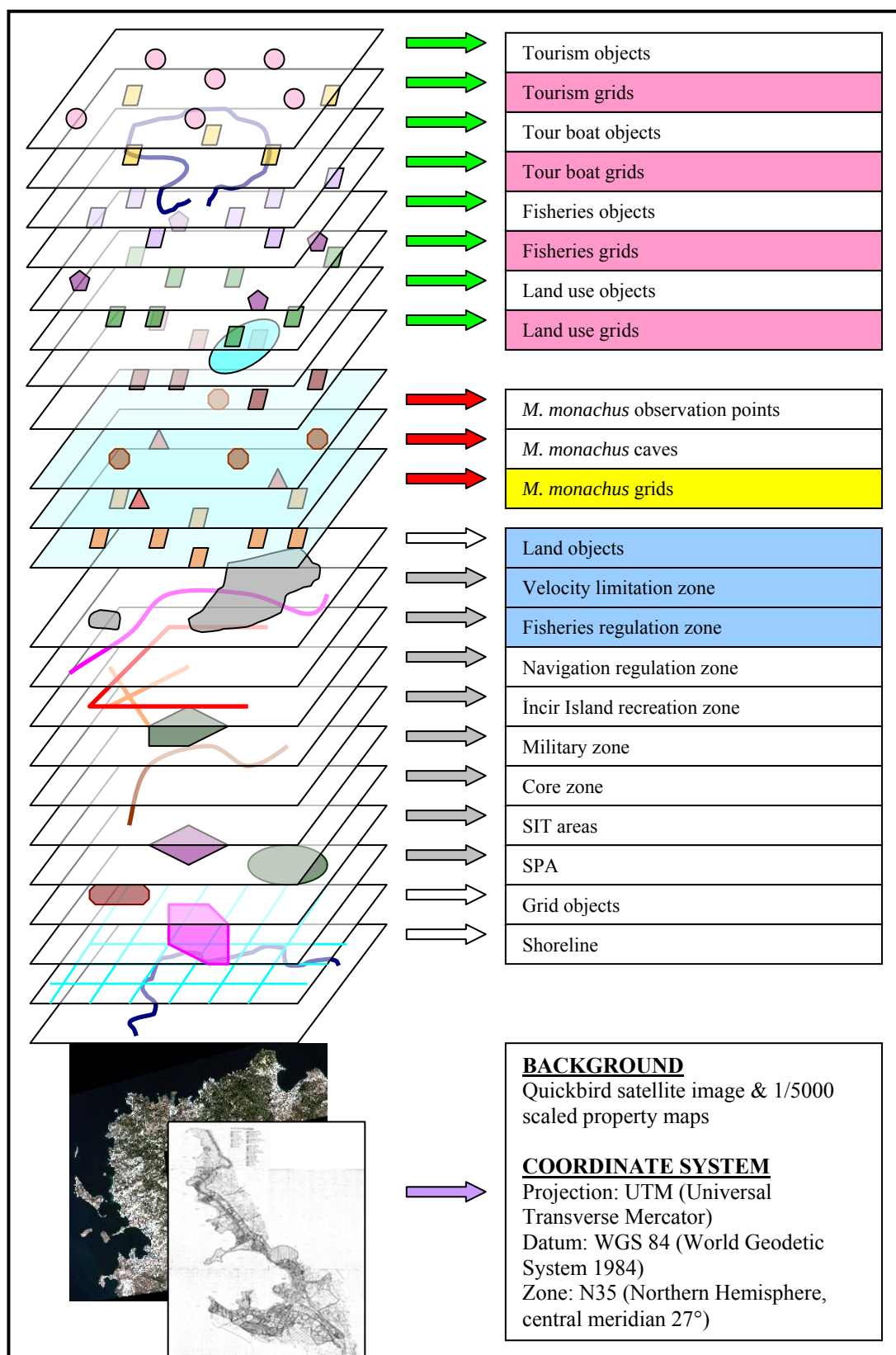


Figure 2.4 The GIS layers (Green arrows: human activities dataset, red arrows: *M. monachus* dataset, grey arrows: present regulations dataset. White boxes: created layers, colored boxes: derived layers).

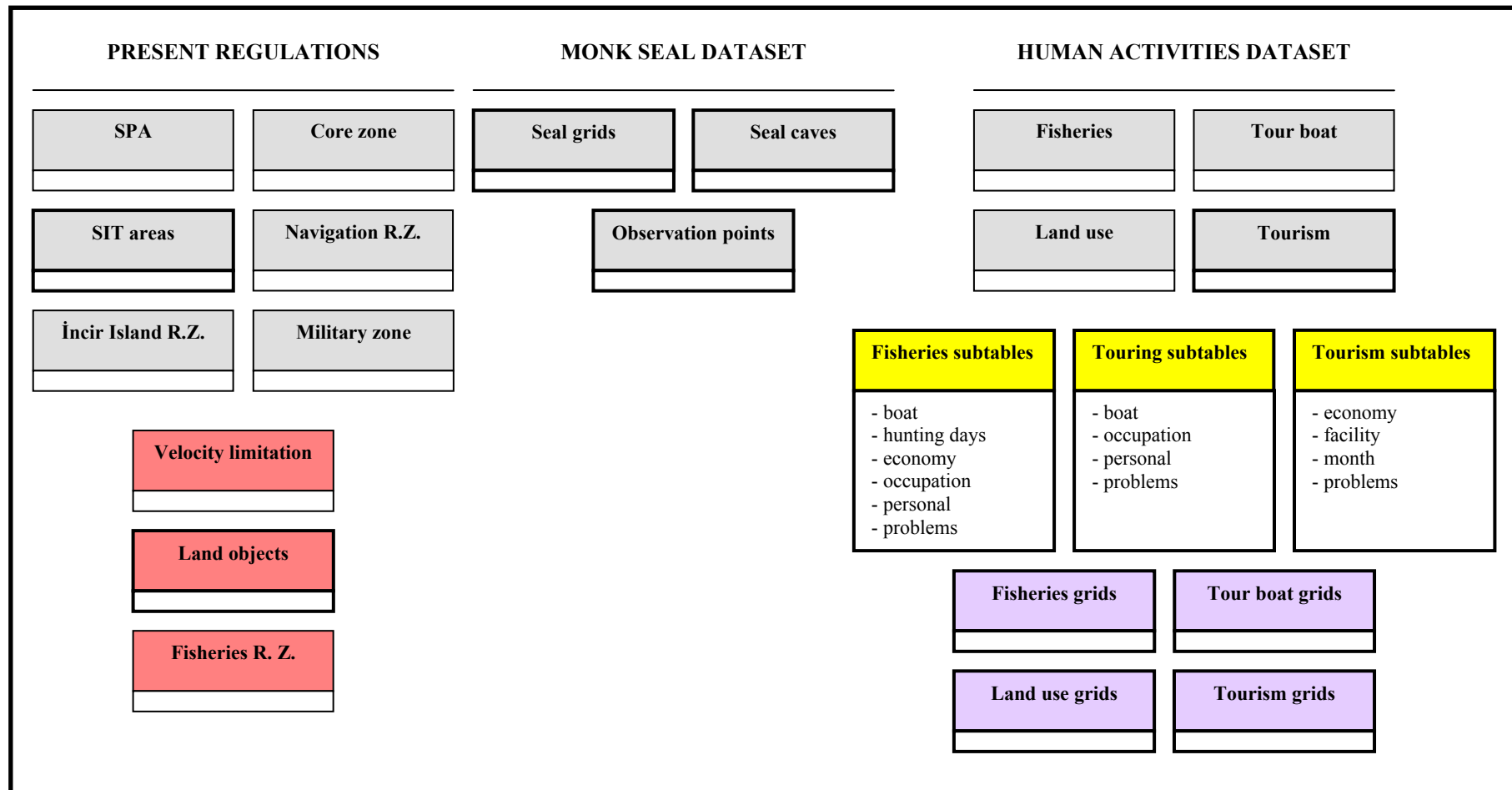


Figure 2.5 The relational database structure of the GIS environment (Thick bordered tables include data for analysis, others include only format data. Grey boxes: created tables, yellow boxes: subtables, colored boxes: derived tables).

2.4.2.1 The Raster Work: Preparation of the Base Maps and 3-Dimensional Demonstrations

The Quickbird satellite imagery used as background spans seven image files. Data preparation tool “**mosaic images**” of Erdas Imagine 8.7 software was used to combine the images to form the background for GIS digitizing. “**Mosaicking** is the process of joining georeferenced images together to form a larger image or a set of images” (Erdas Field Guide, 2003). A reference image was selected in the REF column of the CellArray (Figure 2.6). This reference image acts as the baseline and determines the default output map projection, cell size and data type (Erdas on-line help). The other six images were attached to the reference according to their map and projection information. After combining satellite image dataset by mosaic tool of Erdas, the image was converted to GeoTIFF format in Envi software.

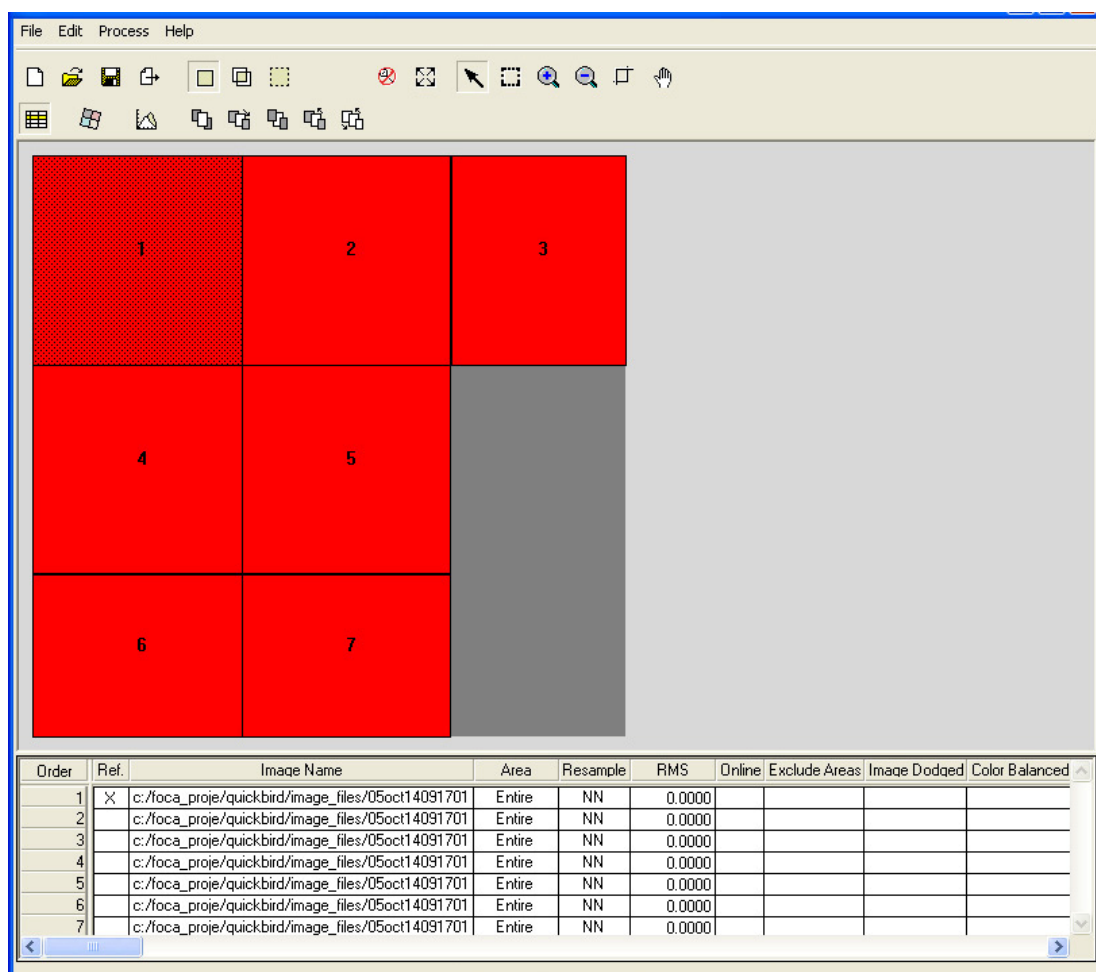


Figure 2.6 The mosaicking in Erdas Imagine (Image no.1 is the reference).

The TIFF formatted scanned Master Land Use maps were also used as background for digitizing the SIT areas and tourism foundations. Unlike satellite images, scanned data did not have any map and projection information. Thus, mosaicking was not applicable to this image set. Adobe Photoshop CS2 was used to combine five Master Land Use maps (Figure 2.7). The original maps were cut from the border that would be the line of intersection between images and the canvases were rotated clockwise or counter clockwise, where needed, to reduce scanning errors and obtain the best fit. Then, maps were combined by enlarging the canvas size of a single image and placing others to that canvas visually.

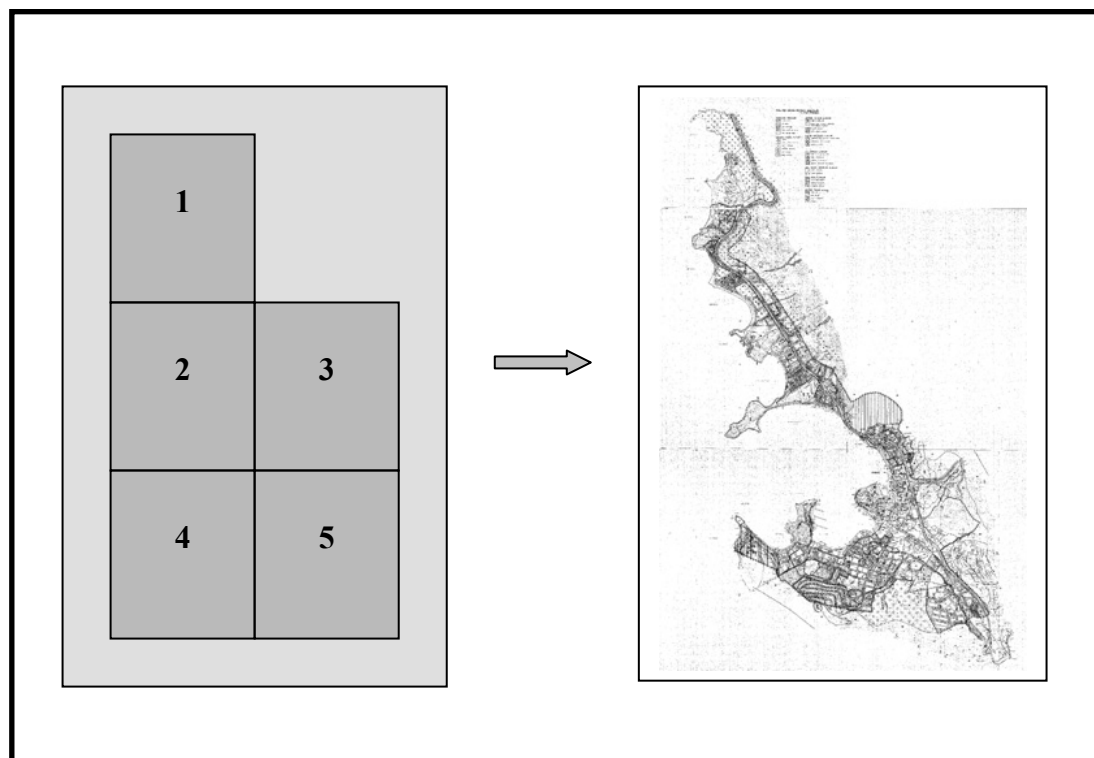


Figure 2.7 Preparation of base map from prosperity maps in Adobe Photoshop (The light grey surface is the canvas and darker numerated ones are the 1/5000 scaled Land Use maps).

Another raster work was to create the digital elevation models (DEM) of the study area in RSI Envi 4.0. The ASTER image data includes DEM information of the target area captured by the sensors. In addition to VNIR, SWIR and TIR bands, the band 3B (B stands for backwards) works at the same spatial resolution with band 3 of the VNIR sensor, but at a backward angle of 28 degrees, producing a stereopair (Figure 2.8) for the ASTER image (SulSoft, 2003). Any other satellite image, even

with different resolutions, may be overlaid on the ASTER DEM (Envi User's Guide, 2003).

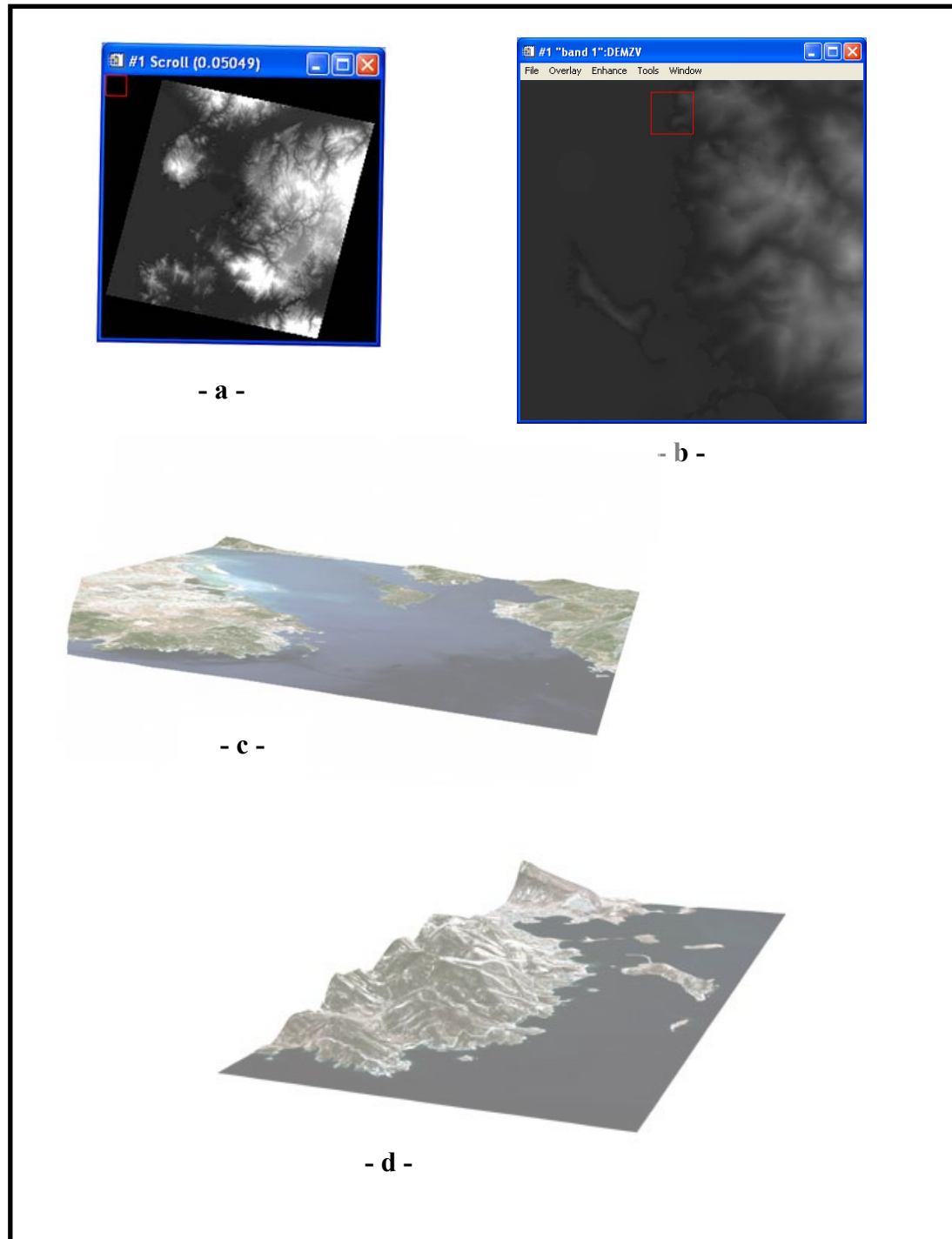


Figure 2.8 Digital elevation models obtained by Envi (a & b: ASTER stereopair DEMs at different zoom levels to the study area, c: Landsat image with 30m resolution overlaid on ASTER DEM, d: Quickbird image with 60cm resolution overlaid on ASTER DEM).

2.4.2.2 Image Registration

One of the most important tasks of GIS is the registration of the components to a real world coordinate system (Haddock, 1997). Accurate image registration is of high importance especially in on-screen digitizing since the objects of other created layers are georeferenced relative to the background image. The coordinate error of pixels of the base maps will also be encountered at the digitized vector layers, and the error will probably increase when the digitizing errors (user error) are added.

The images were registered to MapInfo, Manifold and AutodeskMap environments. When choosing the coordinate system of the GIS structure, original map information of the satellite imagery was taken into consideration, otherwise map parameters were to be transformed. The projection of the Quickbird satellite image was Universal Transverse Mercator (UTM) and datum was World Geodetic System 1984 (WGS84). The study area is within the 35th zone of UTM, in the northern hemisphere. Taking in account these parameters, the satellite image was georeferenced both using software auto registration tools and manually.

Manifold software automatically registered the image according to the GEOTIFF geographic information when imported to the environment. In MapInfo, first GEOREG tool was loaded from the tool manager, and then, the image was automatically registered by this tool. In this process, MapInfo automatically creates three control points, which are three corners of the image, and registers the image according to the coordinate value of these three points. The projection info did not need to be defined in both Manifold and MapInfo because projection, datum, zone and unit parameters were also imported (Figure 2.9). The image was also inserted to AutodeskMap environment according to image file defaults. Unlike GIS softwares, projection, datum and zone definitions needed to be defined to assign global coordinate system in this CAD software.

```
!table
!version 300
!charset WindowsTurkish
```

Definition Table

File "satellite_view.tif"

Type "RASTER"

(474225.59999999998,4290741) (0,0) Label "Pt 1",

(488159.39999999997,4290741) (23223,0) Label "Pt 2",

(474225.59999999998,4277083.7999999998) (0,22762) Label "Pt 3"

CoordSys Earth Projection 8, 104, "m", 27, 0, 0.9996, 500000, 0

Units "m"

-a-

```
<?xml version="1.0" encoding="UTF-8" ?>
<preset>
<name>Universal Transverse Mercator - Zone 35 (N)</name>
<datum>World Geodetic 1984 (WGS84)</datum>
<system>Transverse Mercator</system>
<unit>Meter</unit>
<majorAxis>6.3781370000000000000000000000e+006</majorAxis>
<eccentricity>8.18191908426214860000000000e-002</eccentricity>
<centerX>0.000000000000000000000000e+000</centerX>
<centerY>0.000000000000000000000000e+000</centerY>
<centerZ>0.000000000000000000000000e+000</centerZ>
<scaleX>9.996000000000000400000000e-001</scaleX>
<localScaleX>5.999999999999998000000000e-001</localScaleX>
<scaleY>9.996000000000000400000000e-001</scaleY>
<localScaleY>5.999999999999998000000000e-001</localScaleY>
<falseEasting>5.000000000000000000000000e+005</falseEasting>
<localOffsetX>4.742255999999998000000000e+005</localOffsetX>

<falseNorthing>0.000000000000000000000000e+000</falseNorthing>
<localOffsetY>4.277083200000000200000000e+006</localOffsetY>
<centerLat>0.000000000000000000000000e+000</centerLat>
<centerLon>2.700000000000000000000000e+001</centerLon>
</preset>
```

-b-

Figure 2.9 Auto georegistration parameters of MapInfo and Manifold (a: Notepad text format of MapInfo .TAB file belonging to satellite view, b: XML of Manifold projection information)

The satellite image was also registered manually in the GIS environment. Although GIS softwares need at least three control points, six points were chosen as control points to register the image in both MapInfo and Manifold softwares for a more accurate registration (Figure 2.10). In manual registration, map coordinates of control points were entered and which locations on the raster image correspond to those coordinates was indicated (MapInfo Professional Reference Guide, 1998).

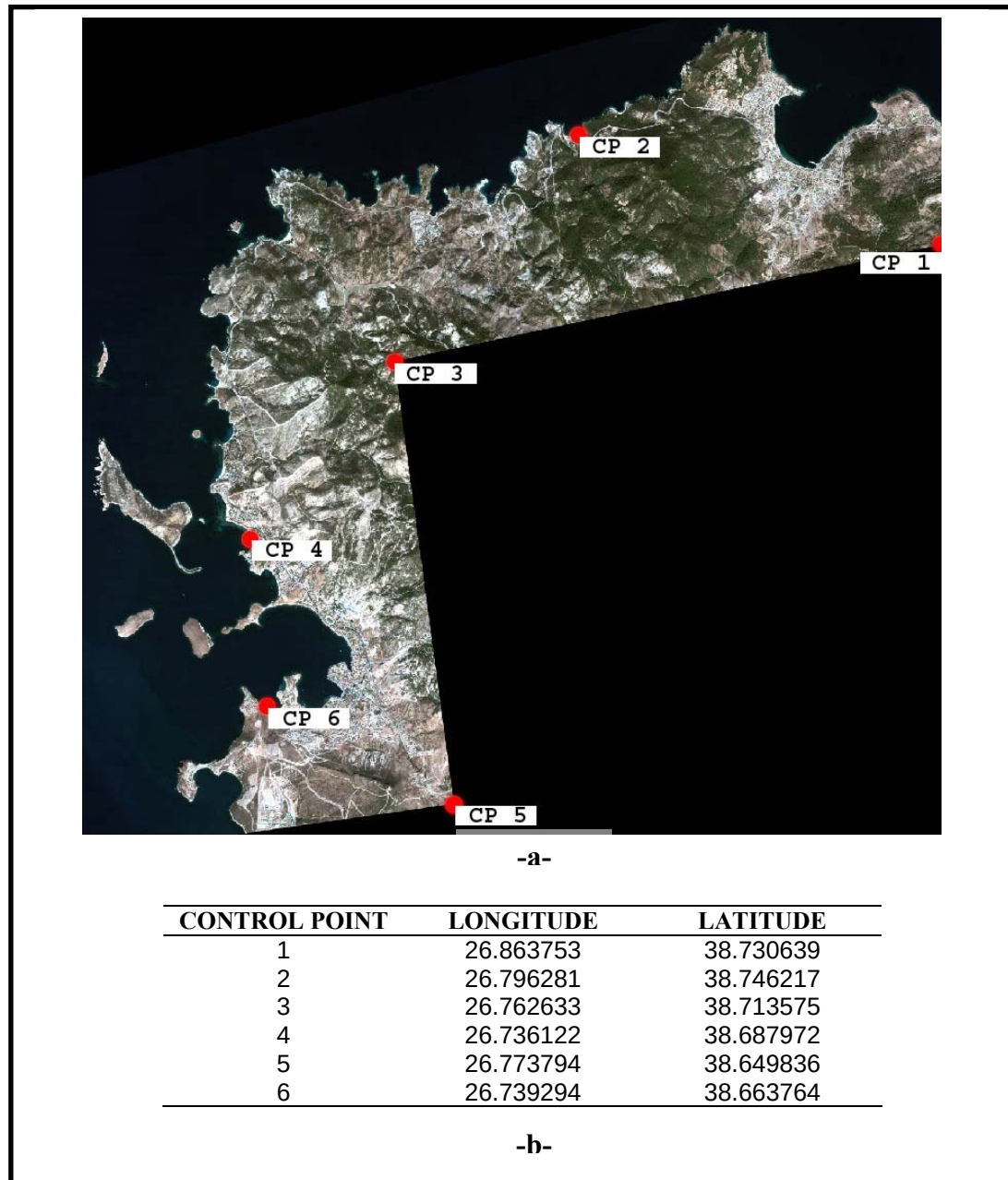


Figure 2.10 Control points for manual image registration in GIS softwares (a: the location of control points, b: the coordinates of control points).

The combined Master Land Use map was registered in Manifold by image-to-image registration technique which is absent in MapInfo. This method adjusts one image to the geographic location of a known good reference image (Manifold User Manual, 2005). The reference image was the registered Quickbird satellite image, and the target image was the Master Land Use map to be registered (Figure 2.11). 14 control points were identified in both images at same locations and the Master Land Use map was georegistered according to the matching control points on the satellite image.

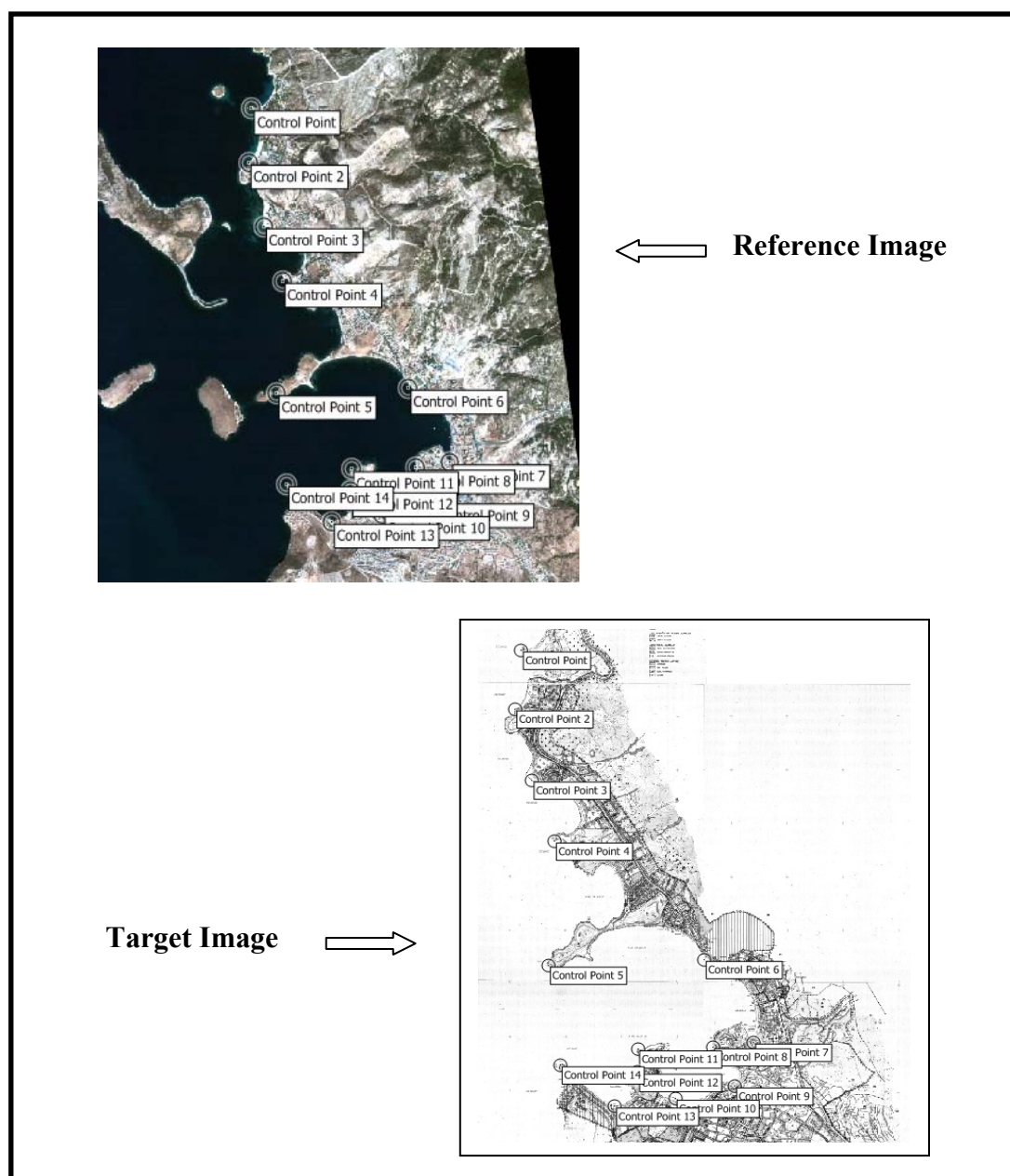


Figure 2.11 Image-to-image registration in Manifold.

2.4.2.3 *The Vector Work: Creating the GIS Layers*

After the definition and assignation of the coordinate system of the GIS environment, the layers of the datasets were digitized into that coordinate system. Most of the digitizing process was performed in AutodeskMap except for the point features, each layer was imported to MapInfo and Manifold environments, and necessary object transformations (e.g. converting lines to polylines or polygons) were done in MapInfo. There were three main reasons for this GIS-CAD integration:

- To benefit from the drawing capabilities of the CAD software; thus minimize time for digitizing,
- To keep every polyline and polygon features in their simplest form –that is to draw them in line mode of CAD which keeps each line segment as a selectable object–; thus to make it easy to redraw or correct the features if needed later, and
- The AutoCAD DXF format can be read directly by or imported to any GIS software; thus the created layers may also be used easily in future studies, even though some other GIS software will be used.

On-screen digitizing process was done in point-mode digitizing. The important subjects during drawing in AutodeskMap were the characterization of the objects by lines and the zoom of display since the former affects the geomorphology of the vectorized features, and the latter affects the resolution of the created vector layer. For this reason, the layers were digitized in a zoom of 1/500 scale, and same approaches were applied to similar problems (e.g. shadows in the satellite imagery) in order to systemize the user errors.

The digitizing procedure was briefly as follows:

- Creating a new layer: define the new layer in AutodeskMap by “Layer Properties Manager”. Give the name of the layer and assign color, line type and line weight of the layer.
- Make the layer current and draw the features which are in the area of interest of that layer in polyline mode of AutoCAD.

- Import the layer to the GIS environment.
- Define the map properties (projection, datum, zone, and unit) of the imported layer in GIS software.

Point features, on the other hand, were digitized in MapInfo. The features with known coordinates (e.g. Mediterranean Monk Seal caves) were drawn by Create Points command. This technique reads the coordinates in a previously created table, and creates point objects on that coordinates. The point features without known coordinates (e.g. touristic sites) were digitized using the georegistered Master Land Use map and satellite image as background.

The procedure for digitizing the point objects was as follows:

- Create a new table in MapInfo (term “table” stands for layer in MapInfo).
- Give the name of the table and assign the projection, datum, zone and units for the created layer.
- Assign color and define the symbol font, size, type and color in the Symbol Style window.
- Make the layer editable.
- If the coordinates of the points are known, use Create Points command, and define the source table that includes the coordinates and the fields from where X and Y coordinates will be got.
- Otherwise, digitize the points visually on the base map.

The features created by the methods mentioned above were given various point, line or polygon characteristics. These are symbol style, color, font and size for point objects; line color, style and weight for line objects; and border color, border style, border line weight, area style and area color for polygon objects. Appendix 22 gives the detailed information on digitized and derived features of the GIS environment and their physical characteristics. The concept of layers is then used to produce the maps of each dataset (Figures 2.12-2.19).

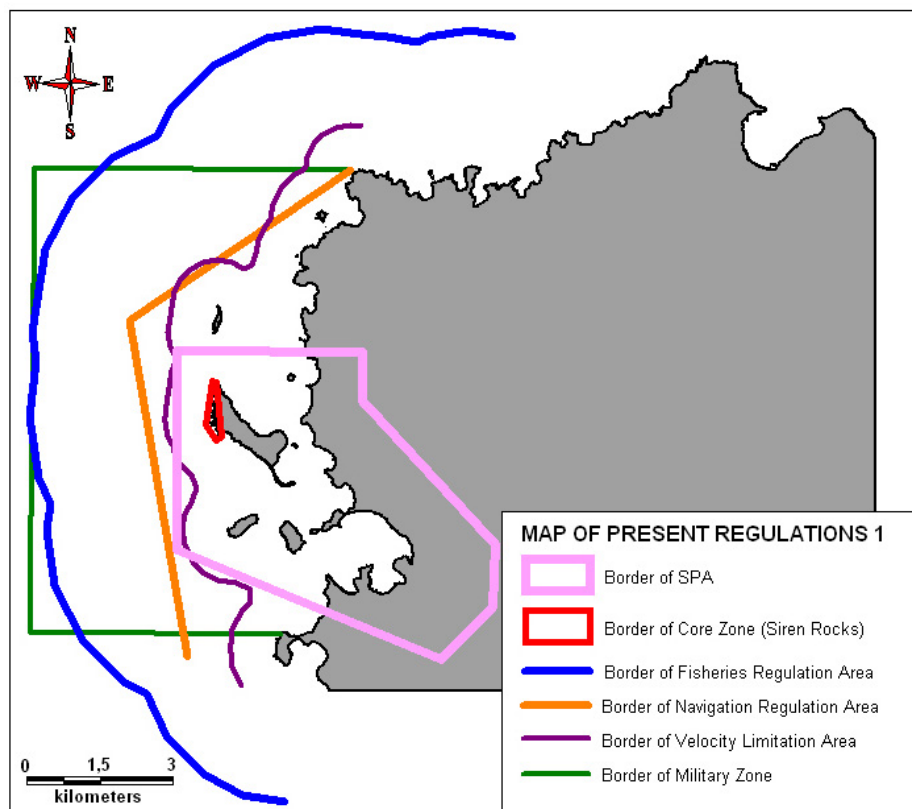


Figure 2.12 Map of present regulations 1: various management and regulation zones.

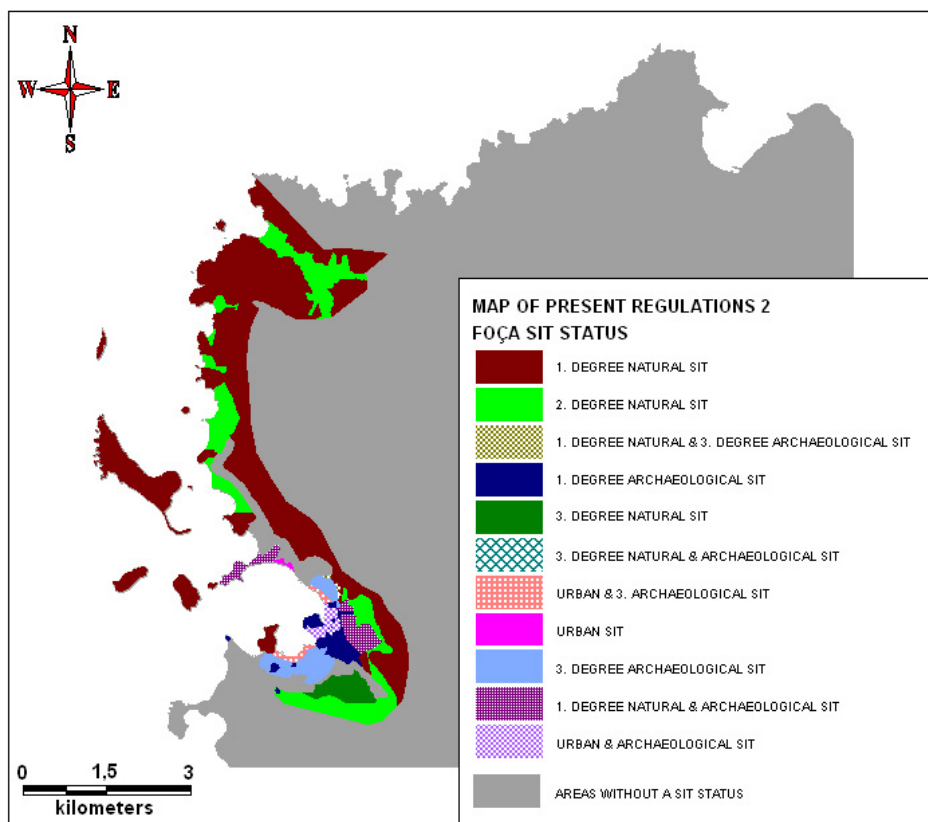


Figure 2.13 Map of present regulations 2: SIT areas.

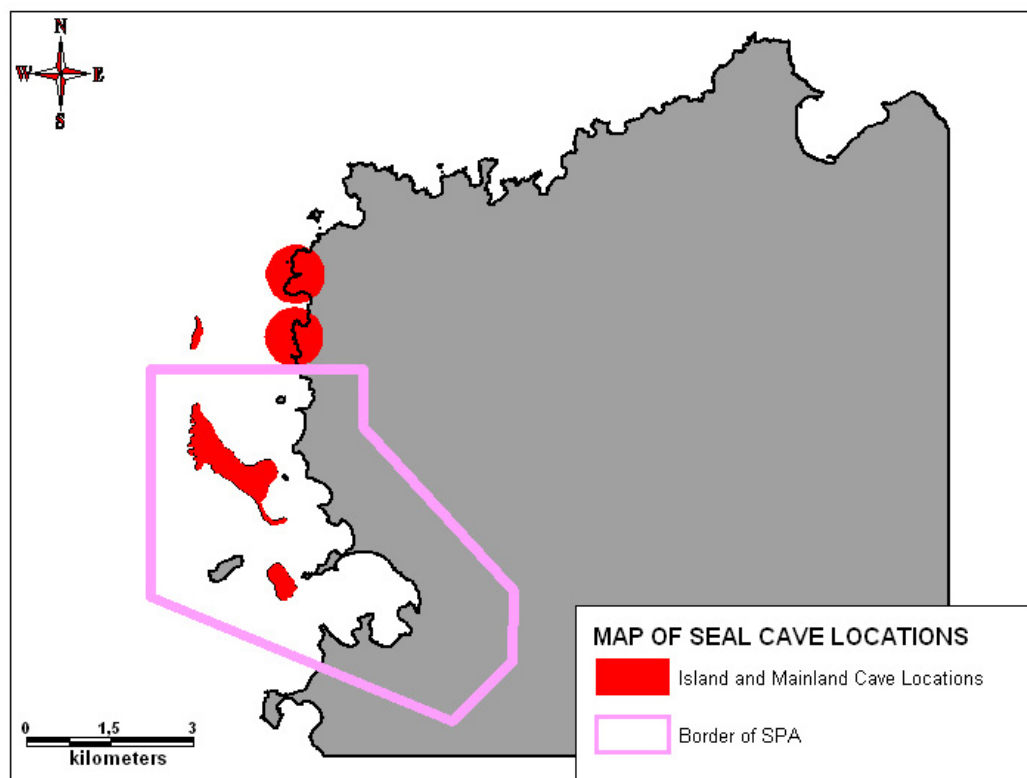


Figure 2.14 Map of Monk Seal cave locations (İncir, Orak and Hayırsız Islands and mainland).

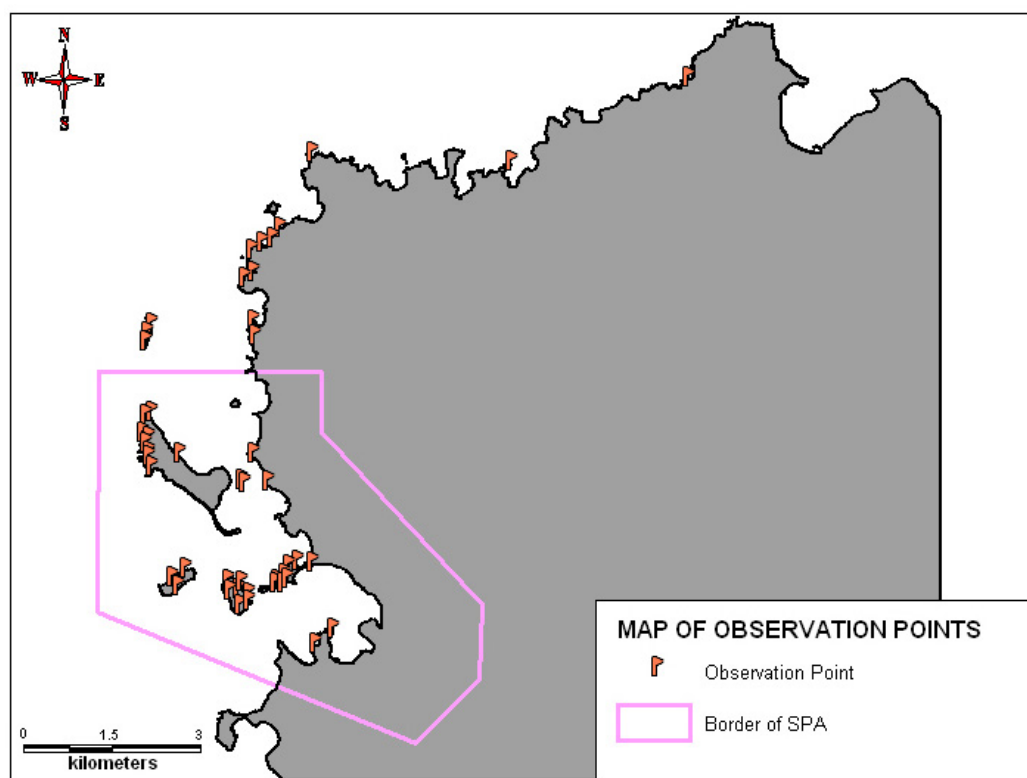


Figure 2.15 Map of Monk Seal observation points of SAD-AFAG.

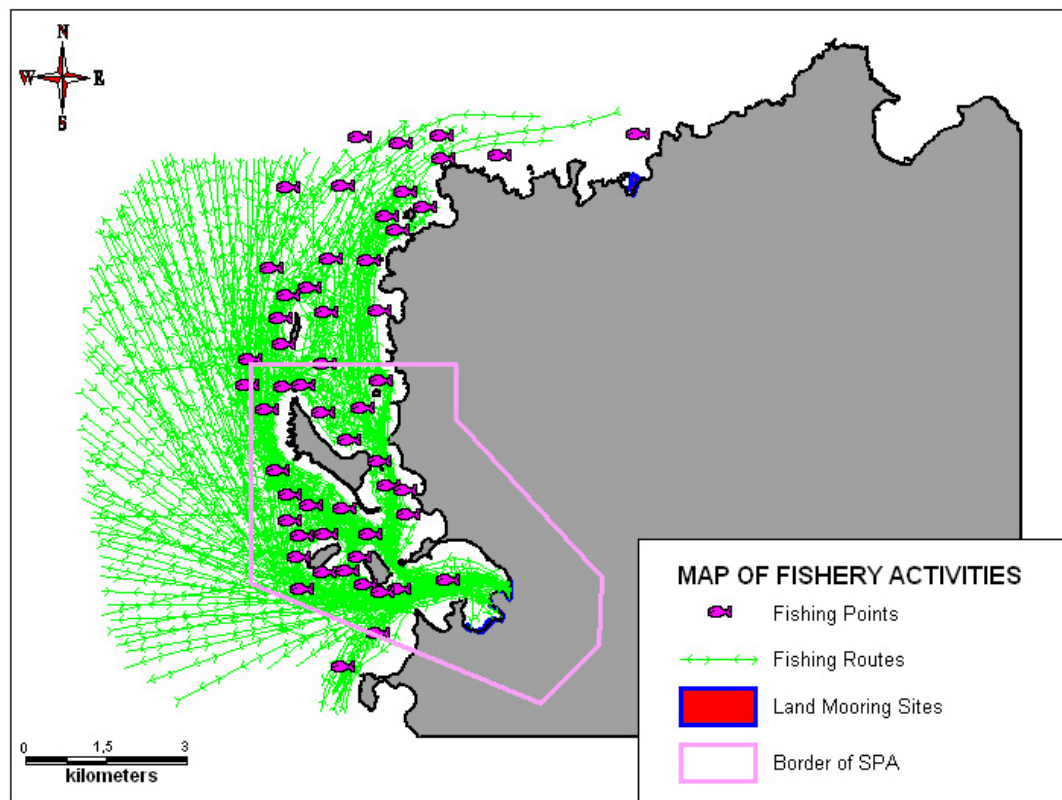


Figure 2.16 Map of fishing points, mooring sites and routes of fishermen.

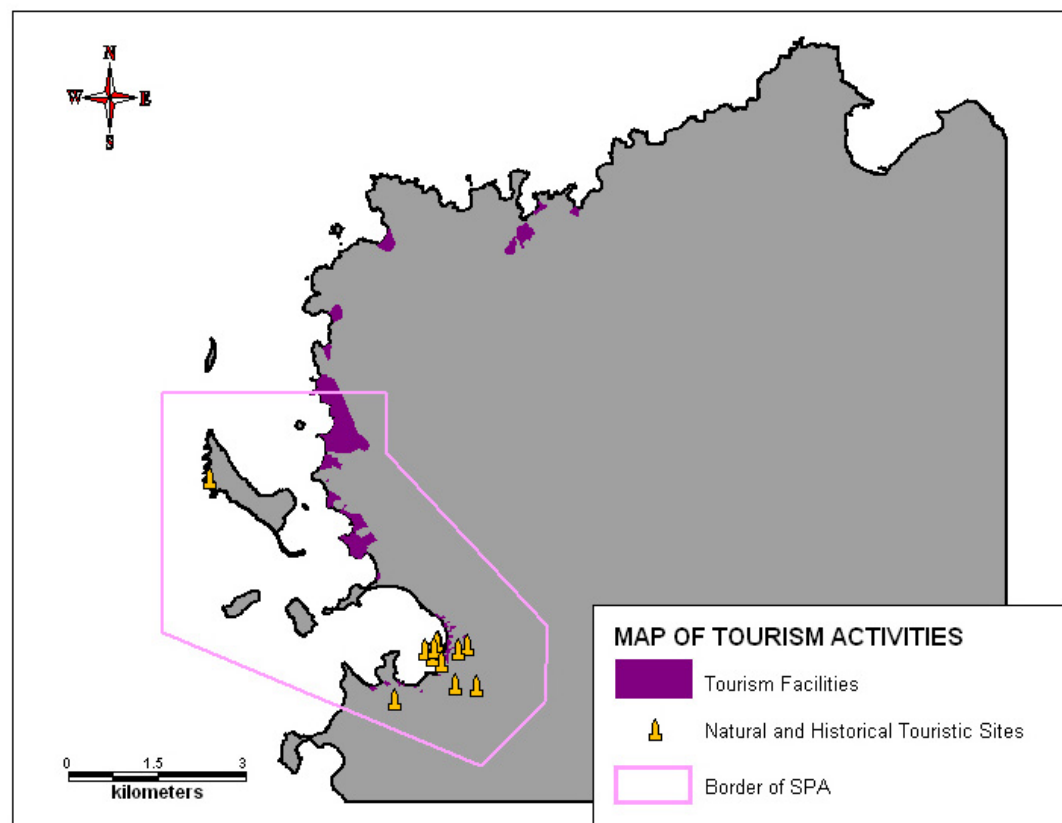


Figure 2.17 Map of distribution of tourism facilities and natural and historical touristic sites.

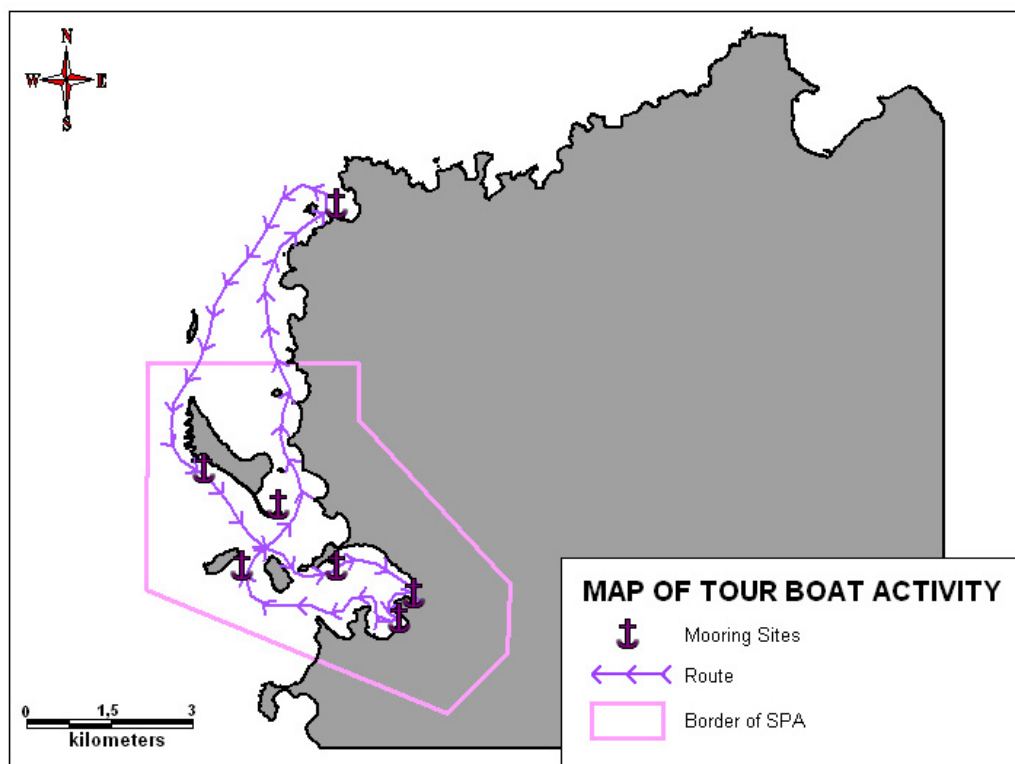


Figure 2.18 Map of tour boat route and mooring points.

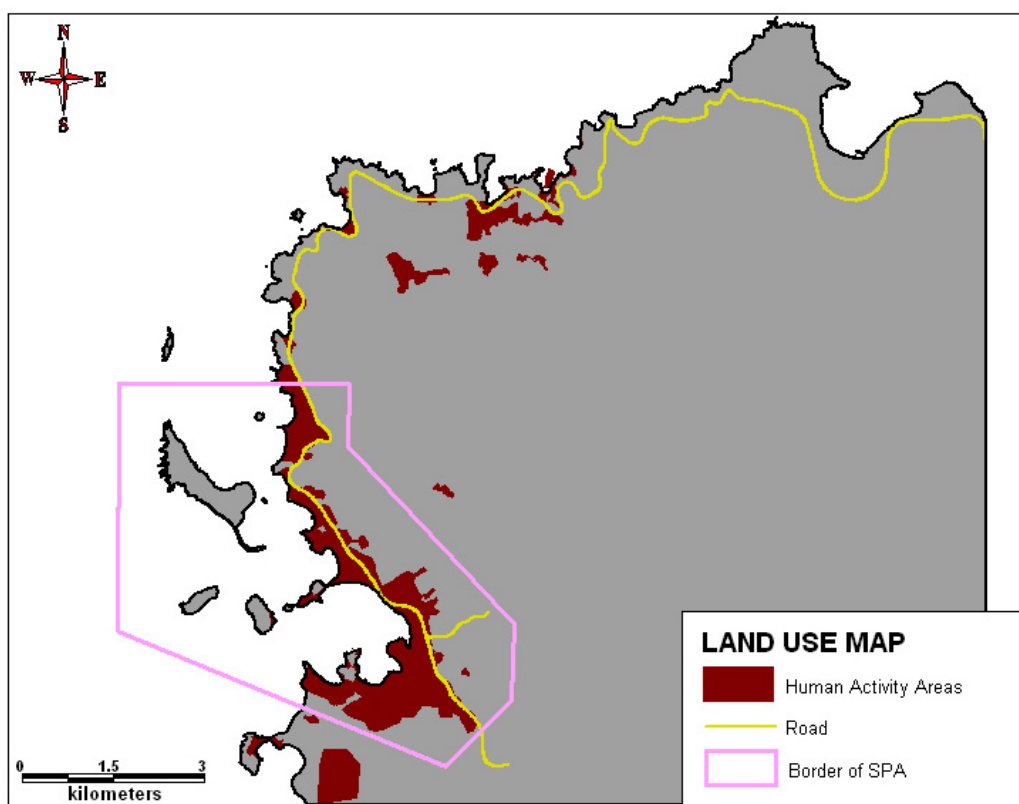


Figure 2.19 Map of land use distribution: all kinds of land-based human activities.

2.4.2.4 The Database Work: Creating the Database in the GIS Environment and Attribute Data Entry

The database component of GIS was created in MapInfo. Whenever a new layer was created in or imported to the MapInfo environment, its related table was defined. The table definition includes projection, field, data type of fields, width of data to be entered (if necessary) and indexing. Indexing speeds up the queries containing numerical and alphabetic comparisons and joins (MapInfo Professional Reference Guide, 1998). Data type definition (Table 2.3) is of high importance since it defines how and in which format a database will store the data, and affects the volume and analysis capabilities of the database. After creating the objects of a layer, the corresponding attribute data was written to the cells of the tables in predefined formats.

Another data entry method was to open Excel sheets directly in MapInfo and then to define the data types and widths while creating the .TAB files. The sighting information of the Mediterranean Monk Seal provided by SAD-AFAG was in .XLS format, thus they were imported to the GIS environment by following this procedure.

Table 2.3 Data types (adopted from MapInfo Professional Reference Guide).

DATA TYPE	DEFINITION
Character	Stores up to 254 alphanumeric characters. Arithmetic operations on numerals can not be performed in a character field. Data width must be defined.
Decimal	Stores numbers in fixed-point decimal form. The decimal point counts as one character width. Data and decimal width must be defined.
Integer	Stores integers within the range from -2 billion to +2 billion.
Small Integer	Stores integers within the range from -32,768 to +32,768.
Float	Stores numbers in floating-point decimal form.
Date	Contains a date in the format specified by the Window's Control Panel Regional Settings, Short Date format.
Logical	Stores only true/false or yes/no (existence/absence) information. T for true/yes (existence) and Y for false/no (absence).

2.4.3 Analysis

Analysis process was performed through single data-set analysis and integrated analysis of the data-sets. Single data-set analysis examines each dataset in itself and evaluates the characteristics of that data-set whereas integrated analysis examines the interrelations and interactions between the Mediterranean Monk Seal and human activities. The synergistic and antagonistic relations of human activities, together with economical considerations, are also in the scope of integrated approach.

2.4.3.1 Single Data-set Analysis

The approach examines the spatial distribution of existence regulations, *M. monachus*, fisheries, tourism, tour boat and land use activities. In order to obtain spatial patterns at a comparable scale, two modes of area usage were defined for each activity: core and buffer zones.

Core zone of a human activity is defined as the area used directly by that activity needed to continue its economical existence. It is the minimum area that an activity uses to benefit from the resources within the zone in concern. The use density and frequency of activities are considered to be maximum within these zones. Thus, the pressure caused by that activity on others in a unit time is maximum in core zones. The overlap in core zones is perceived as the conflicting area. **Core zone of *M. monachus*** is, on the other hand, defined as the area that includes the caves the species needs for nesting, breeding or sheltering. This zone is zero-tolerance disturbance area for the species. Unlike core zone, **buffer zone of a human activity** is the area used indirectly by that activity needed to continue its economical existence. It defines the maximum area range to benefit from the resources. The use density and frequency are considered to be less than core zones. Consequently, the pressure on other activities in a unit time is less than the pressure in core zones. **Buffer zone of *M. monachus*** is defined as home range of the species based on the literature information. It is the daily habitat use range of the species for feeding or other biological needs.

2.4.3.1.1 *Present Regulations.* The study area includes several protection and regulation statuses (Table 2.4 & Figures 2.12 and 2.13). SPA, Siren Rocks core zone, fisheries regulation zone and velocity limitation zone were declared mainly for the conservation of *M. monachus*. SPA has an area of 27.58 km², and covers a coastline of 34.14 km. in length. The land and marine areas within the SPA are 12.42 km² (45%) and 15.16 km² (55%), respectively. Siren Rocks core zone is within the SPA at the western coast of Orak Island, but it does not serve as a “no-entry” or “no-take” zone as it is free for artisanal fishing. Although fisheries regulation zone and vessel velocity limitation zone form buffers from the coastline (parallel to coastline), navigation regulation zone and military zone are formed by straight lines that connect the coordinates which were declared by the relevant authorities.

Another important area and resource management and protection tool is the SIT status. There are natural, archaeological and urban SIT statuses in the area. The national tendency to manage the SIT areas is subcategorizing each status (1st degree, 2nd degree, etc.) and declaring some combinations of these subcategories where needed (e.g. 1st Degree Natural & Archaeological SIT). Thus, there are 11 categories of SIT in the area. 1st Degree of any status bans (new) construction within the area; for this reason they may be treated as core zones of protected areas. An important point is that, the archipelago is protected under 1st Degree Natural SIT status.

The regulation zones mentioned above have different managerial issues. The aim for analyzing the present regulations was to profile the existing management tools: the interactions across these regulations and *M. monachus* or human activities are out of the scope of the thesis.

Table 2.4 Present protection and regulation statuses in Foça.

PROTECTION OR REGULATION STATUS	GEOGRAPHICAL INFORMATION	GENERAL INFORMATION
Specially Protected Area (SPA)	Total Area = 27.58 km ² Land Area = 12.42 km ² Marine Area = 15.16 km ² Length of Coastline = 34.14 km.	Declared in 1990. Authority: Environmental Protection Agency for Special Areas (the Ministry of Environment and Forestry) No hunting and marine farm, city planning.
Core Zone (Siren Rocks)	Area = 0.2201 km ²	Declared in 1998. Authority: İzmir Provincial Decree No-entry zone except for artisanal fishermen.
Navigation Regulation Zone	Coordinates as declared by SHODB in “Denizcilere Haftalık İlanlar No: 6, Paragraph no 30/01 & 32/01”.	Declared in 2001. Authority: Under-secretariat of Maritime Affairs Bans the navigation of cargo vessels greater than 300 GRT, and all vessels carrying dangerous substances (SHODB, 2001).
Fisheries Regulation Zone	2 nm. from the island, 1.5 nm. from the mainland coastline.	Declared in 1992. Authority: the Ministry of Agriculture and Rural Affairs No industrial fishing (only for artisanal fishermen)
Velocity Limitation Zone	0.5 nm. from the coastline in SPA	Forbidden to exceed 10 nm/h. Bans all sports and recreational activities performed with high-speed vehicles.
Military Zone	-	-
SIT areas	Total Area = 13.3118 km ²	In effect since mid of 1970s. Authority: the Ministry of Culture and Tourism
1 st Degree Natural SIT	Area = 8.3760 km ²	Any of the 1 st Degree SIT status bans construction within the area.
2 nd Degree Natural SIT	Area = 2.6270 km ²	
3 rd Degree Natural SIT	Area = 0.4327 km ²	2 nd Degree Natural SIT status allows only tourism facilities.
1 st Degree Archaeological SIT	Area = 0.4292 km ²	
3 rd Degree Archaeological SIT	Area = 0.6121 km ²	
Urban SIT	Area = 0.0265 km ²	
1 st Degree Natural & Archaeological SIT	Area = 0.5087 km ²	
1 st Degree Natural & 3 rd Degree Archaeological SIT	Area = 0.0179 km ²	
3 rd Degree Natural & Archaeological SIT	Area = 0.0024 km ²	
Urban & Archaeological SIT	Area = 0.1709 km ²	
Urban & 3 rd Degree Archaeological SIT	Area = 0.1084 km ²	

2.4.3.1.2 The Mediterranean Monk Seal. The locations of seal caves are defined as the activity core zones for the species (Figure 2.14). There are four core zones by definition: mainland core zone (Figure 2.20), Hayırsız Island (Figure 2.21), Orak Island (Figure 2.22) and İncir Island (Figure 2.23). The common characteristic of these core zones is that they include rocky formations which restrict human activities. The reason for defining these land areas as core zones is that the species is dependent on land for nesting and breeding. Activity core zone of the species covers a total area of 1.779 km² and a total coastline of 21.707 km. in length (Table 2.5).

Table 2.5 Core zones of *M. monachus*.

	Area (km ²)	Coastline Length (km)
Mainland Core Zone	0.699	4.999
Hayırsız Island	0.038	1.875
Orak Island	0.871	12.620
İncir Island	0.171	2.213
Total	1.779	21.707

The buffer zone of the species is obtained by buffering the caves with a radius of 20 km. As individual movements can be irregular and unpredictable within a range of roughly 40 km. (IUCN, 1988), an individual may go away 20 km. from its cave in one-day period. Depending on this assumption, **daily habitat use range** of the species is defined as the buffer zone of the seal activity. The buffer zone covers an area of about 1,097 km² and a coastline of about 180 km. from Aliğa to Karaburun and Uzunada (Figure 2.24). All the marine component of the study area is considered as buffer zone by this definition. Daily habitat use range is also in evidence by the sighting data of the species: some Foça seals have been sighted at the coasts of Karaburun and some Karaburun seals have been sighted at Foça coasts. Although the core and buffer zones form the activity area of the species (Figure 2.25), some samples for the IUCN terms **extent of occurrence** (Figures 2.26 & 2.27) and **area of occupancy** (Figure 2.28) are also mapped to support the area usage approach: extent of occurrence covers a continuous area and if the Karaburun sightings of Foça seals were taken into consideration, it would be a convex polygon covering an area to the Karaburun coasts.

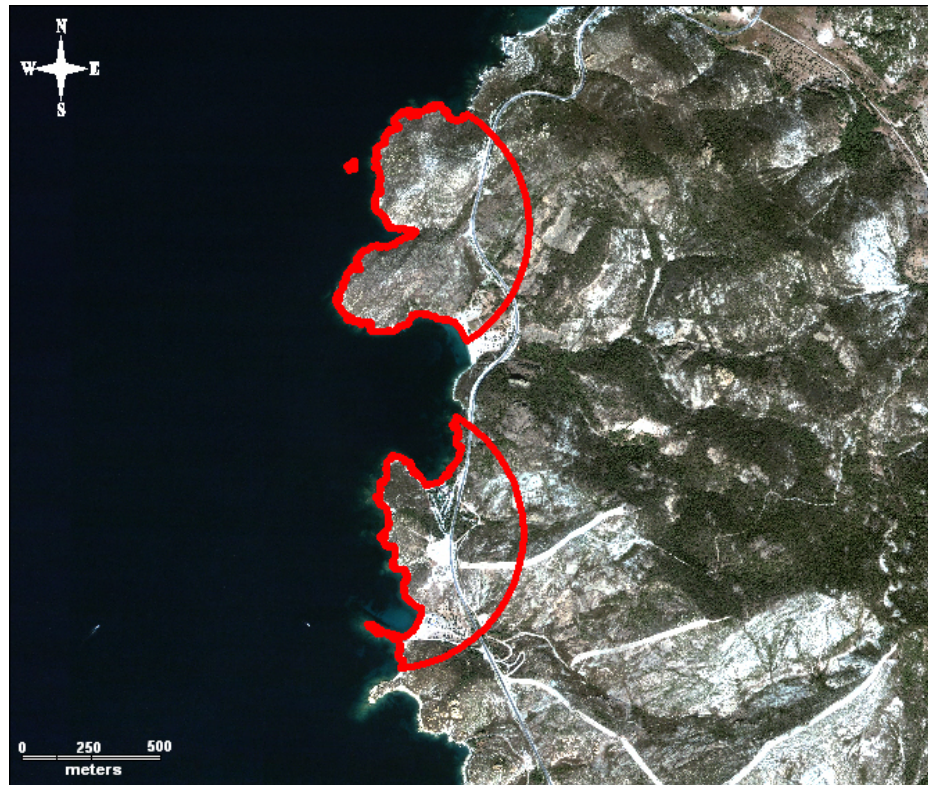


Figure 2.20 Map of mainland core zone.

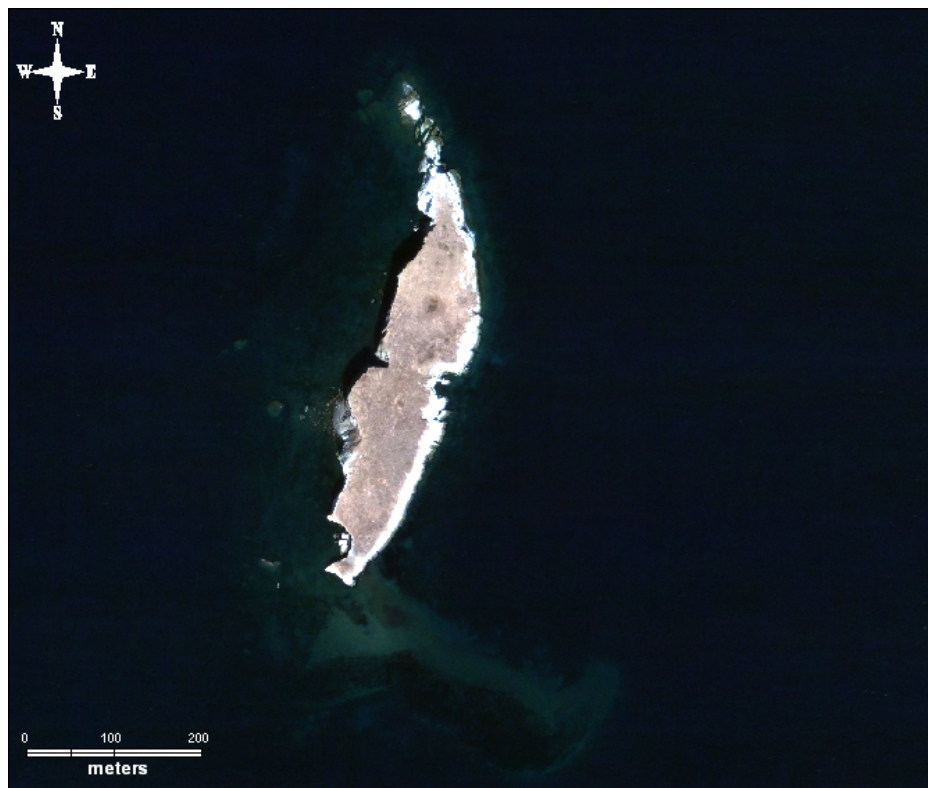


Figure 2.21 Map of Hayırsız Island core zone.



Figure 2.22 Map of Orak Island core zone.



Figure 2.23 Map of İncir Island core zone.

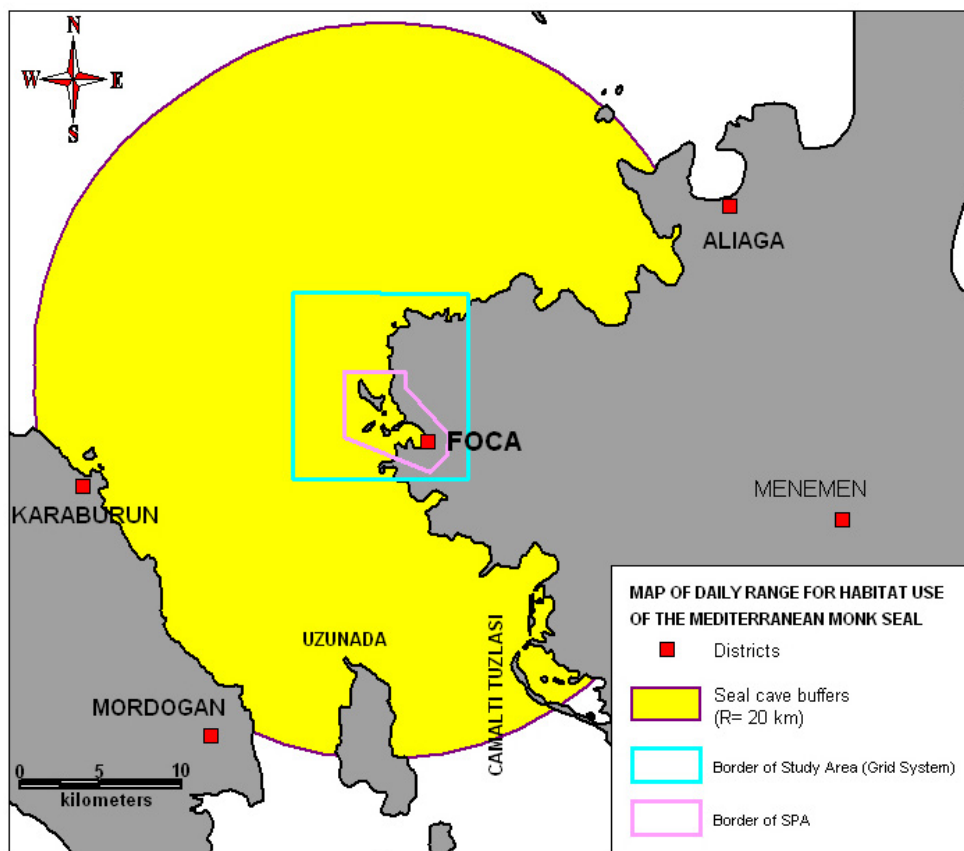


Figure 2.24 Map of daily habitat use range of *M. monachus*.

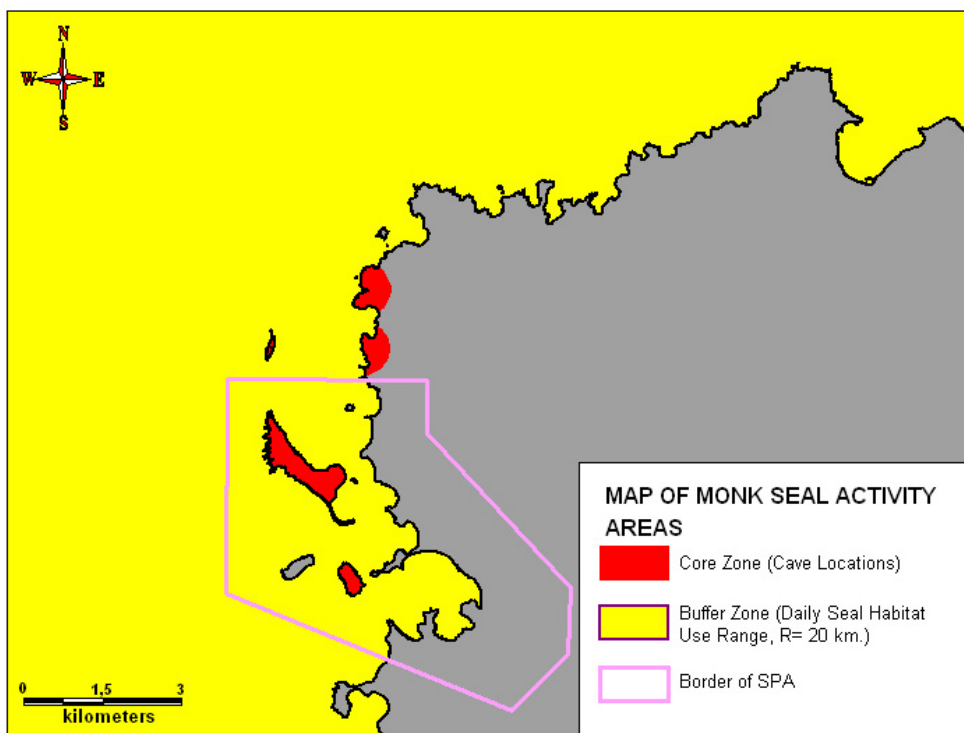


Figure 2.25 Map of *M. monachus* activity areas.

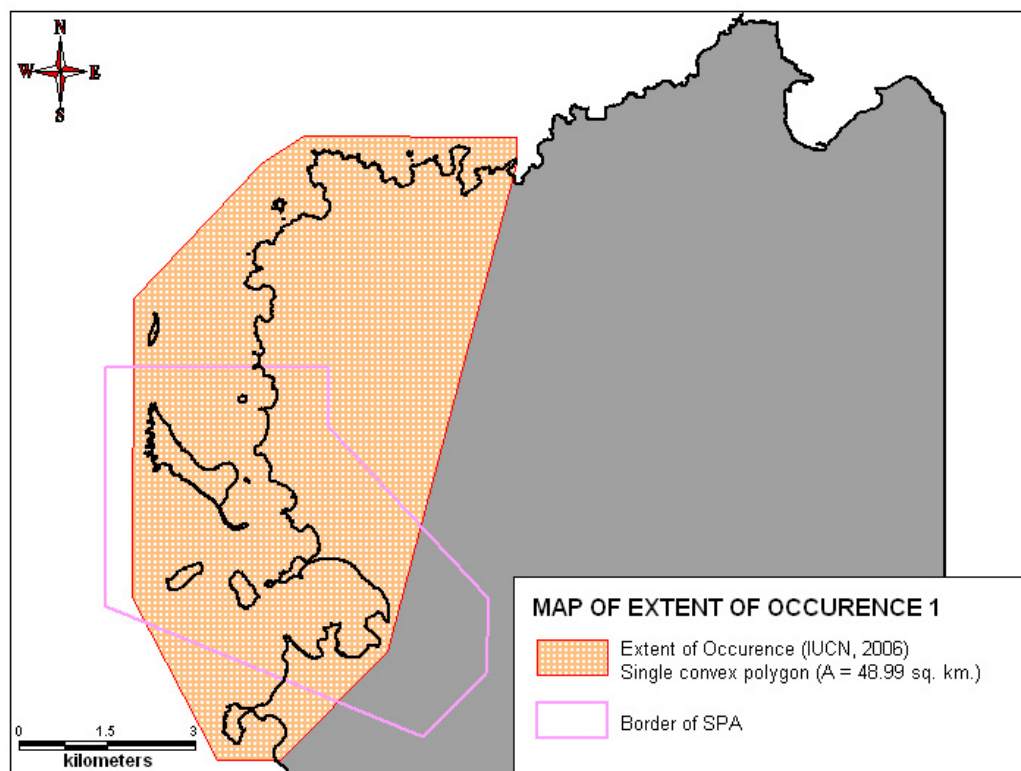


Figure 2.26 Map of extent of occurrence according to IUCN definition.

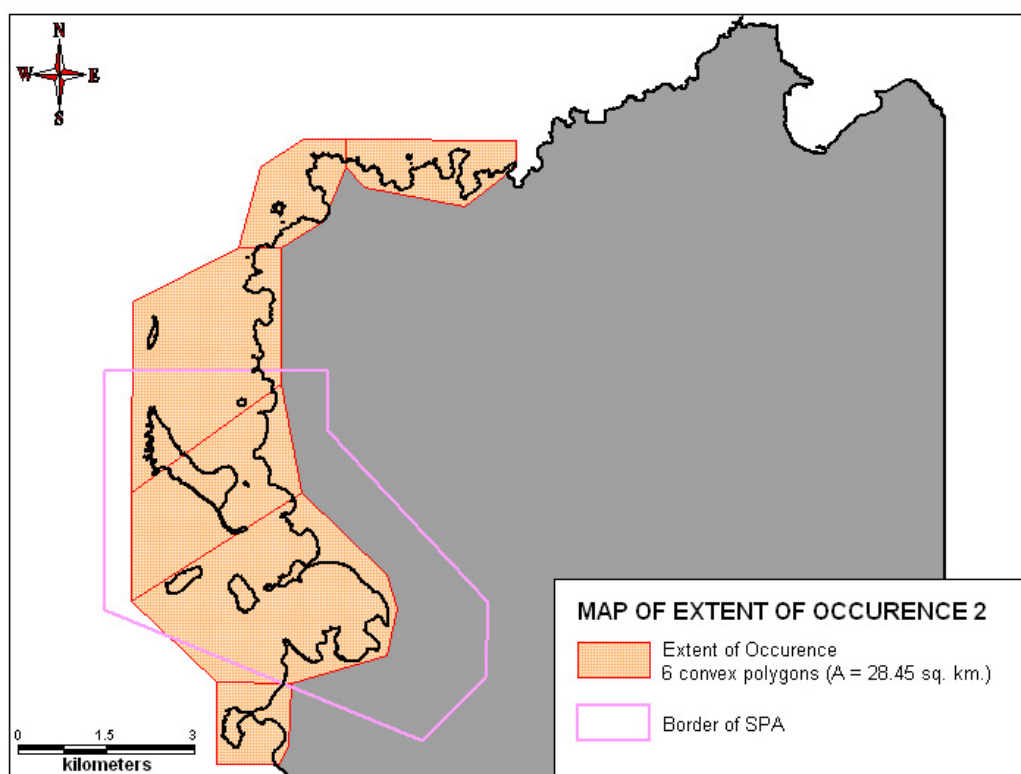


Figure 2.27 Map of extent of occurrence: modified IUCN definition.

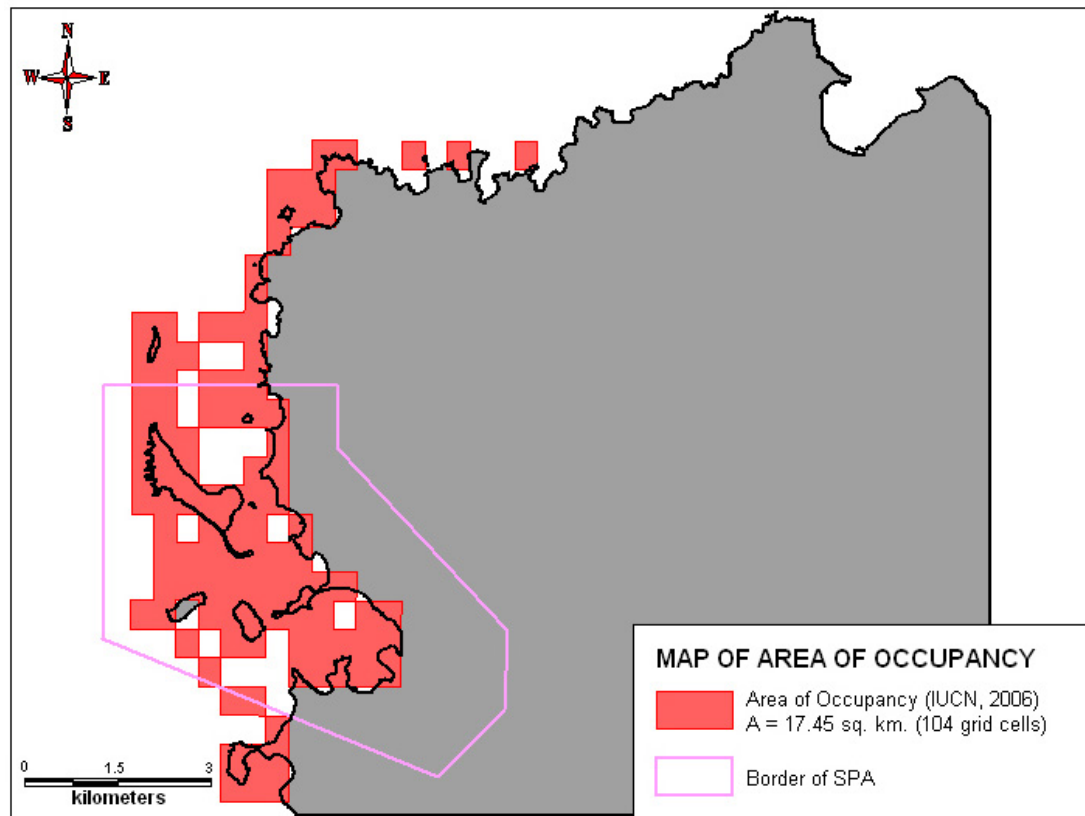


Figure 2.28 Map of area of occupancy according to IUCN definition.

2.4.3.1.3 Fisheries. Three types of core zone are defined for fishery activity: marine farm, fishing areas and land mooring sites. Marine farm was digitized from the satellite image and buffered 200 m. to define the core zone since it is restricted to close to marine farms by this range by laws (Figure 2.29). Fishing areas is obtained by buffering fishing points in Figure 2.16 by a radius of 450 m. The radius was calculated as the half of the length of the nets used by artisanal fishermen (net length = $3 \times 300 = 900$ m.). Land mooring sites was obtained by buffering mooring points by a radius of 50 m. which was considered to be the area of effect for mooring fishing vessels. On the other hand, the buffer zone of fisheries activity was obtained by buffering the routes in Figure 2.16 by a radius of 50 m. which was considered to be the range of effect for vessel cruising. The so-defined core and buffer zones form activity areas of fisheries (Figure 2.30).

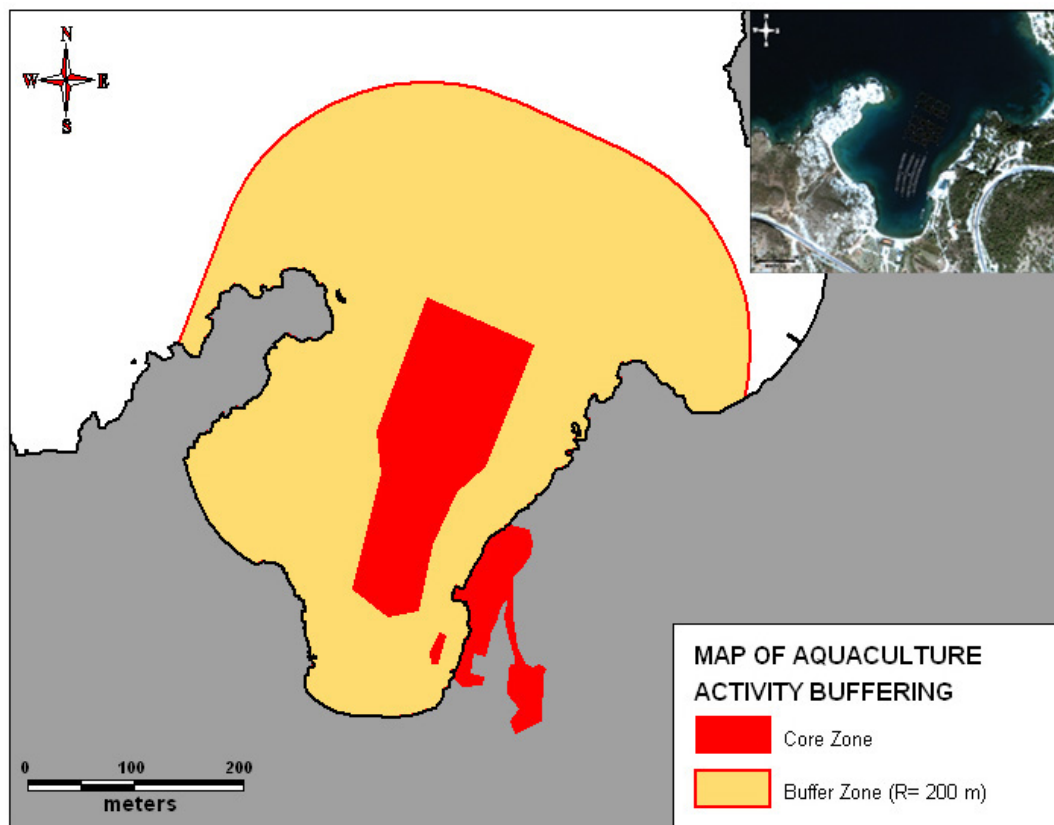


Figure 2.29 Map of marine farm activity areas.

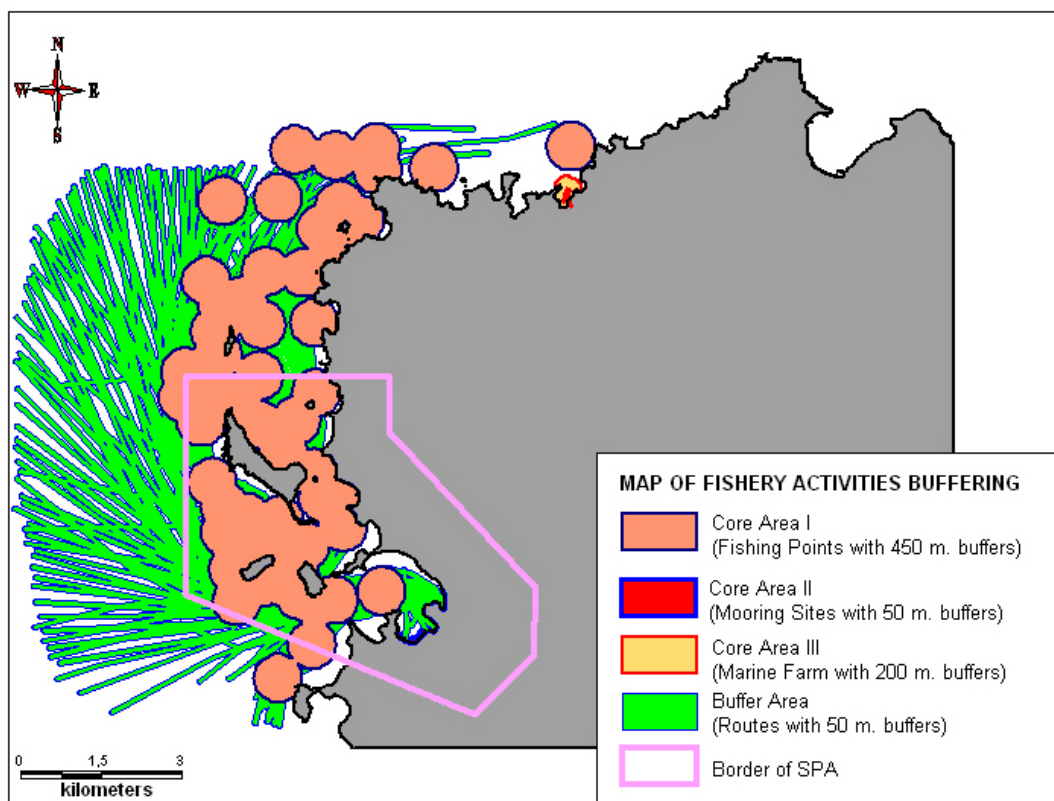


Figure 2.30 Map of fisheries activity areas.

2.4.3.1.4 Tourism Activities. The core zone of the tourism activity is defined as the area covered by tourism facilities demonstrated in Figure 2.17. It includes the lodging facilities (hotels, pensions, etc.), camping sites, restaurants, cafes and bars that contribute an income to the sector. Two buffer zones are defined for tourism: buffer area I and buffer area II. The former is the buffer of tourism facilities and the latter is the buffer of the natural and historical touristic sites mapped in Figure 2.17 except for the Siren Rocks. The buffer calculations were performed on the *mobility* assumption. **Mobility** is defined as the move range of a person for an activity. The buffer obtained by mobility gives the probable area used (or needed) by an activity. The mobility for tourism facilities is assumed to be greater than 500 m. It is proportional to the capacity in unit area and calculated by Formula 1:

$$r_i = (1 + Cap_i / A_i) \times 500 \quad (1)$$

where r_i is the buffer radius, Cap_i is the capacity and A_i is the area of each facility. On the other hand, the mobility for touristic sites is assumed to be 1000 m. because when their locations are considered, a person needs to move a greater distance even though he lodges at the centre of the district.

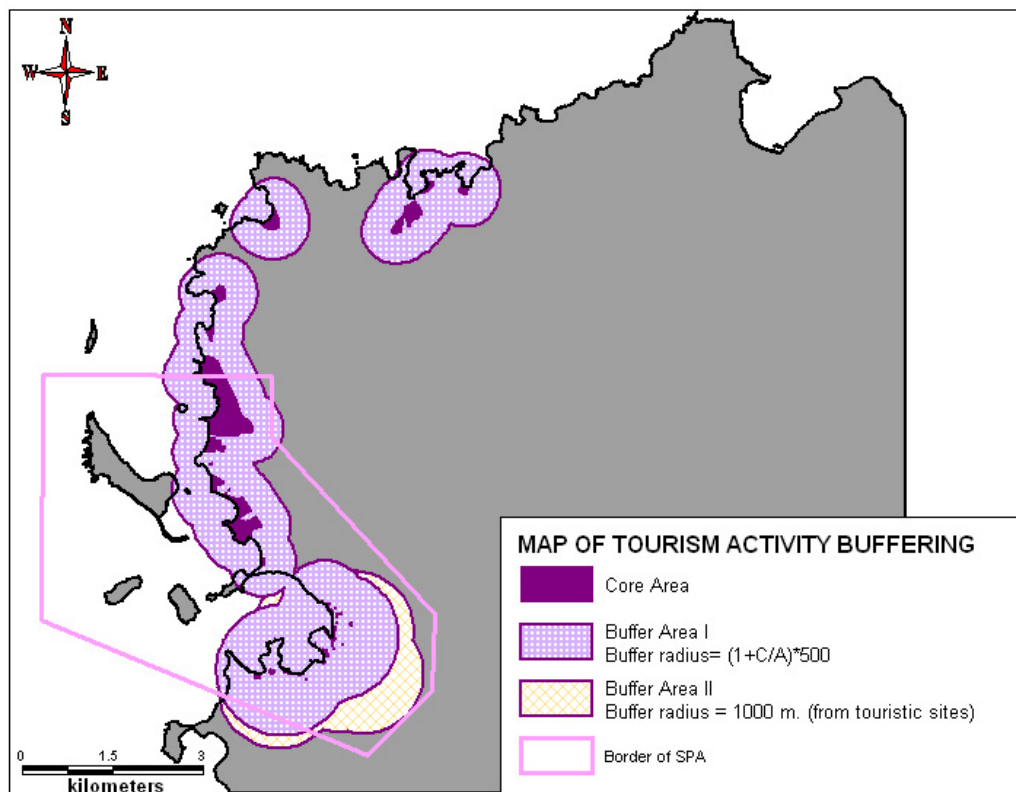


Figure 2.31 Map of tourism activity areas.

2.4.3.1.5 Tour Boat Activities. Tour boat core and buffer activity areas are obtained by buffering the mooring sites and the route of tour boats mapped in Figure 2.18. 7 mooring sites are buffered by a distance of 250 m. to obtain the core zone of the activity, and the route is buffered by a radius of 100 m. to obtain the buffer zone of the activity (Figure 2.32).

2.4.3.1.6 Land Use Activities. Land use map includes all human activities such as urbanization, beach usage, road, infrastructure, agriculture, angling from the coast, etc. It coincides in some areas with the activities mentioned in the previous sections. This is logical as fisheries, tourism and tour boat activities need or result in some other human activities. Core zone for land use is the area mapped in Figure 2.19, and the buffer zone is defined as the 1000 m. of buffer around the core zone (Figure 2.33). The radius of the buffer zone is taken as the half of daily mobility of a person which is assumed to be 2000 m. per day.

The geographical information about core and buffer zones of the activities are given in Table 2.6.

Table 2.6 Geographical coverage of activity core and buffer zones.

Activity	Core Zone Radius (m)	Core Area (km²)	Buffer Zone Radius (m)	Buffer Area (km²)
Monk Seal	-	1.778	20,000	78.59
Fisheries	Marine farm: 200 Fishing point: 450 Mooring site: 50	Total: 23.84	Route: 50	44.72
Tourism	-	1.01	Facilities: $(1+C/A)*500$ Sites: 1,000	Total: 19.071
Tour Boat	250	1.371	Route: 100	4.221
Land Use	-	5.671	1,000	52.14

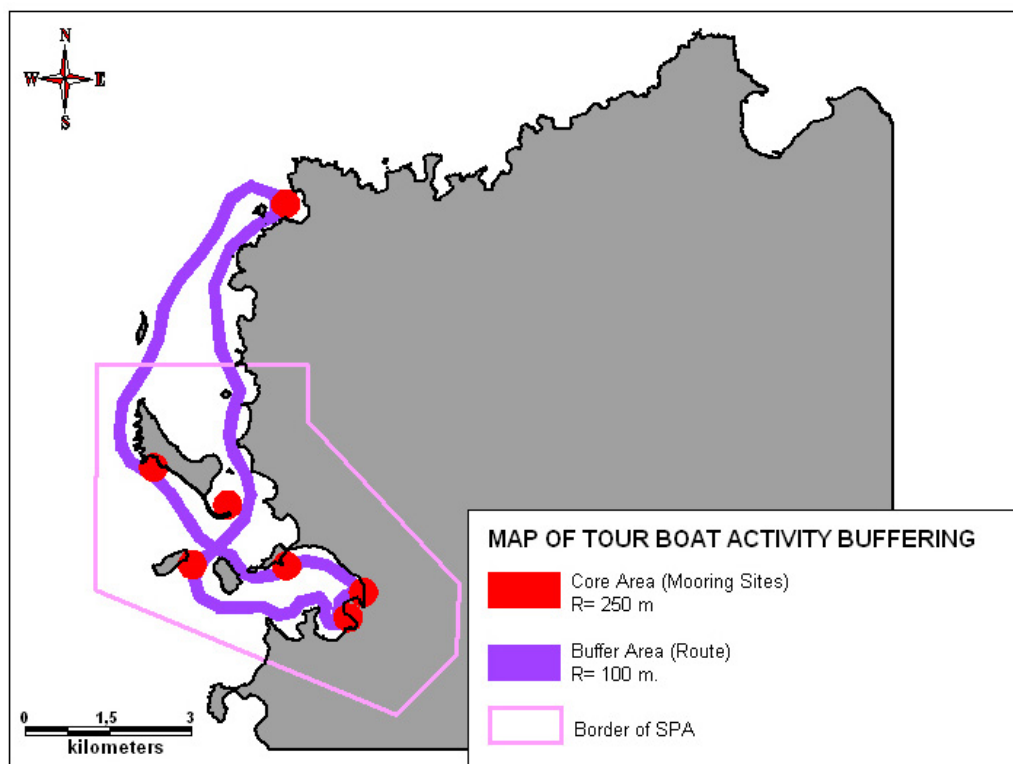


Figure 2.32 Map of tour boat activity areas.

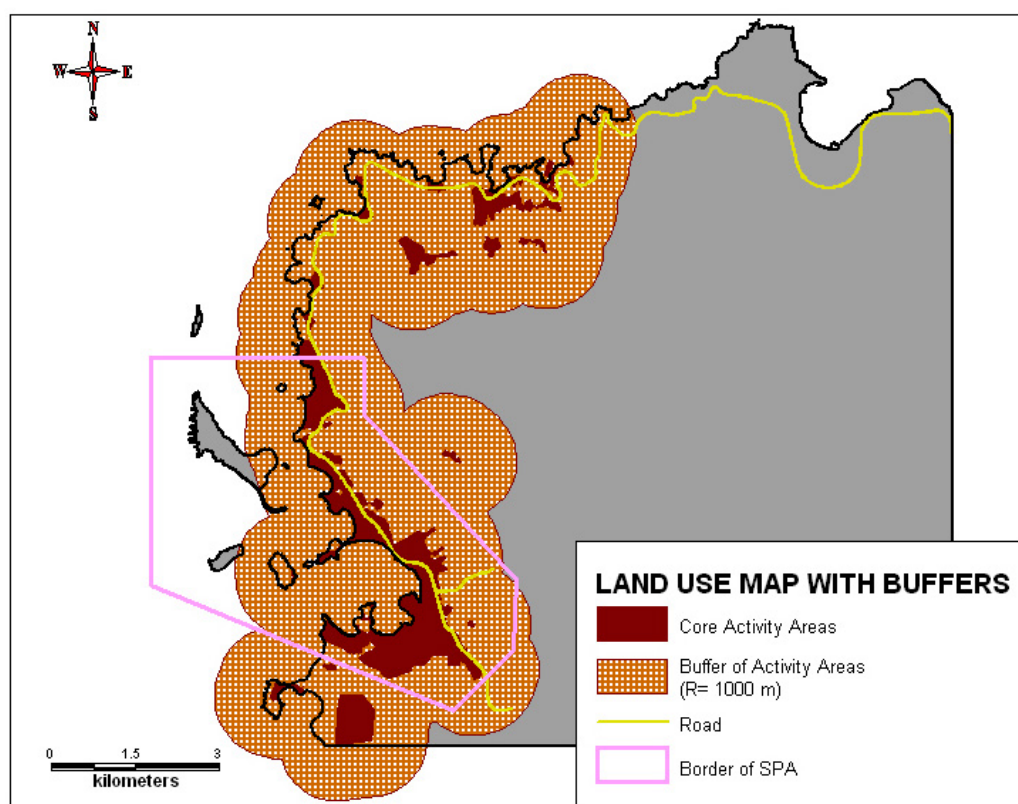


Figure 2.33 Map of land use activity areas.

2.4.3.2 Integrated Analysis

Integrated analysis focuses on four issues: interactions between activities, defining zonal dependencies of each activity by grid factor, zonal diversity of human activities and zonal economics of the fisheries, tourism and tour boat activities.

The interaction of *M. monachus* with human activities and the interactions between each human activity are determined by calculating all possible core and buffer zone intersections. Five activities (*M. monachus*, fisheries, tourism, tour boat and land use) form 10 pairs of interaction and there are four possible interaction types for each pair of activity in consideration: core 1 to core 2, core 1 to buffer 2, buffer 1 to core 2 and buffer 1 to buffer 2. The core and buffer zone layers for each pair are overlaid and the intersection areas are calculated by overlay analysis (Table 2.7). Then, zonal dependency is determined for each activity type by grid factor (Section 2.4.3.2.11). Finally, diversity of human activities for each grid (Section 2.4.3.2.12) and yearly grid cell incomes for fisheries, tourism and tour boats (Section 2.4.3.2.13) are determined in order to view the holistic status of human activities and their zonal and economical dependencies.

2.4.3.2.1 Interaction of Fisheries with *M. monachus*. Fisheries and *M. monachus* activity areas coincide for two situations: fisheries core zone - *M. monachus* buffer zone (Figure 2.34) and fisheries buffer zone - *M. monachus* buffer zone (Figure 2.35). The intersection area for the first situation is 23.84 km² (all the core zone of fisheries activity) and 44.72 km² for the second one (all the buffer zone of fisheries activity). Thus, the core and buffer zones of fisheries are the subsets of *M. monachus* buffer zone as it covers all the marine area within the grid system. The core to core and fisheries buffer to *M. monachus* core intersections are empty set. The reason is that the core zone of *M. monachus* is land areas by definition.

2.4.3.2.2 Interaction of Tourism with *M. monachus*. Tourism and *M. monachus* activity areas coincide except for the tourism core to *M. monachus* buffer zones. The core to core and buffer to buffer intersections are 0.01715 and 5.845 km²,

respectively (Figure 2.36). Tourism buffer zone coincides with *M. monachus* core zone at an area of 0.5889 km² (Figure 2.37).

2.4.3.2.3 Interaction of Tour Boat Activity with M. monachus. Tour boat activity coincides with *M. monachus* at three zonal statuses: core to core with an area of 0.0489 km², buffer to buffer with an area 4.221 km² (Figure 2.38) and tour boat core to *M. monachus* buffer with an area of 1.089 km² (Figure 2.39). Tour boat buffer activity does not intersect with *M. monachus* core zone.

2.4.3.2.4 Interaction of Land Use Activities with M. monachus. The intersection of land use and *M. monachus* core and buffer zones cover an area of 0.1162 and 18.67 km², respectively (Figure 2.40). Buffer zone of land use coincides with monk seal core zone for 0.9857 km² (Figure 2.41). There is no intersection for land use core to monk seal buffer interaction type.

2.4.3.2.5 Interaction of Fisheries with Tourism. The activities only coincide at the fisheries core to tourism buffer (Figure 2.42) and buffer to buffer pairs (Figure 2.43). The area coverage of the former is 3.312 km² and the latter is 2.682 km².

2.4.3.2.6 Interaction of Fisheries with Tour Boat Activity. The activities coincide at all of the four interaction types. The intersection areas are 0.7606 km² for core to core pair (Figure 2.44), 3.299 km² for fisheries core to tour boat buffer pair (Figure 2.45), 0.6448 km² for fisheries buffer to tour boat core pair (Figure 2.46) and 3.813 km² for buffer to buffer pair (Figure 2.47).

2.4.3.2.7 Interaction of Fisheries with Land Use Activities. The core to core and buffer to buffer interaction types coincide at 0.0281 and 9.949 km² of coverage (Figure 2.48). Fisheries core zone overlaps land use buffer zone with an area of 11.50 km² (Figure 2.49).

2.4.3.2.8 Interaction of Tour Boat Activity with Tourism. The core to core and buffer to buffer intersections are 0.0081 and 1.377 km², respectively (Figure 2.50).

0.677 km² of tour boat core zone is within the tourism buffer zone (Figure 2.51). Tour boat buffer and tourism core zones do not intersect.

2.4.3.2.9 Interaction of Tour Boat Activity with Land Use Activities. The intersection areas are 0.2041 and 3.03 km² for core to core and buffer to buffer interaction types respectively (Figure 2.52). Although tour boat core zone covers an area of 1.166 km² within the buffer zone of land use (Figure 2.53), land use core zone does not intersect with tour boat buffer zone.

2.4.3.2.10 Interaction of Tourism with Land Use Activities. The core to core and buffer to buffer intersections of the activities are 0.9802 and 15.28 km², respectively (Figure 2.54). Land use core zone occupies an area of 3.79 km² within the buffer zone of tourism (Figure 2.55), but tourism core zone does not within the buffer zone of land use.

Table 2.7 Zonal interactions of activities (MS: monk seal, F: fisheries, T: tourism, TB: tour boat, LU: land use, A1: area of 1st activity of interaction type, A2: area of 2nd activity of interaction type, IA: area of intersection, UA: area of union, IA/A1: percent of IA within A1, IA/A2: percent of IA within A2, IA/UA: percent of IA within UA).

Interaction type	A1 (km ²)	A2 (km ²)	IA (km ²)	UA (km ²)	IA/A1 (%)	IA/A2 (%)	IA/UA (%)
F core-MS core	23.84	1.78	0.00	25.62	0.00	0.00	0.00
F core-MS buffer	23.84	78.59	23.84	78.59	100.00	30.33	30.33
F buffer-MS core	44.72	1.78	0.00	46.50	0.00	0.00	0.00
F buffer-MS buffer	44.72	78.59	44.72	78.59	100.00	56.90	56.90
T core-MS core	1.01	1.78	0.07	2.72	7.08	4.02	2.63
T core-MS buffer	1.01	78.59	0.00	79.60	0.00	0.00	0.00
T buffer-MS core	19.07	1.78	0.59	20.26	3.09	33.12	2.91
T buffer-MS buffer	19.07	78.59	5.85	91.82	30.65	7.44	6.37
TB core-MS core	1.37	1.78	0.05	3.10	3.57	2.75	1.58
TB core-MS buffer	1.37	78.59	1.09	78.87	79.43	1.39	1.38
TB buffer-MS core	4.22	1.78	0.00	6.00	0.00	0.00	0.00
TB buffer-MS buffer	4.22	78.59	4.22	78.59	100.00	5.37	5.37
LU core-MS core	5.67	1.78	0.12	7.33	2.05	6.54	1.58
LU core-MS buffer	5.67	78.59	0.00	84.26	0.00	0.00	0.00
LU buffer-MS core	52.14	1.78	0.99	52.93	1.89	55.44	1.86
LU buffer-MS buffer	52.14	78.59	18.67	112.06	35.81	23.76	16.66
F core-T core	23.84	1.01	0.00	24.85	0.00	0.00	0.00
F core-T buffer	23.84	19.07	3.31	39.60	13.89	17.37	8.36
F buffer-T core	44.72	1.01	0.00	45.73	0.00	0.00	0.00
F buffer-T buffer	44.72	19.07	2.68	61.11	6.00	14.06	4.39
F core-TB core	23.84	1.37	0.76	24.45	3.19	55.48	3.11
F core-TB buffer	23.84	4.22	3.30	24.76	13.84	78.16	13.32
F buffer-TB core	44.72	1.37	0.64	45.45	1.44	47.03	1.42
F buffer-TB buffer	44.72	4.22	3.81	45.13	8.53	90.33	8.45
F core-LU core	23.84	5.67	0.03	29.48	0.12	0.50	0.10
F core-LU buffer	23.84	52.14	11.50	64.48	48.24	22.06	17.83
F buffer-LU core	44.72	5.67	0.00	50.39	0.00	0.00	0.00
F buffer-LU buffer	44.72	52.14	9.95	86.91	22.25	19.08	11.45
TB core-T core	1.37	1.01	0.01	2.37	0.59	0.80	0.34
TB core-T buffer	1.37	19.07	0.68	19.77	49.38	3.55	3.43
TB buffer-T core	4.22	1.01	0.00	5.23	0.00	0.00	0.00
TB buffer-T buffer	4.22	19.07	1.38	21.92	32.62	7.22	6.28
LU core-TB core	5.67	1.37	0.20	6.84	3.60	14.89	2.98
LU core-TB buffer	5.67	4.22	0.00	9.89	0.00	0.00	0.00
LU buffer-TB core	52.14	1.37	1.17	52.35	2.24	85.05	2.23
LU buffer-TB buffer	52.14	4.22	3.03	53.33	5.81	71.78	5.68
LU core-T core	5.67	1.01	0.98	5.70	17.28	97.05	17.19
LU core-T buffer	5.67	19.07	3.79	20.95	66.83	19.87	18.09
LU buffer-T core	52.14	1.01	0.00	53.15	0.00	0.00	0.00
LU buffer-T buffer	52.14	19.07	15.28	55.93	29.31	80.12	27.32

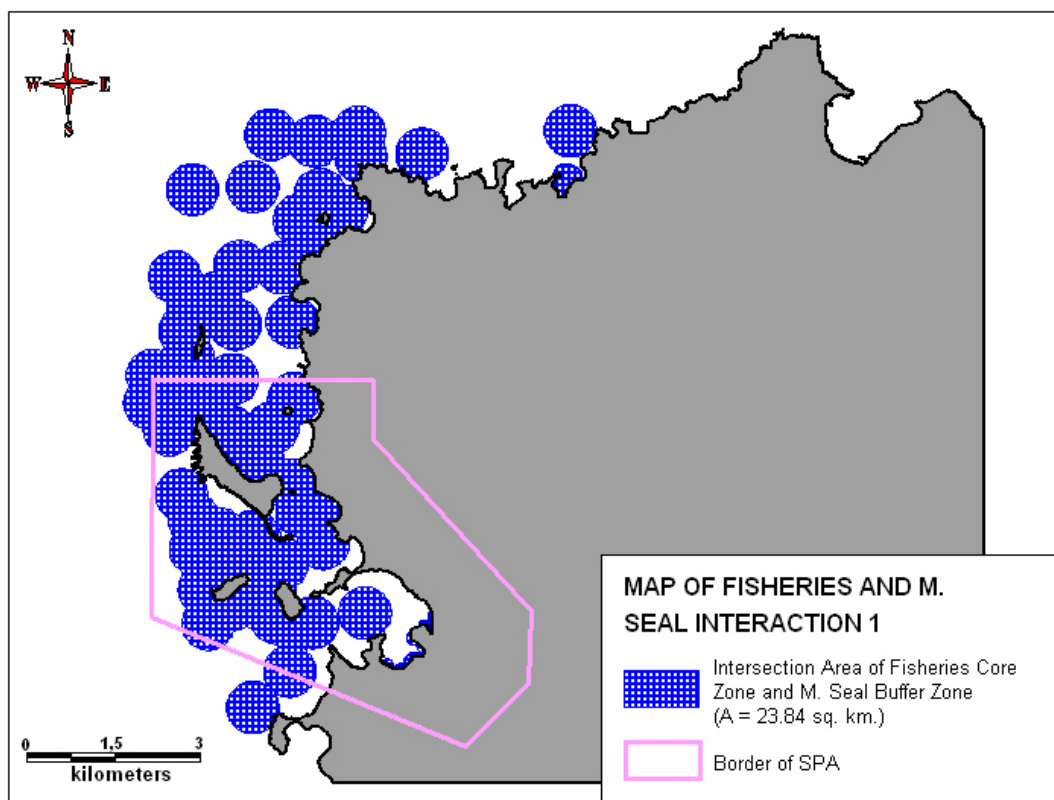


Figure 2.34 Map of fisheries and *M. monachus* intersection 1.

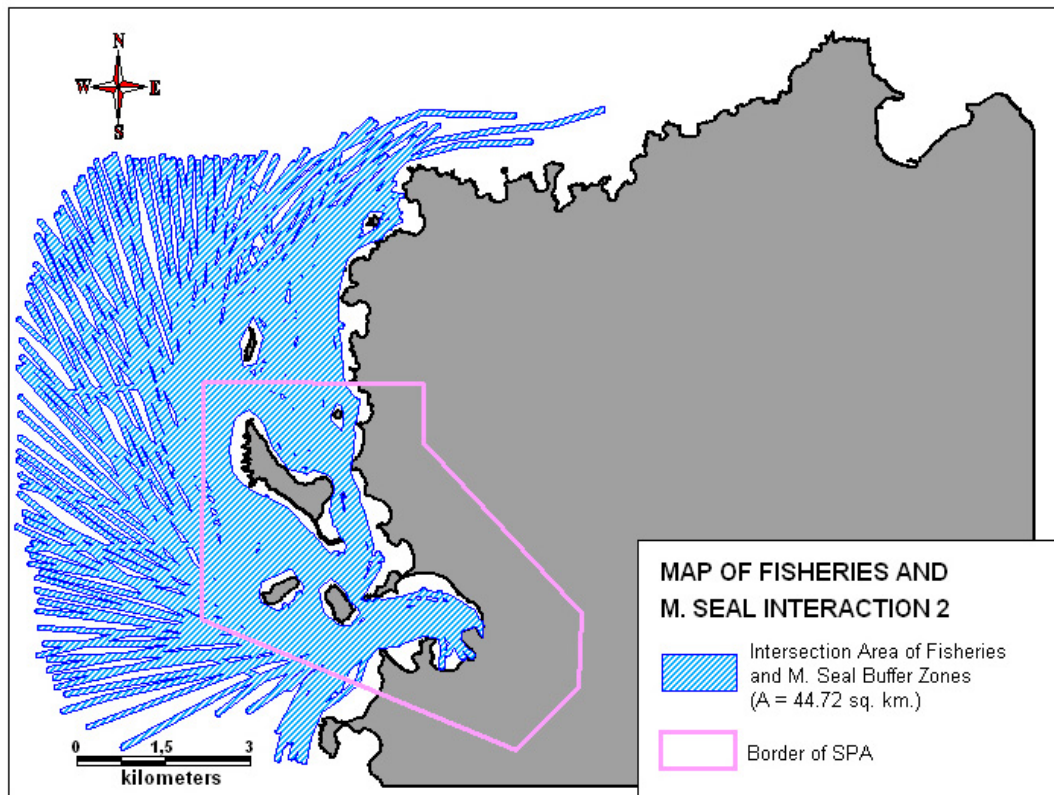


Figure 2.35 Map of fisheries and *M. monachus* intersection 2.

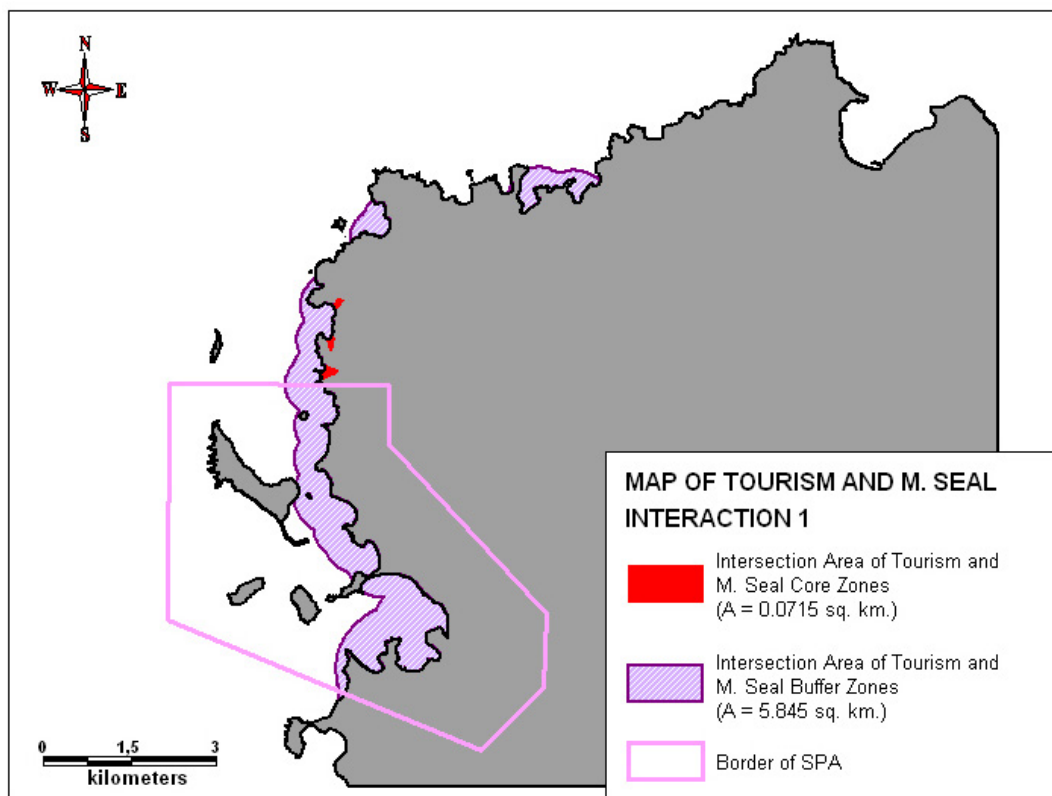


Figure 2.36 Map of tourism and *M. monachus* intersection 1.

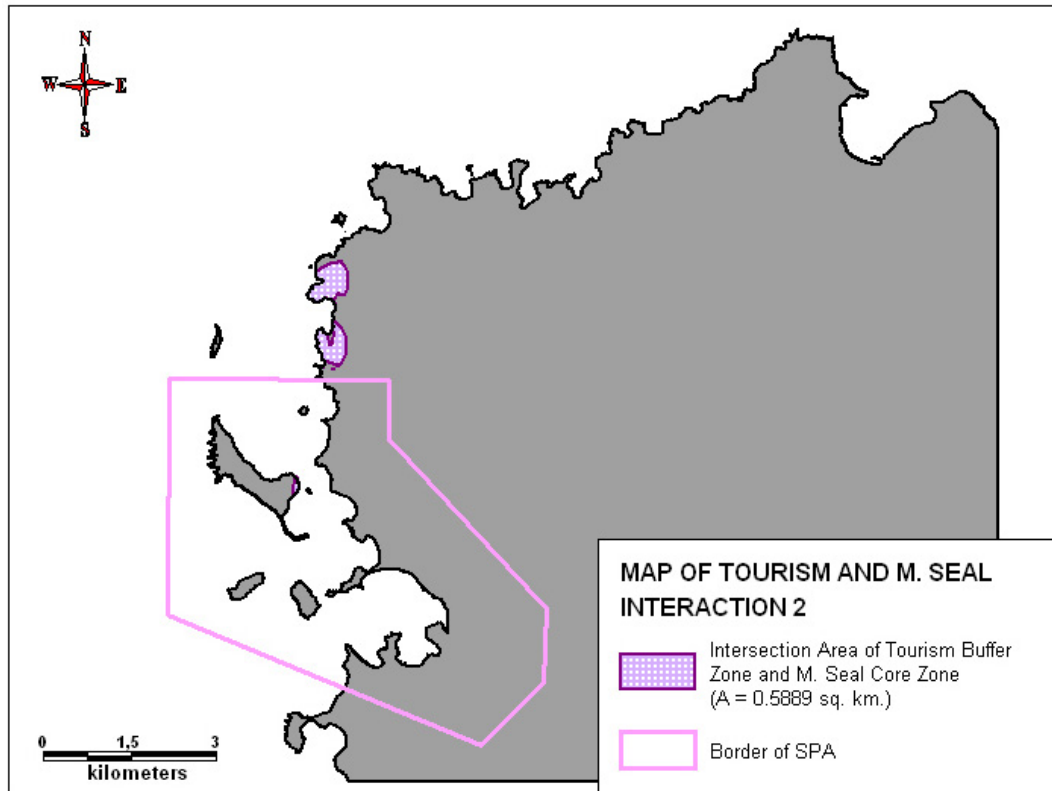


Figure 2.37 Map of tourism and *M. monachus* intersection 2.

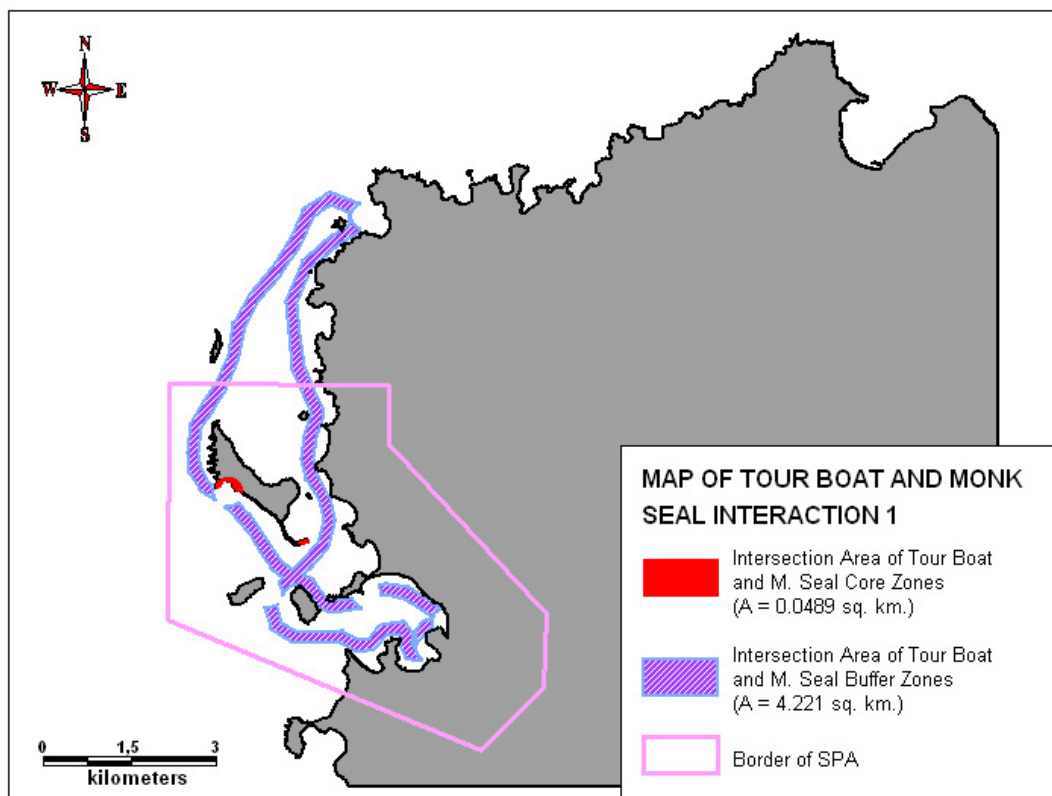


Figure 2.38 Map of tour boat and *M. monachus* intersection 1.

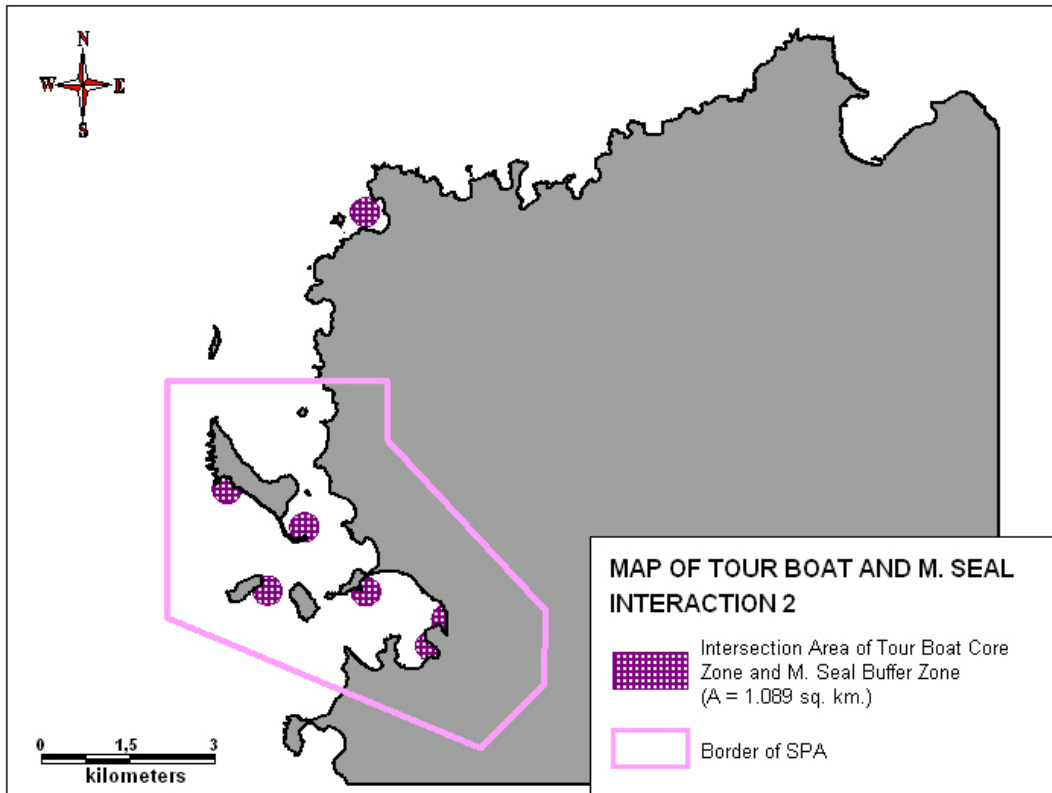


Figure 2.39 Map of tour boat and *M. monachus* intersection 2.

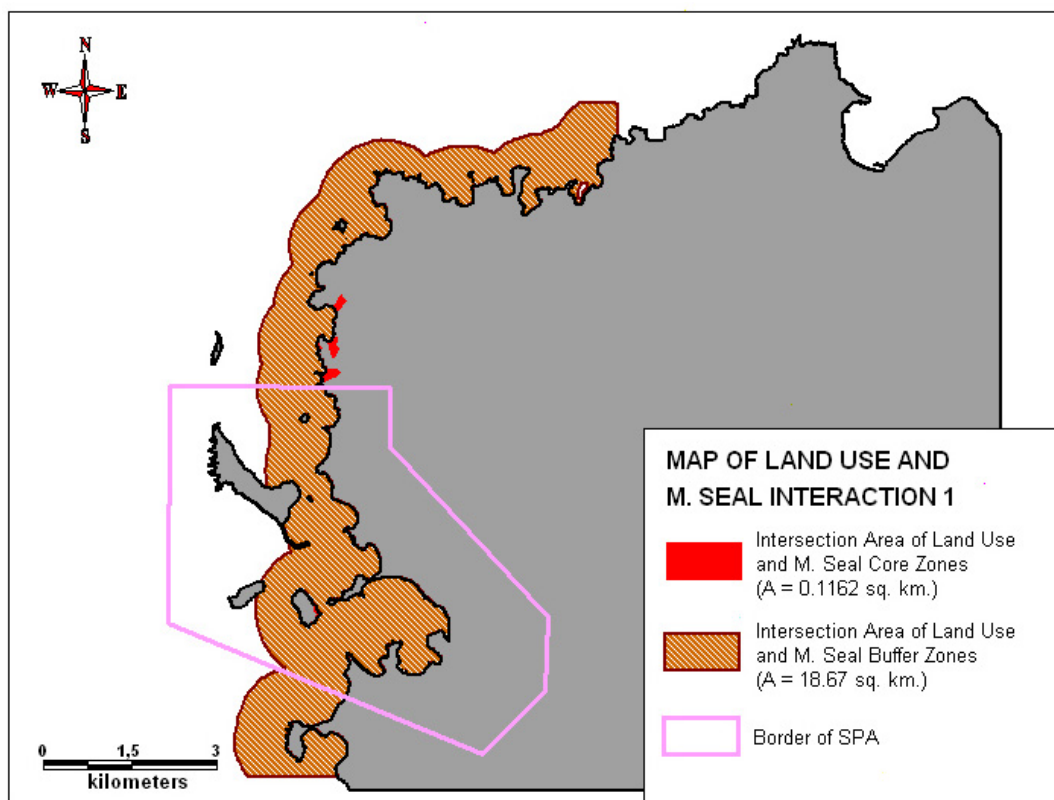


Figure 2.40 Map of land use and *M. monachus* intersection 1.

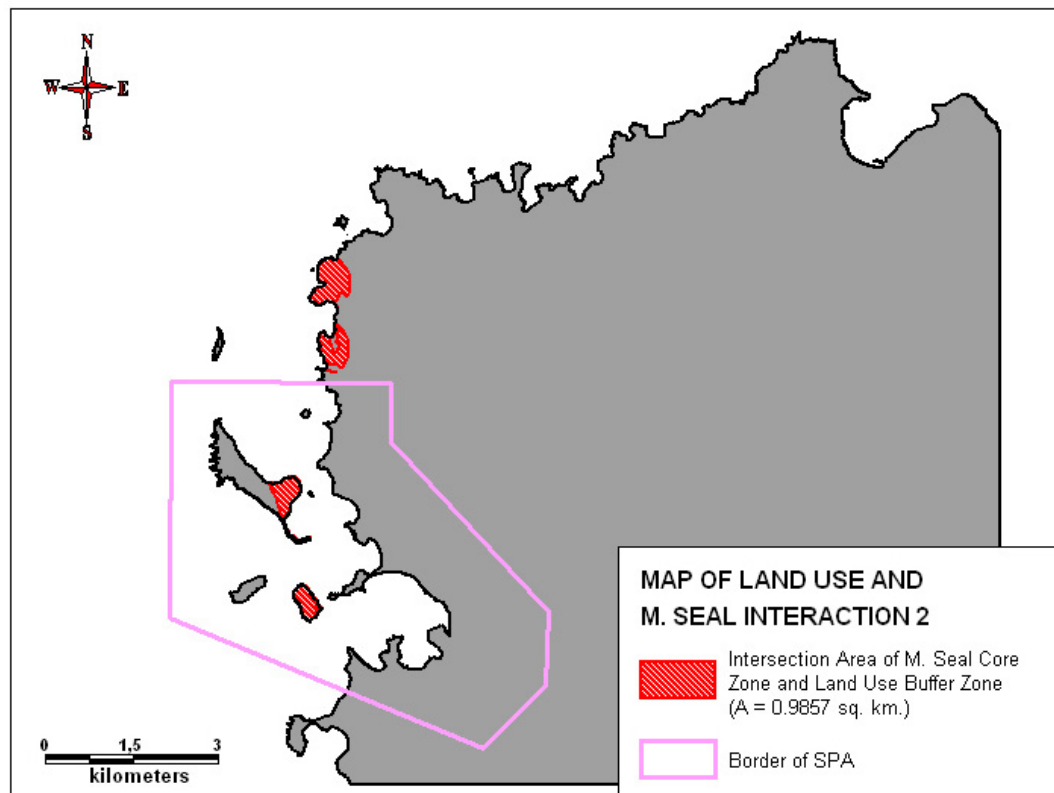


Figure 2.41 Map of land use and *M. monachus* intersection 2.

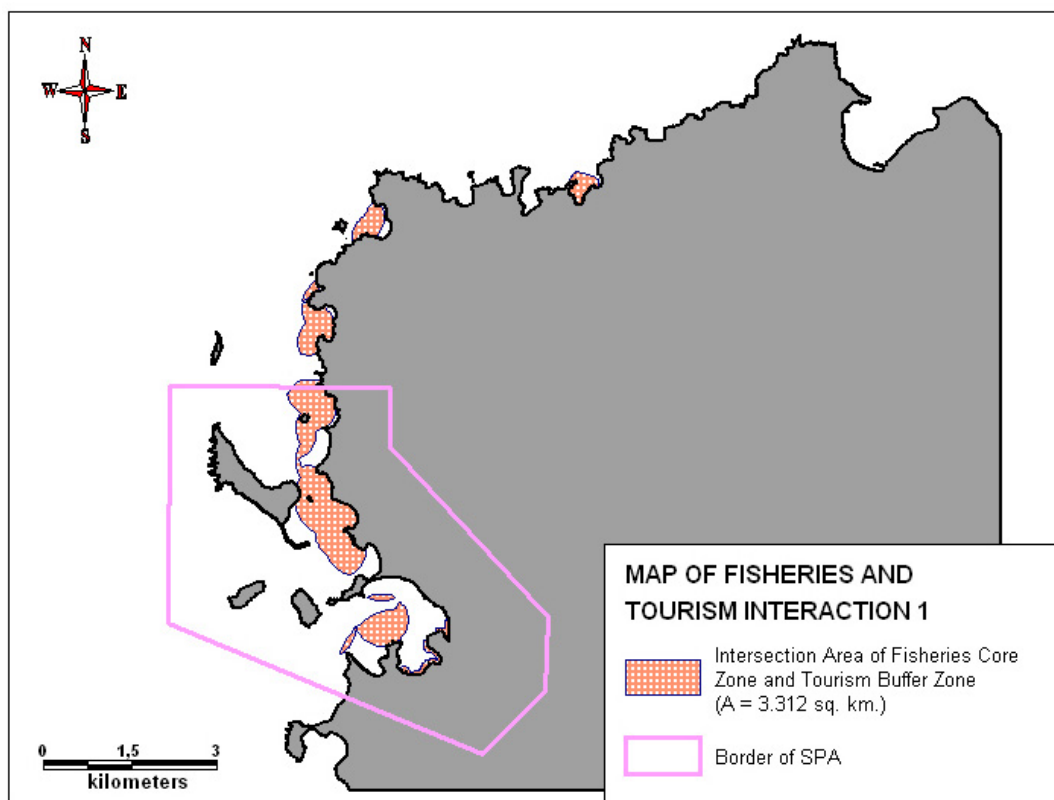


Figure 2.42 Map of fisheries and tourism intersection 1.

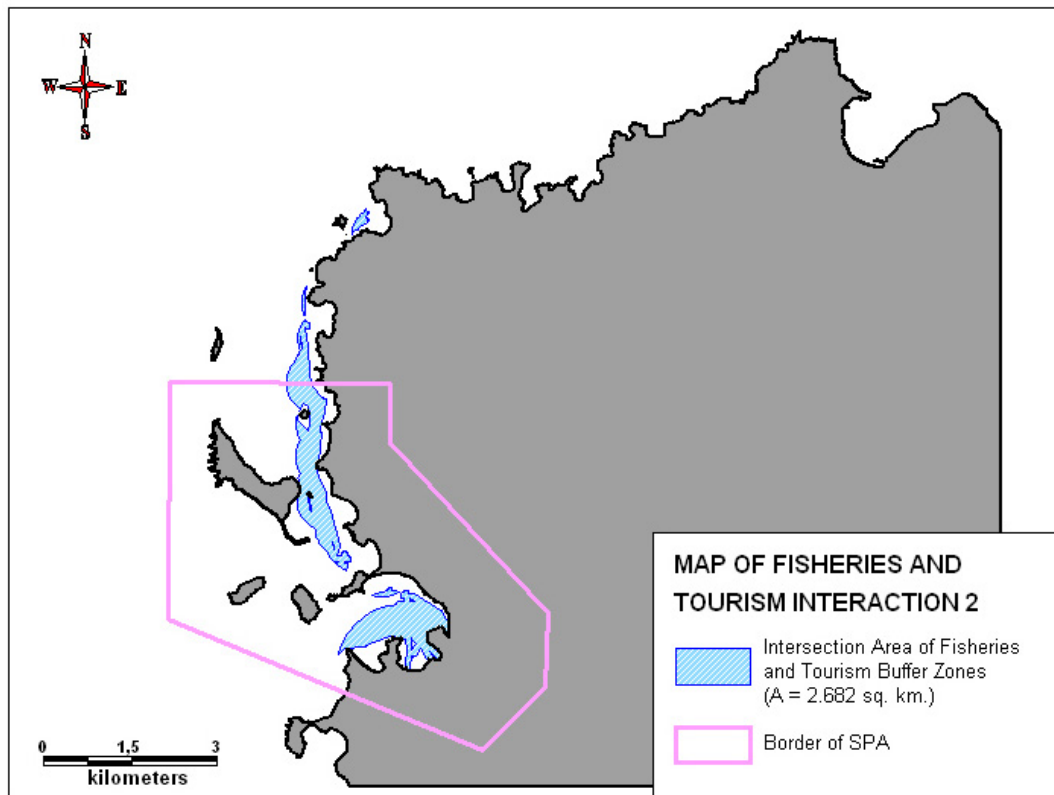


Figure 2.43 Map of fisheries and tourism intersection 2.

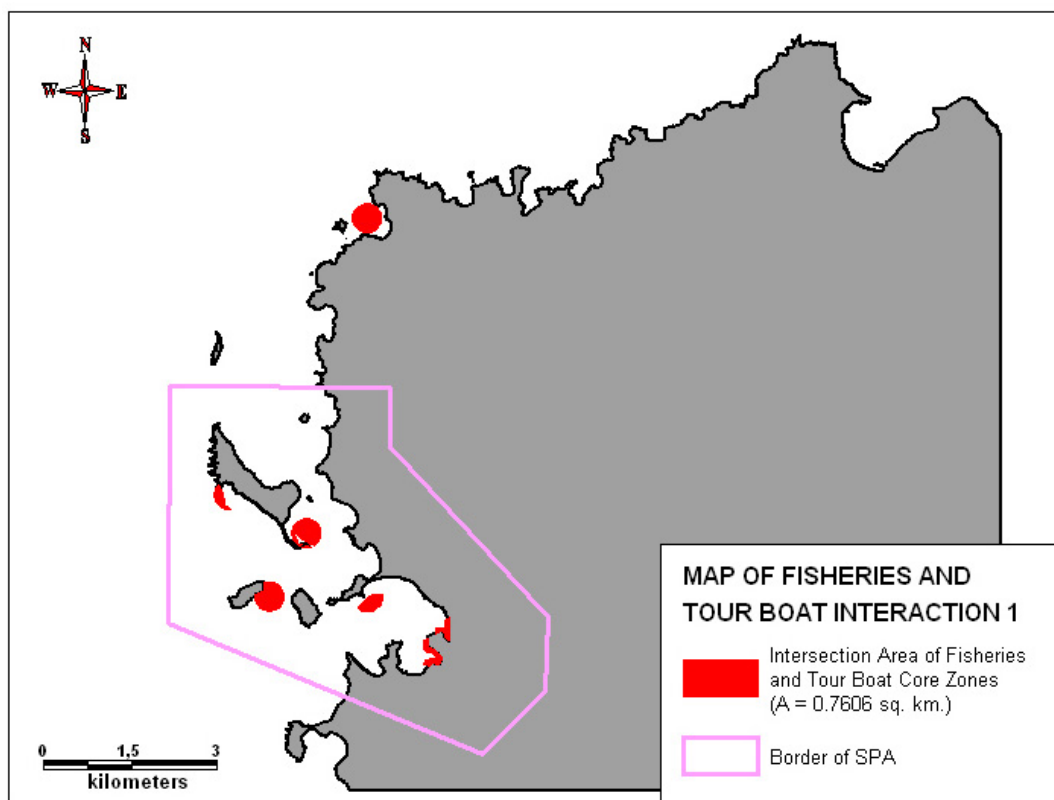


Figure 2.44 Map of fisheries and tour boat intersection 1.

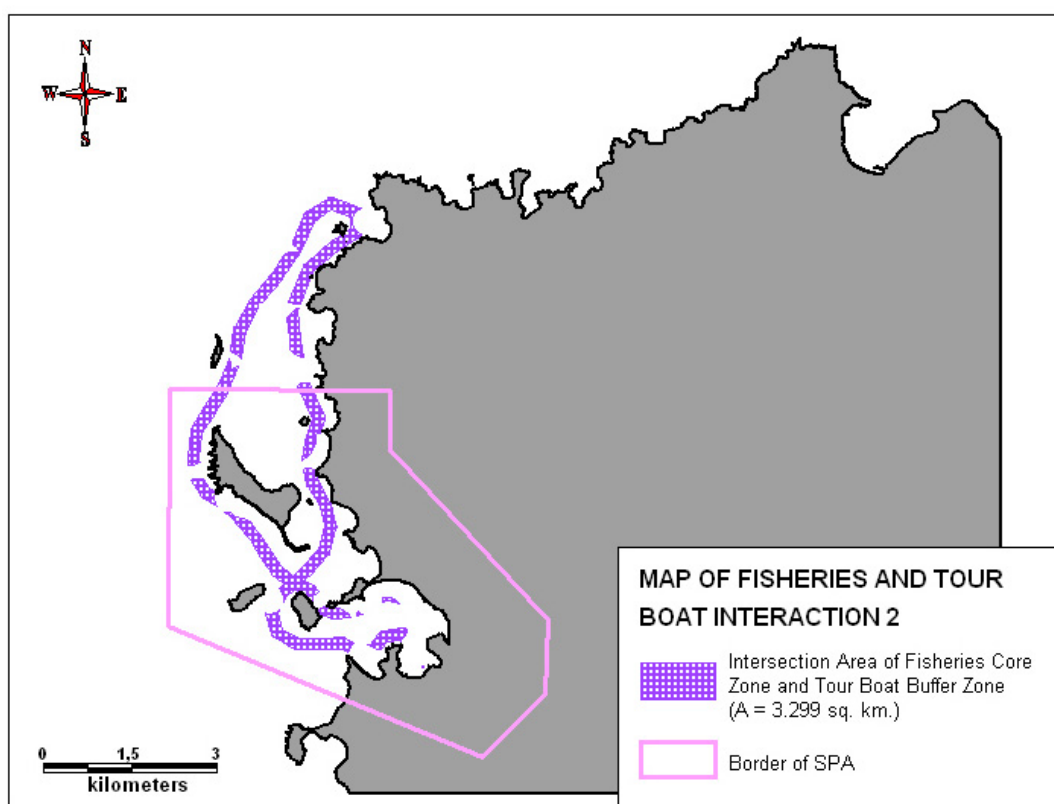


Figure 2.45 Map of fisheries and tour boat intersection 2.

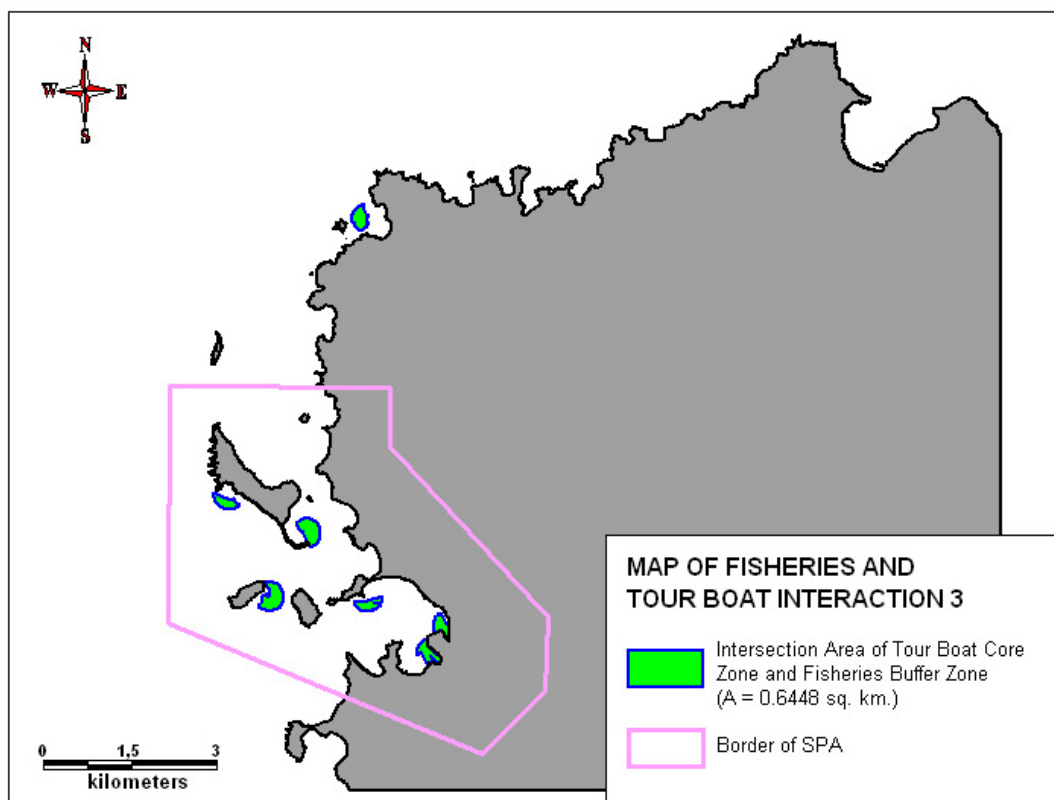


Figure 2.46 Map of fisheries and tour boat interaction 3.

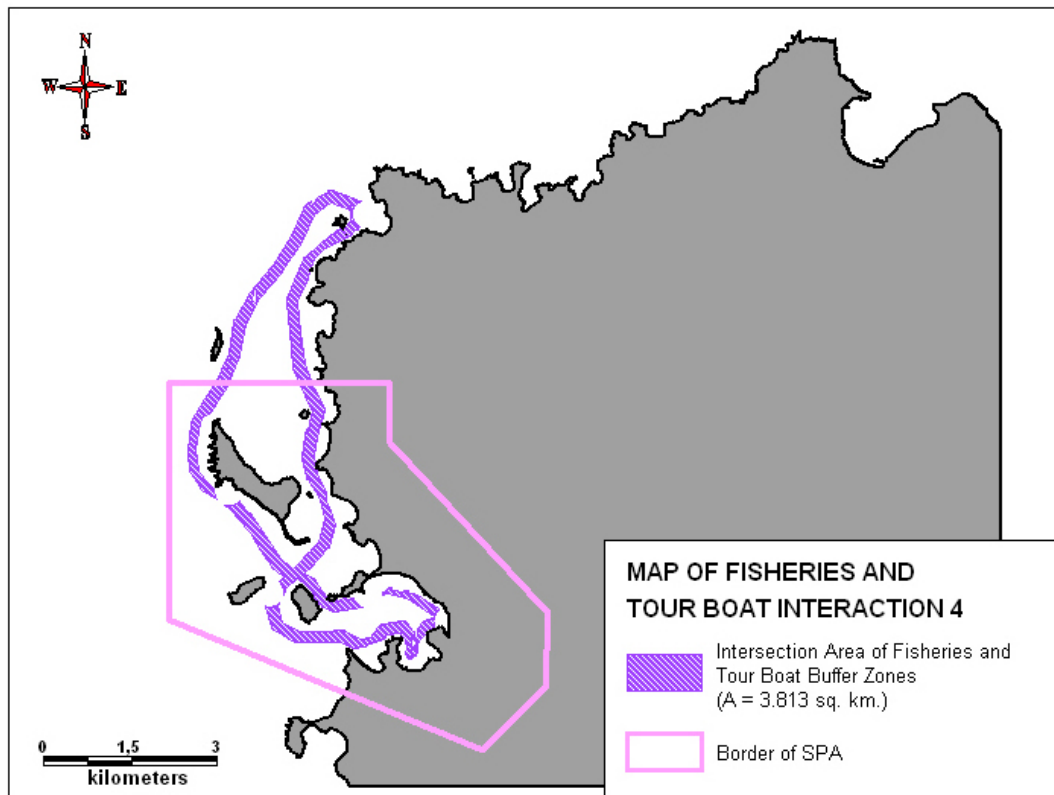


Figure 2.47 Map of fisheries and tour boat interaction 4.

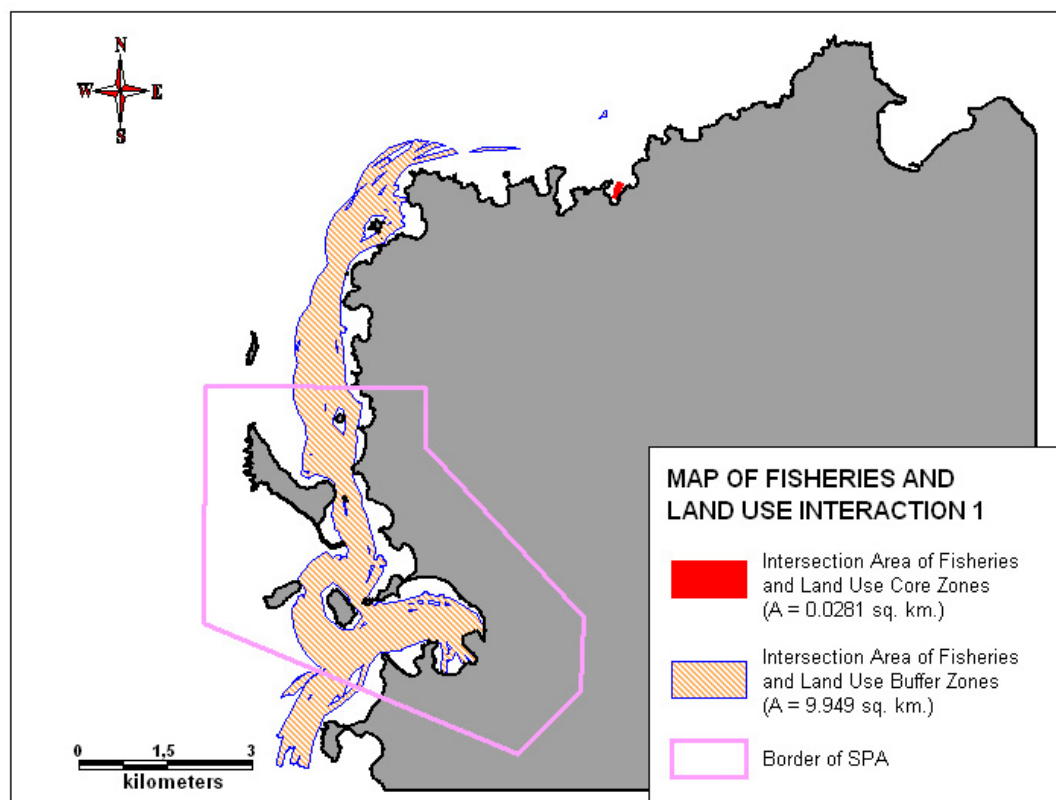


Figure 2.48 Map of fisheries and land use intersection 1.

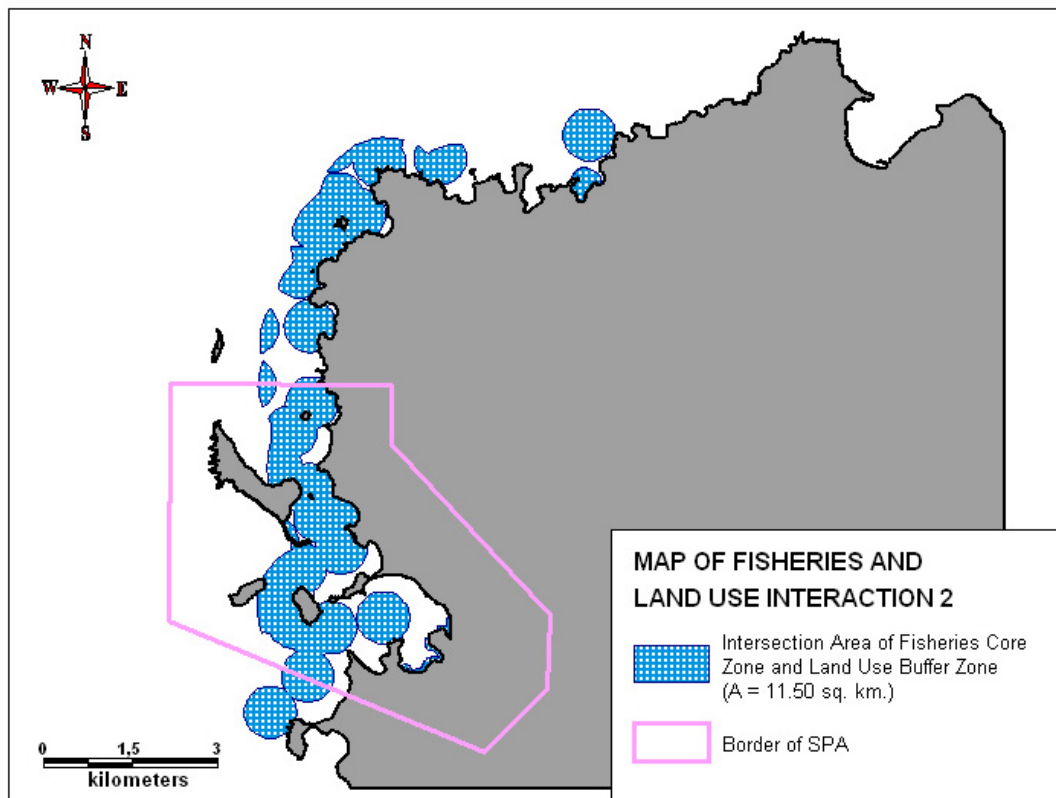


Figure 2.49 Map of fisheries and land use intersection 2.

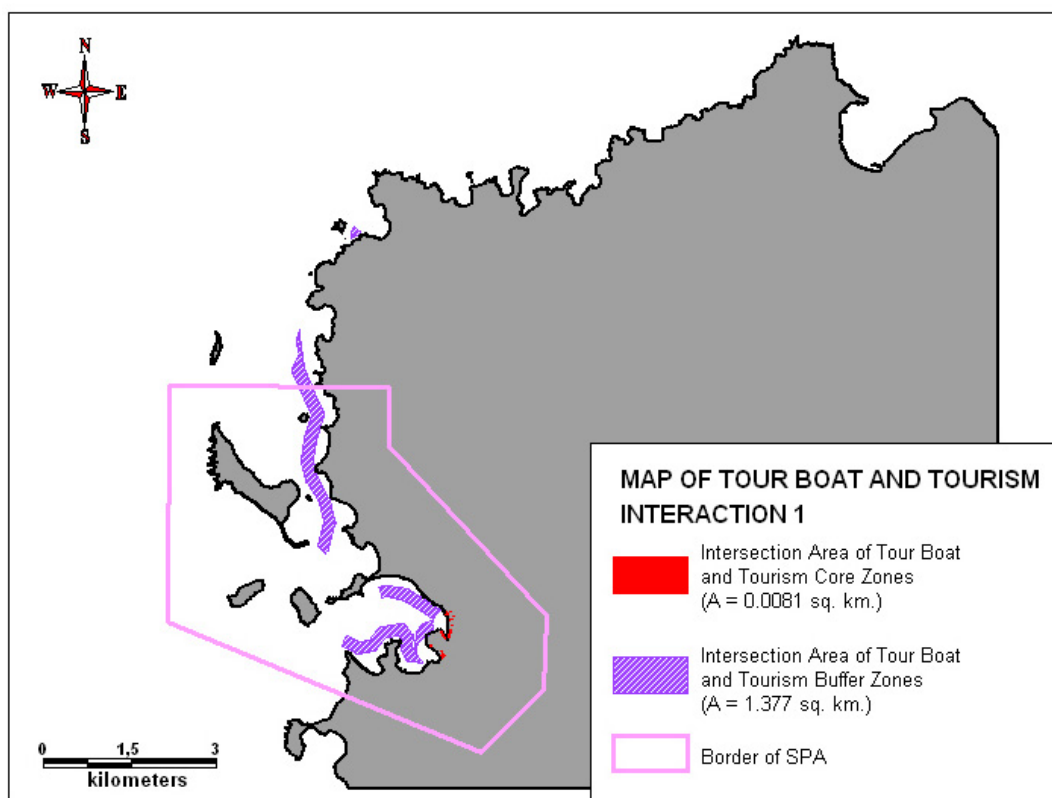


Figure 2.50 Map of tour boat and tourism intersection 1.

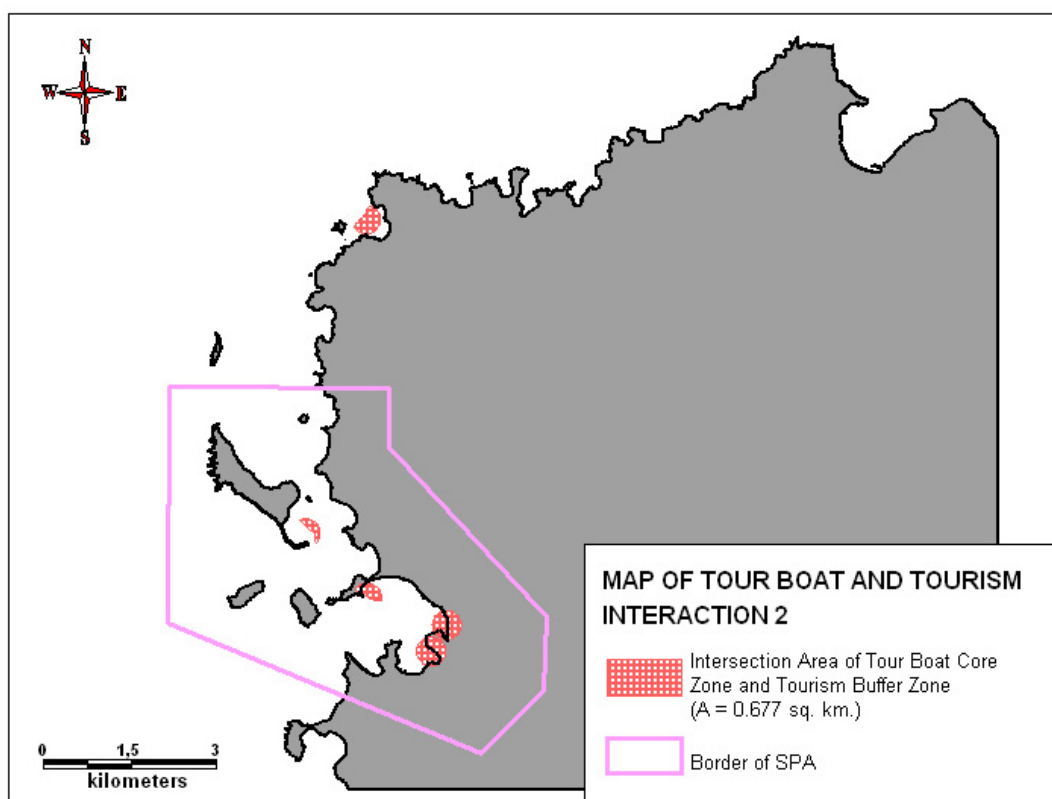


Figure 2.51 Map of tour boat and tourism intersection 2.

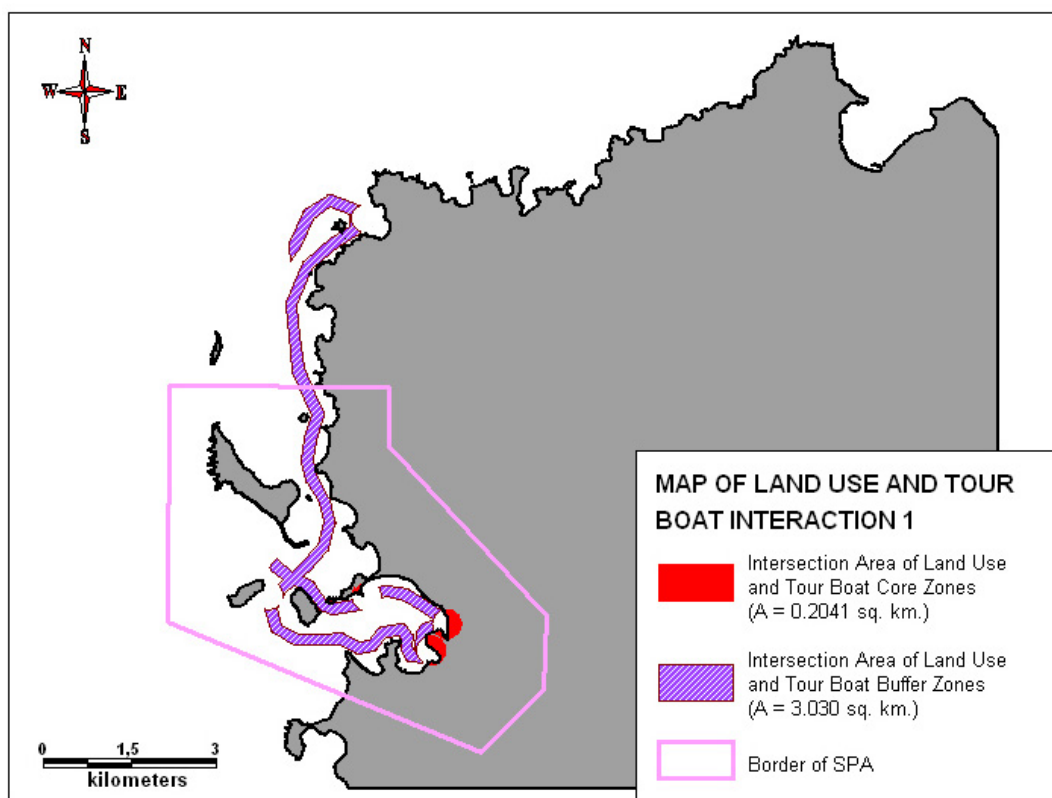


Figure 2.52 Map of tour boat and land use intersection 1.

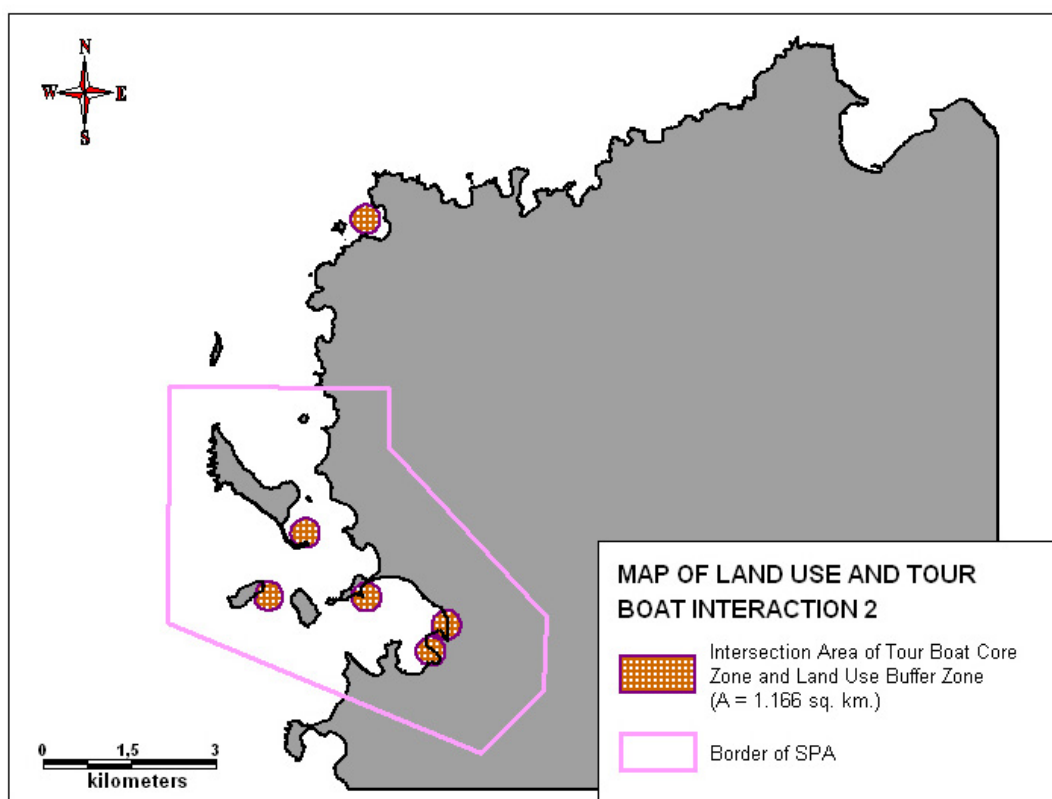


Figure 2.53 Map of tour boat and land use intersection 2.

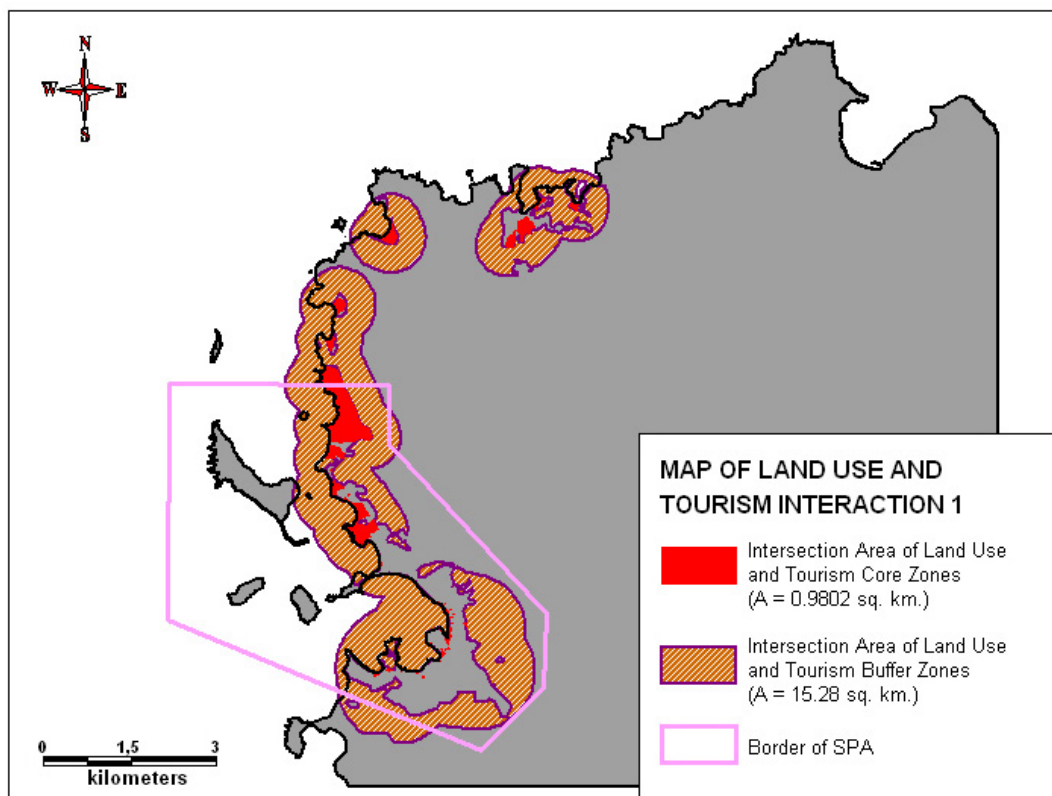


Figure 2.54 Map of tourism and land use intersection 1.

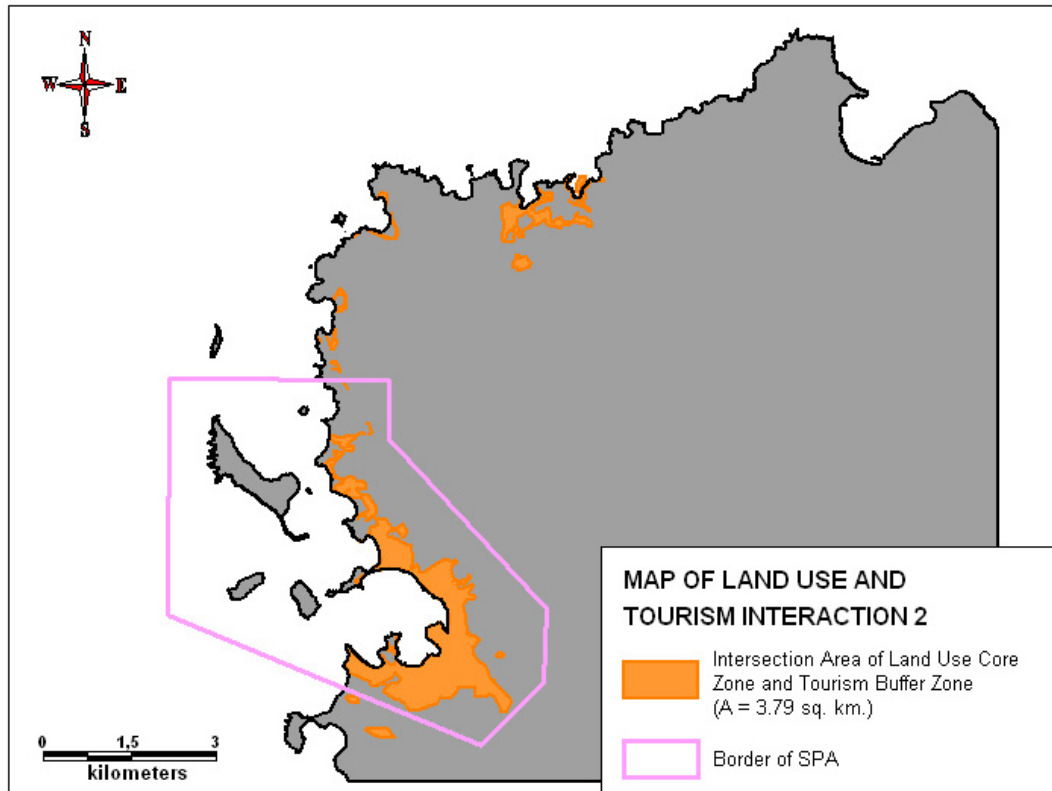


Figure 2.55 Map of tourism and land use intersection 2.

2.4.3.2.11 Mapping Zonal Dependencies: Grid Factor. In the previous sections, the use and demand areas for each activity were mapped as core and buffer zones, which in turn quantify the cumulative area usage for each dataset. Further results focus on comparable quantities of each activity: zonal dependency. **Zonal dependency of an activity** is the area that activity uses or needs to continue its economical existence per unit area which is one grid cell of the grid system. In order to determine zonal dependency, core and buffer zone values are converted to a unitless grid factor. **Grid factor** is defined as the proportion of the area of activity type (core, buffer or total = core + buffer) within a grid cell to the area of one grid cell and formulized as:

$$GF_i = \left[\sum_{j=1}^m CA_j + \sum_{k=1}^n BA_k \right] / GA_i \quad (2)$$

where GF_i is the grid factor of an activity in each grid cell, CA_j is the area of each core zone, m is the number of core zones, BA_k is the area of each buffer zone, k is the number of buffer zones in that grid cell and GA_i is the grid cell area (Figure 2.56). When the grid factors of core zones are to be calculated, BA is taken as zero; and CA is taken as zero when the grid factors of buffer zones are to be calculated. By definition, the minimum value of GF of an activity is 0 at grid cells where CA and BA are both 0 (case of full vacancy), and the maximum value is 1 where the sum of CA and BA equals to GA (case of no vacancy). The grid factor mapping for each activity includes four steps: **1.** Determination of the areas of all core and buffer zones of all activities within each cell of the grid system: the SPLIT function of MapInfo is first used to split the core and buffer zones according to the grid system and the areas of all activity types are then calculated by SQL querying (Figure 2.57a). Thus, the coverage areas of the core, buffer and total zones inside each grid cell are determined. **2.** GF calculation: the grid factors for core zones, buffer zones and total of zones (core plus buffer) for each grid cell are calculated by SQL querying according to the GF formula (Figure 2.57b). **3.** Cumulative GF calculation for all of human activities: After determination of GF of each core, buffer and total zones for each activity, the cumulative grid factors of all core, buffer and total zones of all human activities are calculated by SQL querying (Figure 2.57c). **4.** Thematic mapping of GF s for each activity type.

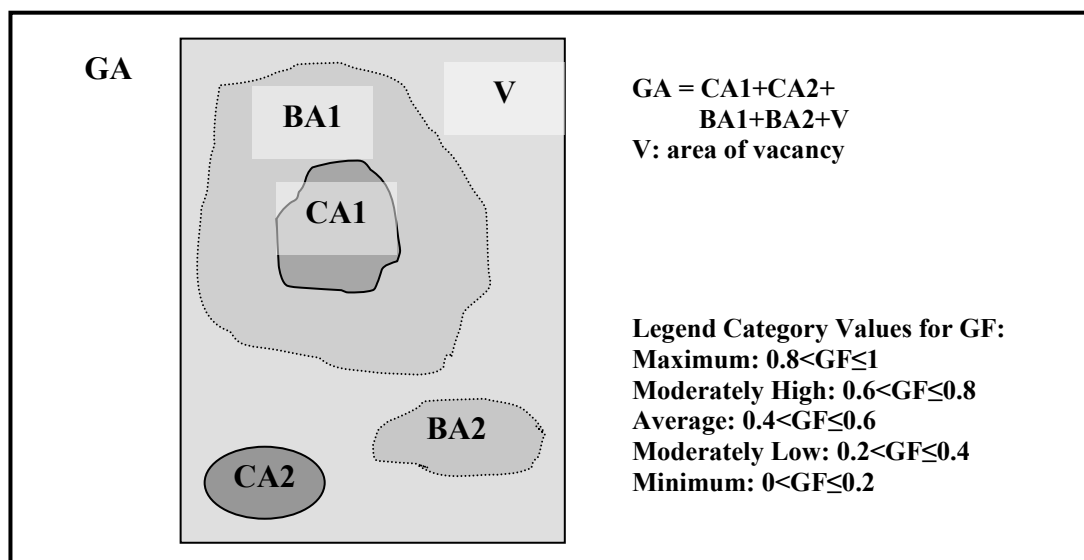


Figure 2.56 Calculation of grid factor.

Select Columns:	grid_id, SphericalArea(core_split.Obj, "sq m"), SphericalArea(buffer_split.Obj, "sq m"), SphericalArea(total_split.Obj, "sq m")
From Tables:	grid, "activity type"_split
Where Condition:	grid.Obj Contains "activity type"_split.Obj
Order by Columns:	grid_id
-a-	
Select Columns:	grid_id, core_split, buffer_split, total_split, SphericalArea(core_split.Obj, "sq m") / SphericalArea(grid.Obj, "sq m"), SphericalArea(buffer_split.Obj, "sq m") / SphericalArea(grid.Obj, "sq m"), SphericalArea(total_split.Obj, "sq m") / SphericalArea(grid.Obj, "sq m")
From Tables:	grid, "activity type"_split
Order by Columns:	grid_id
-b-	
Select Columns:	grid_id, fisheries_core_GF + tourism_core_GF + tour_boat_core_GF + land_use_core_GF, fisheries_buffer_GF + tourism_buffer_GF + tour_boat_buffer_GF + land_use_buffer_GF, fisheries_total_GF + tourism_total_GF + tour_boat_total_GF + land_use_total_GF
From Tables:	fisheries_grid, tourism_grid, tour_boat_grid, land_use_grid
Order by Columns:	grid_id
-c-	

Figure 2.57 Queries used for GF calculation.

2.4.3.2.12 Mapping Zonal Diversity of Human Activities. The analysis depends on the presence / absence data of the activities. **Zonal diversity of human activities** is the number of human activities present in each grid cell and it is mapped for three categories: core zones, buffer zones and total zones (core or buffer). Zonal diversity of core and buffer zones of human activities is obtained by counting the number of core and buffer activities within each cell. The presence of core and buffer zones within each grid cell is determined by SQL querying (Figure 2.58a & 2.58b) and the numbers of core and buffer activities for each grid cell are entered as new columns to the grid table. Zonal diversity of total zones is determined by counting the number of activities whether it is core or buffer within each grid cell and its presence is also determined by SQL querying (Figure 2.58c) and an additional column is defined for the number of total activities for each grid cell. Finally, activity diversity maps are produced by thematic mapping.

Select Columns: * From Tables: fisheries_grid, tourism_grid, tour_boat_grid, land_use_grid Where Condition: fisheries_core_GF > 0 Or tourism_core_GF > 0 Or tour_boat_core_GF > 0 Or land_use_core_GF Order by Columns: grid_id
-a-
Select Columns: * From Tables: fisheries_grid, tourism_grid, tour_boat_grid, land_use_grid Where Condition: fisheries_buffer_GF > 0 Or tourism_buffer_GF > 0 Or tour_boat_buffer_GF > 0 Or land_use_buffer_GF Order by Columns: grid_id
-b-
Select Columns: * From Tables: fisheries_grid, tourism_grid, tour_boat_grid, land_use_grid Where Condition: fisheries_core_GF > 0 Or tourism_core_GF > 0 Or tour_boat_core_GF > 0 Or land_use_core_GF Or fisheries_buffer_GF > 0 Or tourism_buffer_GF > 0 Or tour_boat_buffer_GF > 0 Or land_use_buffer_GF Order by Columns: grid_id
-c-

Figure 2.58 Queries used for determination of activity presence in each grid cell.

2.4.3.2.13 *Mapping Zonal Economics: Annual Income per Grid Cell.* The annual incomes of fisheries, tourism and tour boat activities of year 2003 are calculated in order to present a management approach. The annual income of fisheries is calculated by Formula 3 using fish landings data taken from the District Directorate of the Ministry of Agriculture:

$$I_F = \sum_{i=1}^n (W_i \times P_i) \quad (3)$$

where W_i is the amount of each fish species landed, P_i is the unit price of each fish species for 2003 and n is the number of species landed. Annual income of tourism is calculated by Formula 4 using questionnaires data:

$$I_T = C_t \times P_{ave} \times D_{ave} \times f_{ave} \quad (4)$$

where C_t is the total capacity of the tourism facilities, P_{ave} is average unit price per customer for 2003, D_{ave} is the average number of working days in a year and f_{ave} is the average fullness percentage of the facilities. Finally, annual income for tour boat activity is calculated using questionnaire data by Formula 5:

$$I_{TB} = C_t \times P_{ave} \times D_{ave} \quad (5)$$

where C_t is the total capacity of tour boats, P_{ave} is the average unit price per customer in 2003 and D_{ave} is the average number of working days in a year. In order to convert the annual incomes of the activities to a comparable scale, zonal economics is defined. **Zonal economics** is the annual income of a human activity per one grid cell. The approach distributes annual income of an activity proportional to its total grid factors (core plus buffer) at each grid cell using the formula:

$$GI_i = I_j \times GF_i / \sum_{i=1}^n GF_i \quad (6)$$

where GI_i is the annual income of a single grid cell, I_j is the annual total income of the a human activity, GF_i is the total grid factor of the activity at each grid cell and n is the number of grid cells used by each activity. GIs are determined and added to grid tables of each activity by an SQL query and then thematic maps are produced.

CHAPTER THREE

RESULTS

3.1 The Mediterranean Monk Seal

3.1.1 Grid Factors

The core zone of *M. monachus* occupies 40 grid cells (Figure 3.1). Three of these cells have a grid factor value between 0.8 and 1 (maximum); two at mainland core zone and one in Siren Rocks. On the other hand, buffer zone intersects with 514 grid cells 444 of them are classified as maximum (Figure 3.2). When the total of core and buffer grid factors are considered, 518 grid cells are considered to be used by the species and 462 of them have the maximum value range (Figure 3.3).

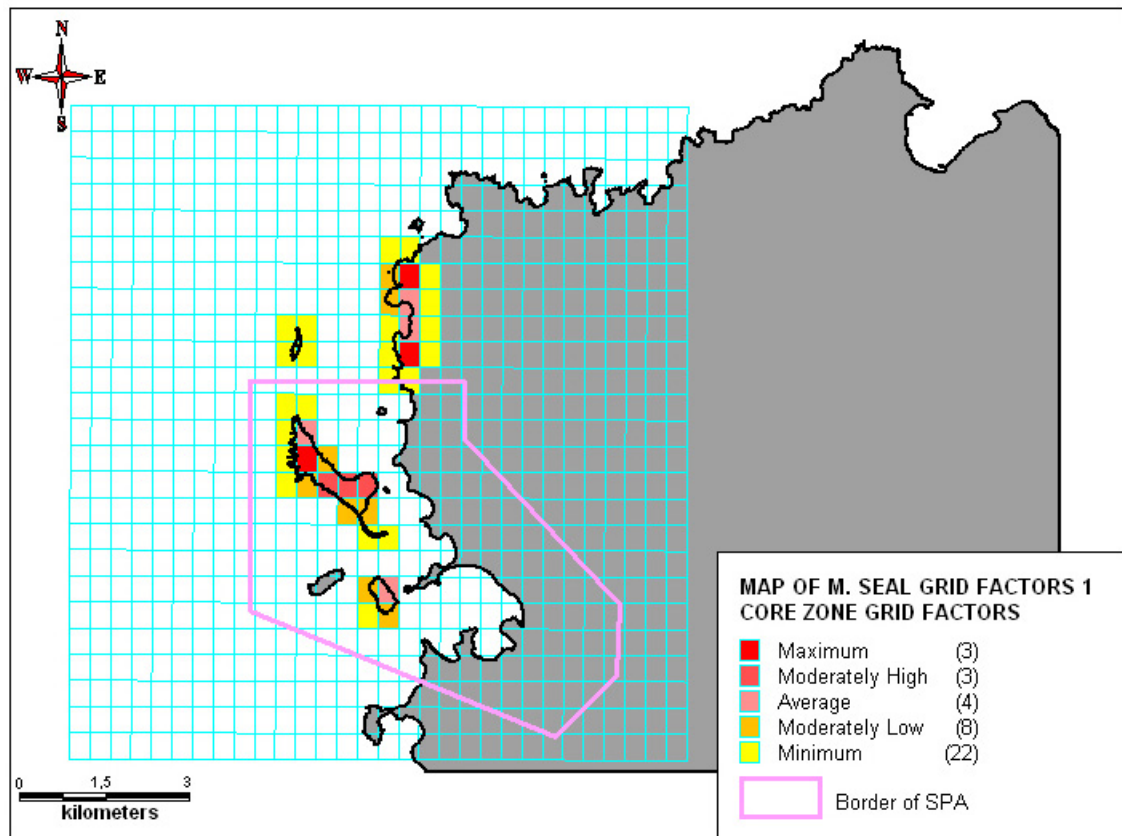


Figure 3.1 Map of *M. monachus* core zone grid factors.

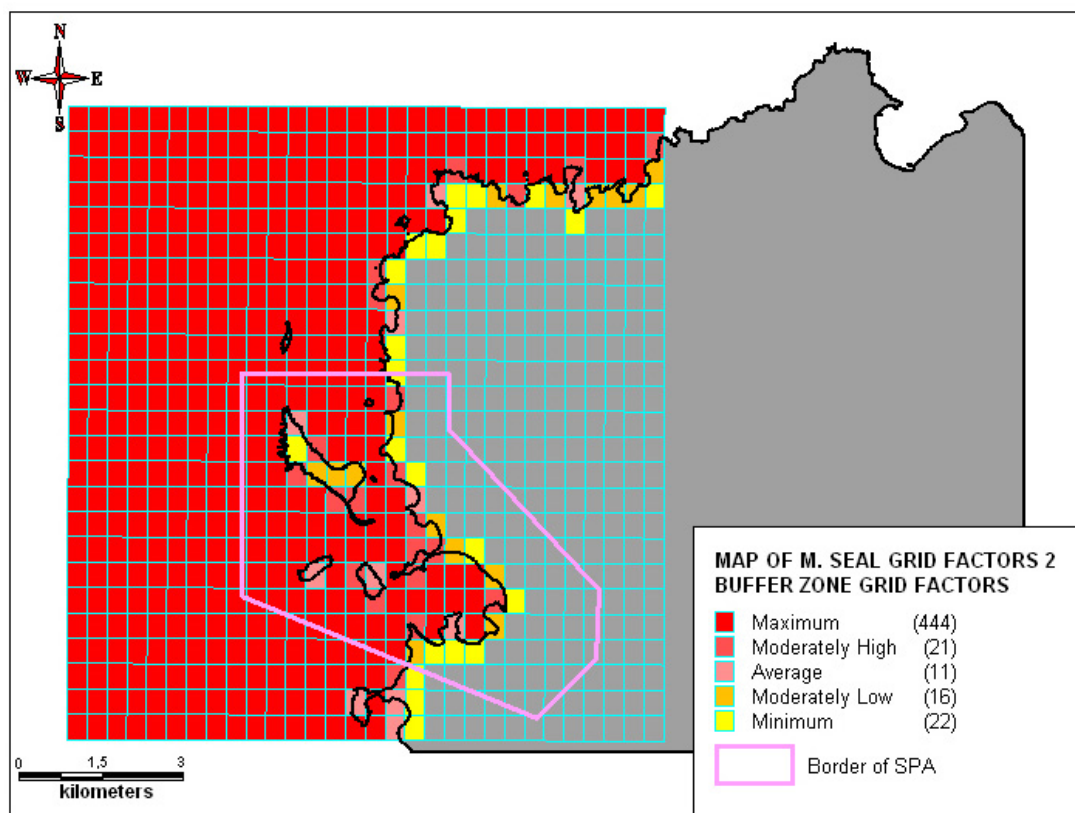


Figure 3.2 Map of *M. monachus* buffer zone grid factors.

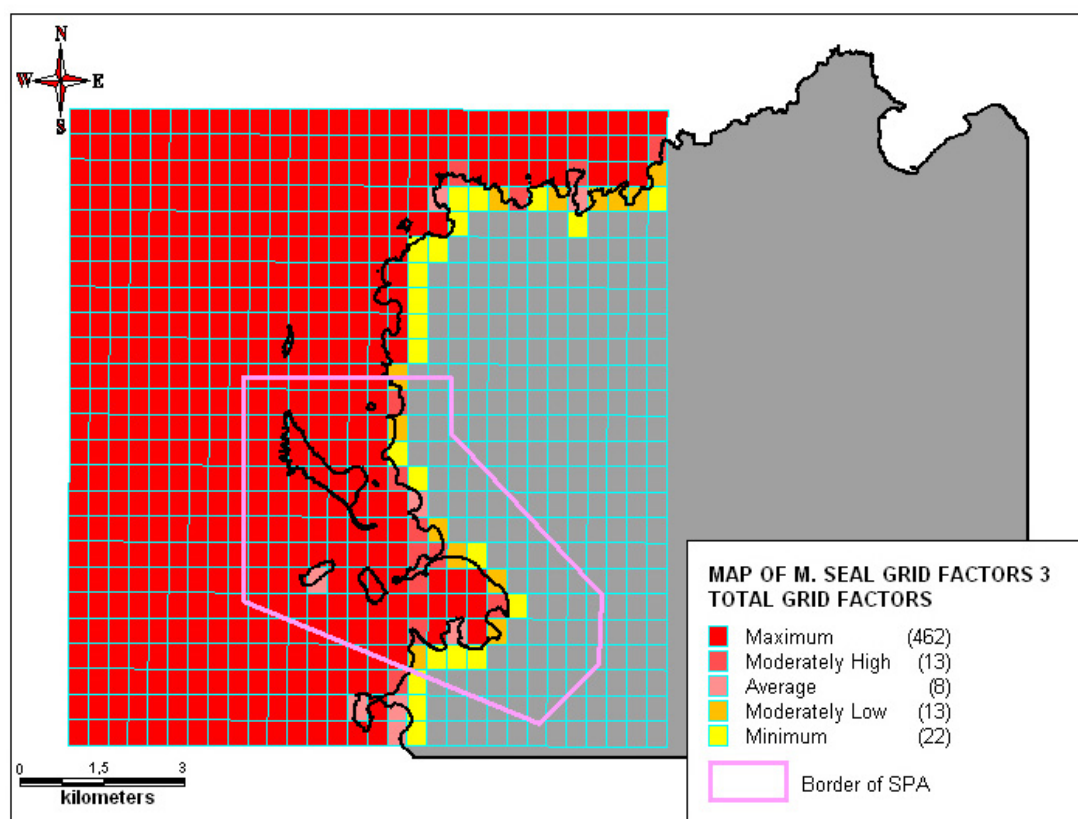


Figure 3.3 Map of *M. monachus* total grid factors.

3.1.2 Sighting Data

The records of SAD-AFAG include sightings of several individuals 9 of which were given identification codes (See Appendix 23 for the catalogue of Foça seals) and were analyzed in three categories: cave check sightings, observation point sightings and incidental observations. Cave check and observation point (Appendix 24) sightings are the monitoring data of the species since there was an effort to observe the species. Total sightings data (monitoring plus incidental observations) of the species is also mapped to view the total area usage of the species.

Cave check monitoring shows that defined core zones except the mainland caves are frequently used by the species, especially Hayırsız Island (Figure 3.4). The number of sightings and observed individuals make peak in 1996 and a decrease trend since then (Figure 3.5). Despite cave check monitoring, observation points' data demonstrates that mainland core zone is used by the species with a low frequency and the frequency of observation is maximum at Siren Rocks of Orak Island (Figure 3.6) The peaks of the number of sightings and observed individuals slid to 1997, but with a sharp decline in the following year (Figure 3.7). According to the total monitoring data (Figure 3.8), the caves at Siren Rocks are more frequently used than others. The yearly distribution of observation and individual numbers make the peak in 1996 with 79 individuals at 62 observations (Figure 3.9).

Incidental observations reported from the local communities show that *M. monachus* uses almost all the coastal strip with high frequencies at all predefined *M. monachus* core zones (Figure 3.10). The number of sightings and observed individuals make the peak again in 1996 with the number of observed individual per sighting rate 1.31 (229/175) (Figure 3.11). Total sighting data of the species (Figure 3.12) also show that there is a considerable decline in species sightings after 1996 (Figure 3.13).

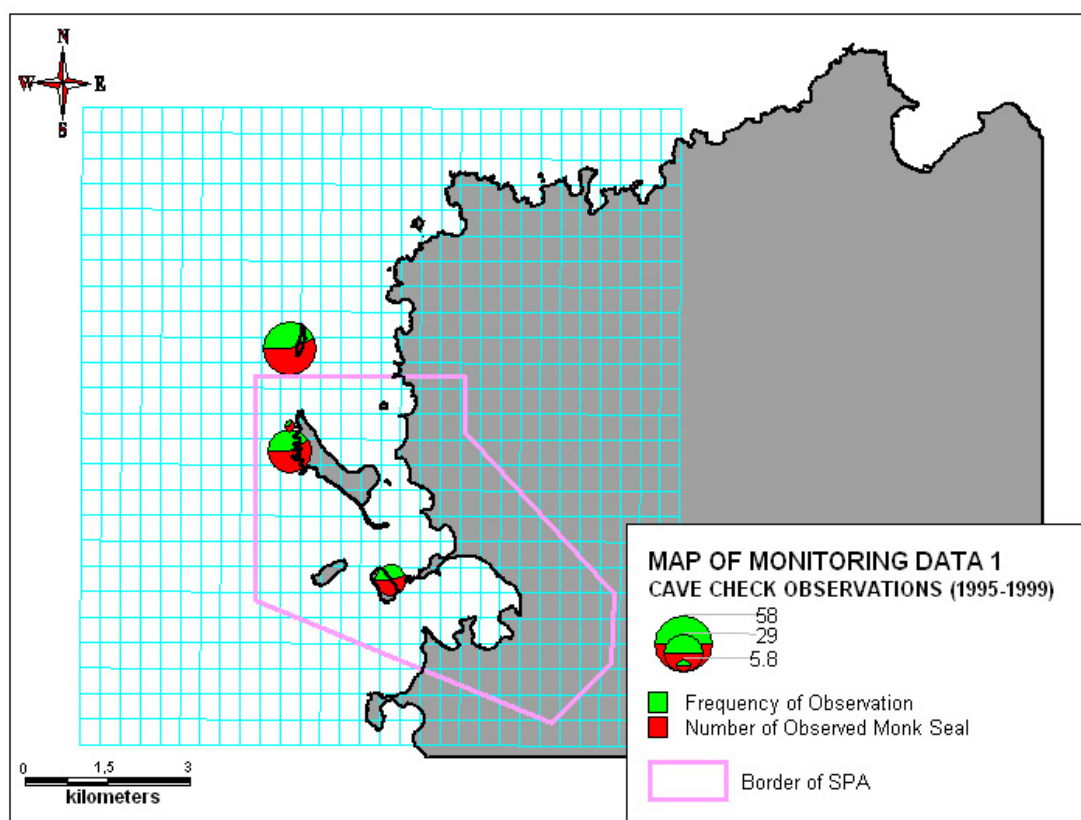


Figure 3.4 Map of *M. monachus* cave check observations.

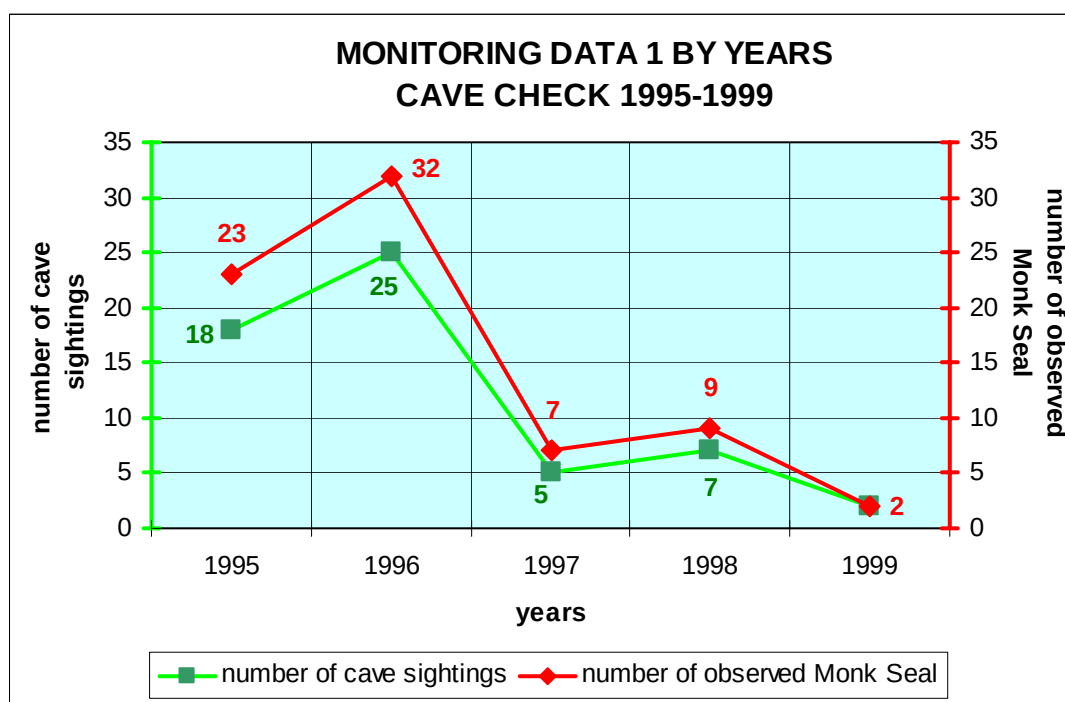


Figure 3.5 Temporal changes in number of cave observations and observed individuals.

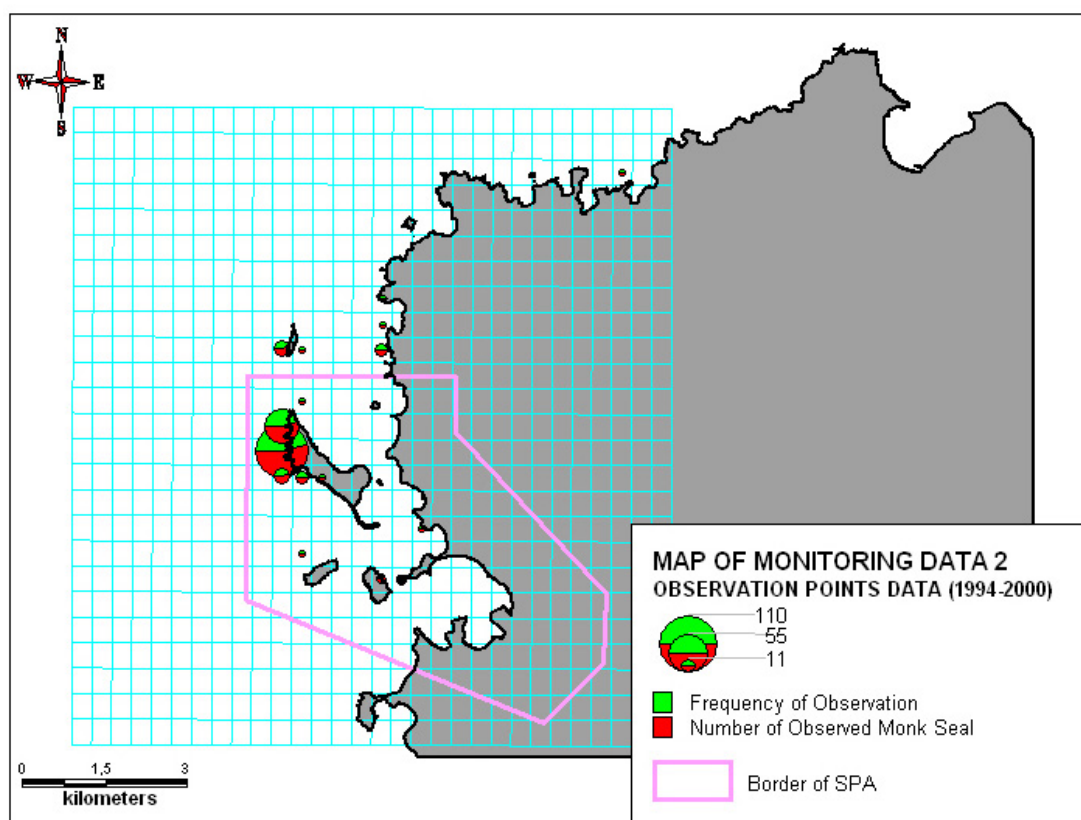


Figure 3.6 Map of *M. monachus* observation point sightings.

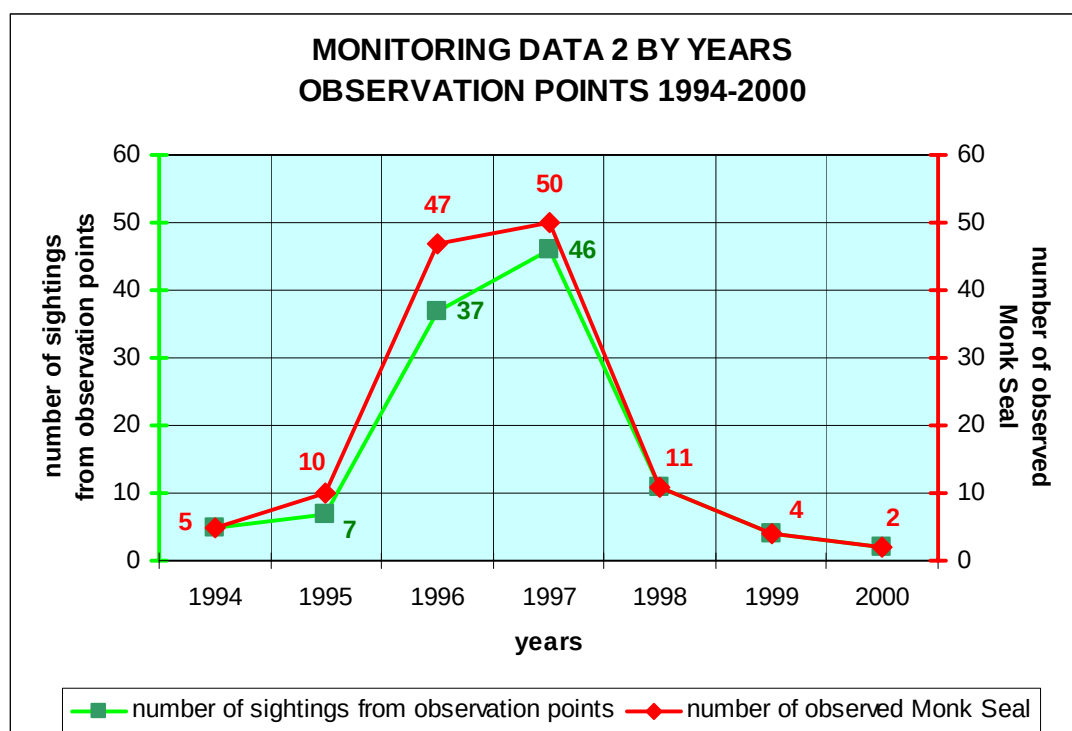


Figure 3.7 Temporal changes in number of observation point sightings and observed individuals.

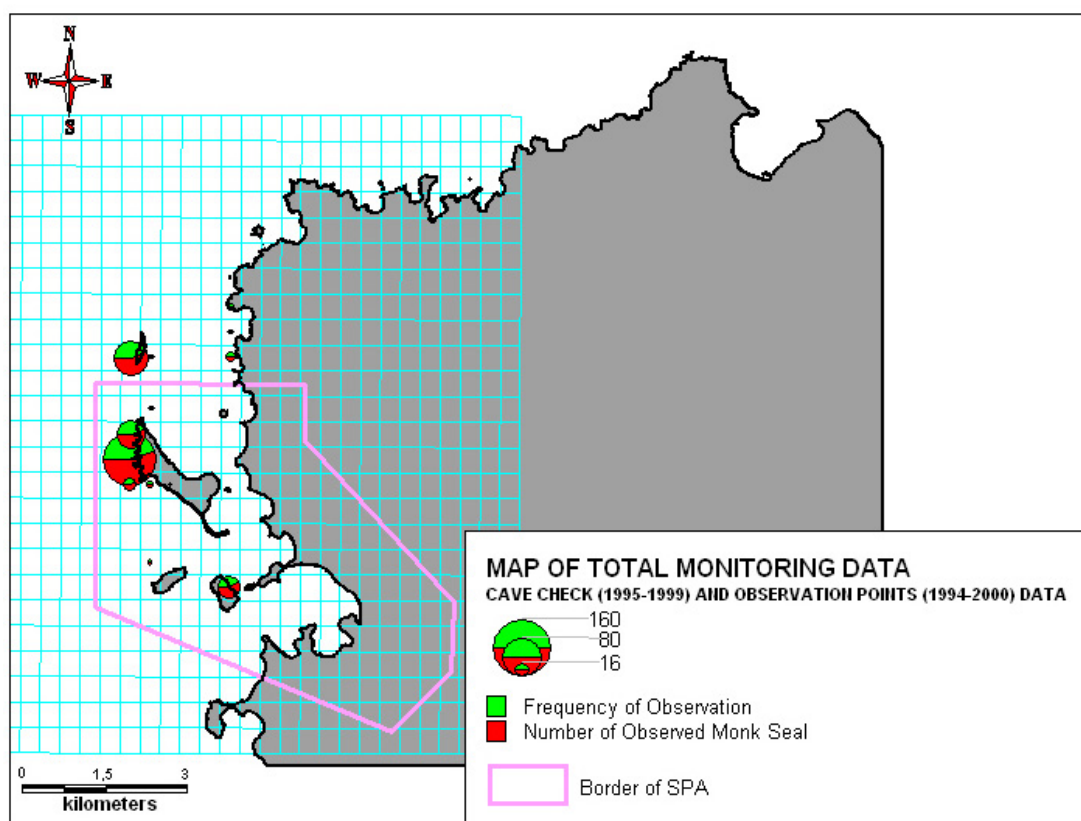


Figure 3.8 Map of total species monitoring data.

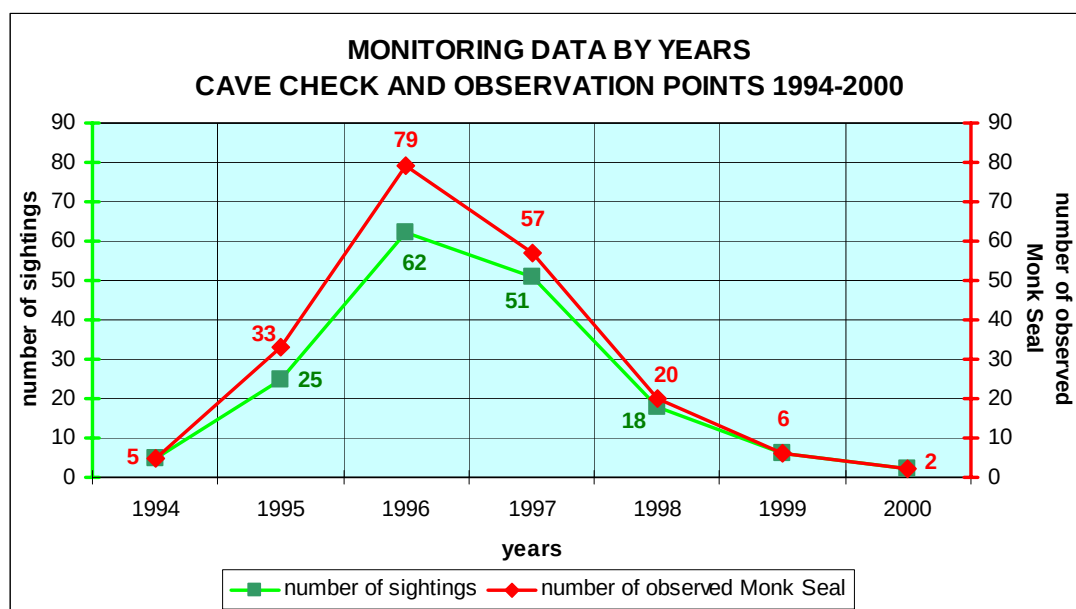


Figure 3.9 Temporal changes in number of monitoring sightings and observed individuals.

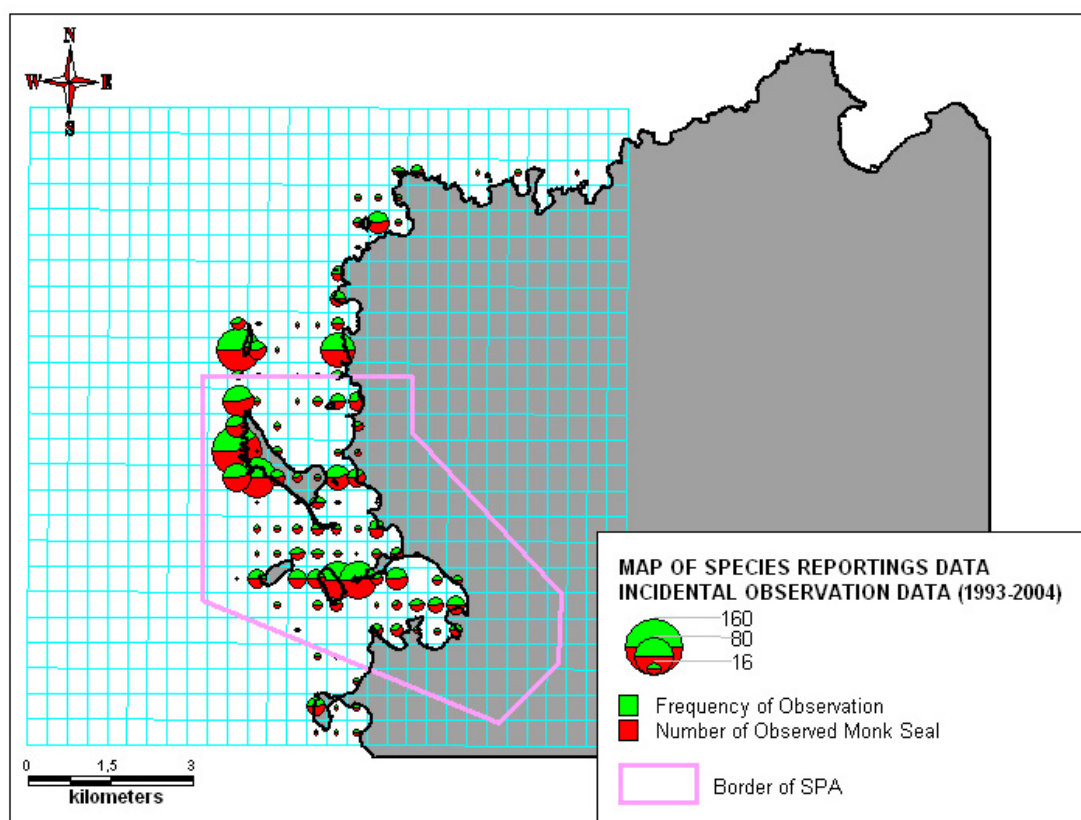


Figure 3.10 Map of *M. monachus* reportings from the public.

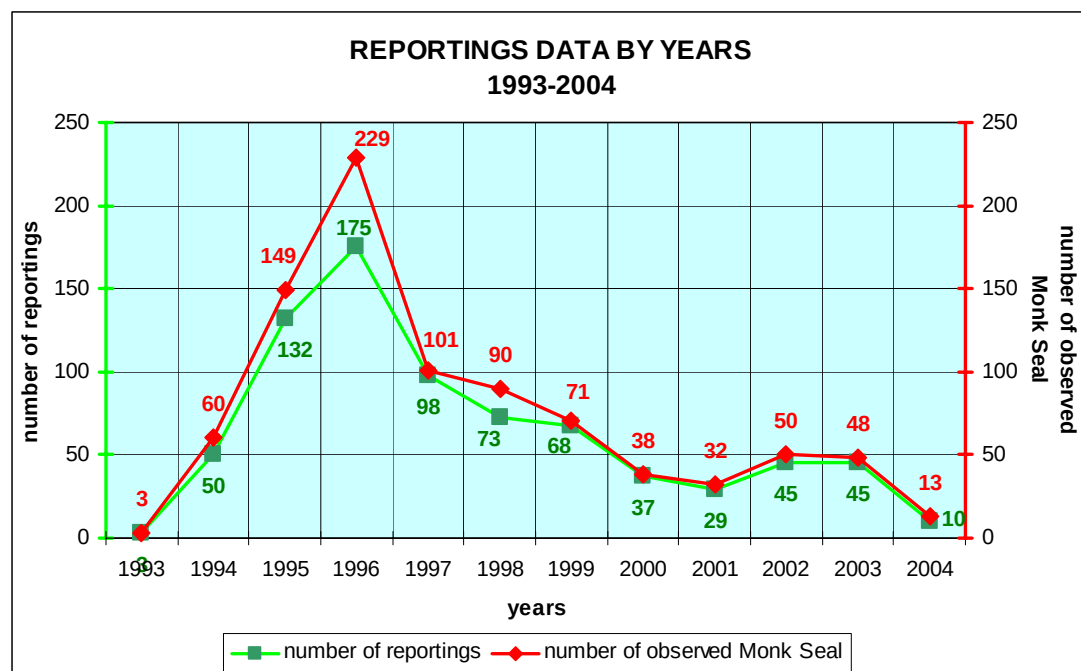


Figure 3.11 Temporal changes in number of incidental observations and observed individuals.

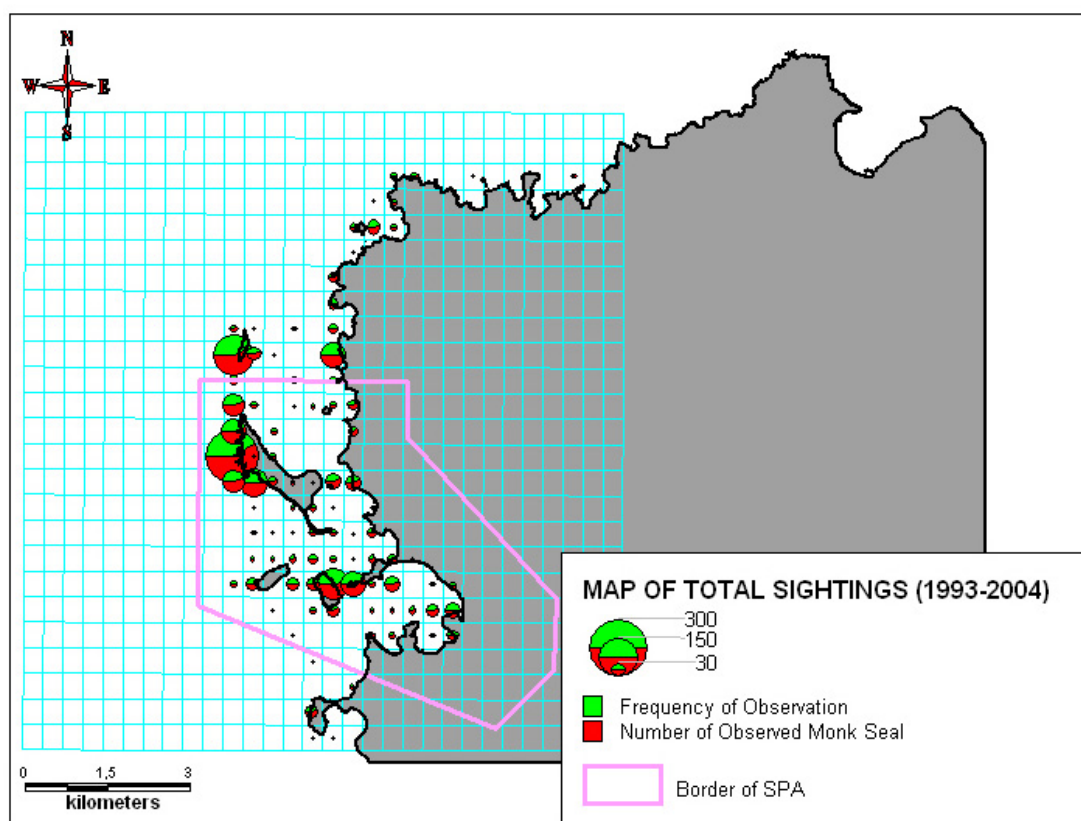


Figure 3.12 Map of total species sightings.

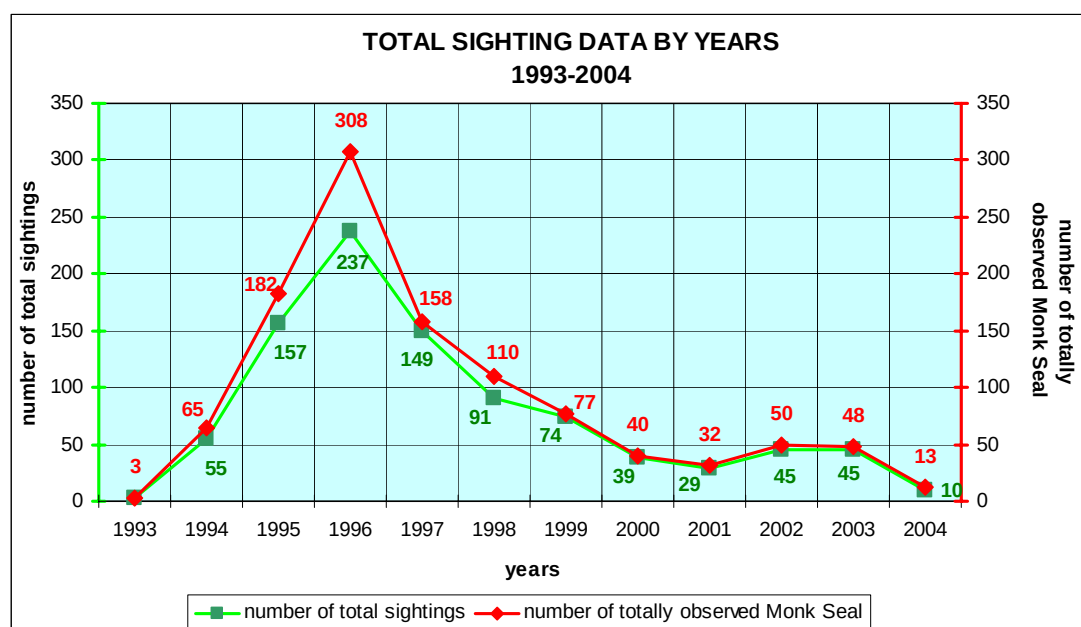


Figure 3.13 Temporal changes in number of total sightings and observed individuals.

3.1.3 Interaction of Monk Seal with Human Activities

The core zone of *M. monachus* is occupied by three human core zone activities: land use, tour boat and tourism. Fisheries core zone does intersect with the *M. monachus* core zone. Land use, tourism and tour boat activities occupy 6.54%, 4.02% and 2.75% of the *M. monachus* core zone (Figure 3.14). On the other hand, these cave areas are occupied only by land use and tourism buffer zones. Land use buffer zone covers 55.44% of the seal core zone while tourism buffer zone coverage is 33.12% (Figure 3.15).

The *M. monachus* buffer zone includes two core zones of human activities. Fisheries core zone occupies 30.33% and tour boat core zone occupies 1.39% of the seal buffer zone (Figure 3.16). The species buffer zone intersects with buffer zones of all human activities in the marine area. Interaction with fisheries is maximum compared to others: 56.9% of seal buffer zone is also used by fishermen (Figure 3.17).

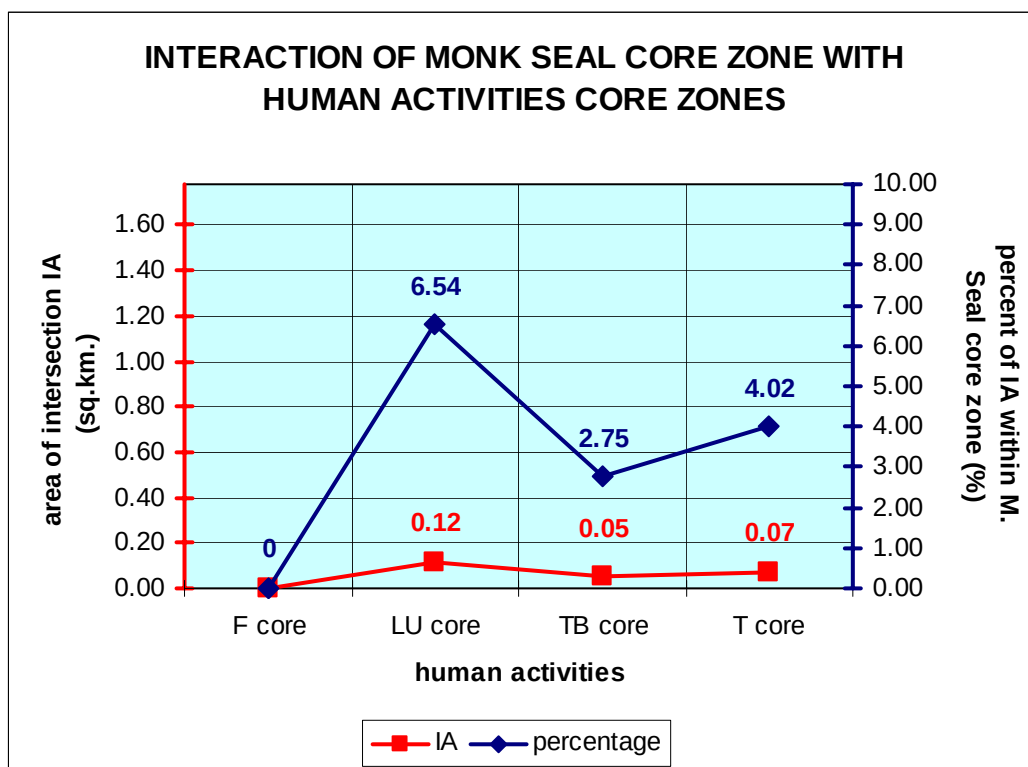


Figure 3.14 Core-to-core interactions between *M. monachus* and human activities.

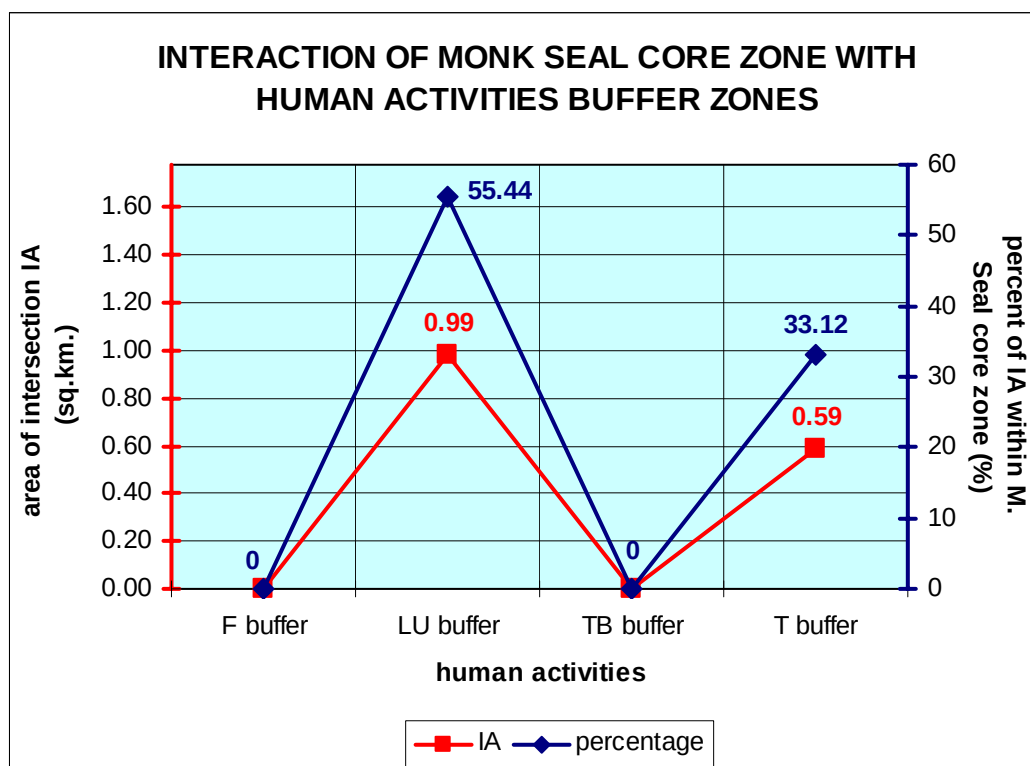


Figure 3.15 Core-to-buffer interactions between *M. monachus* and human activities.

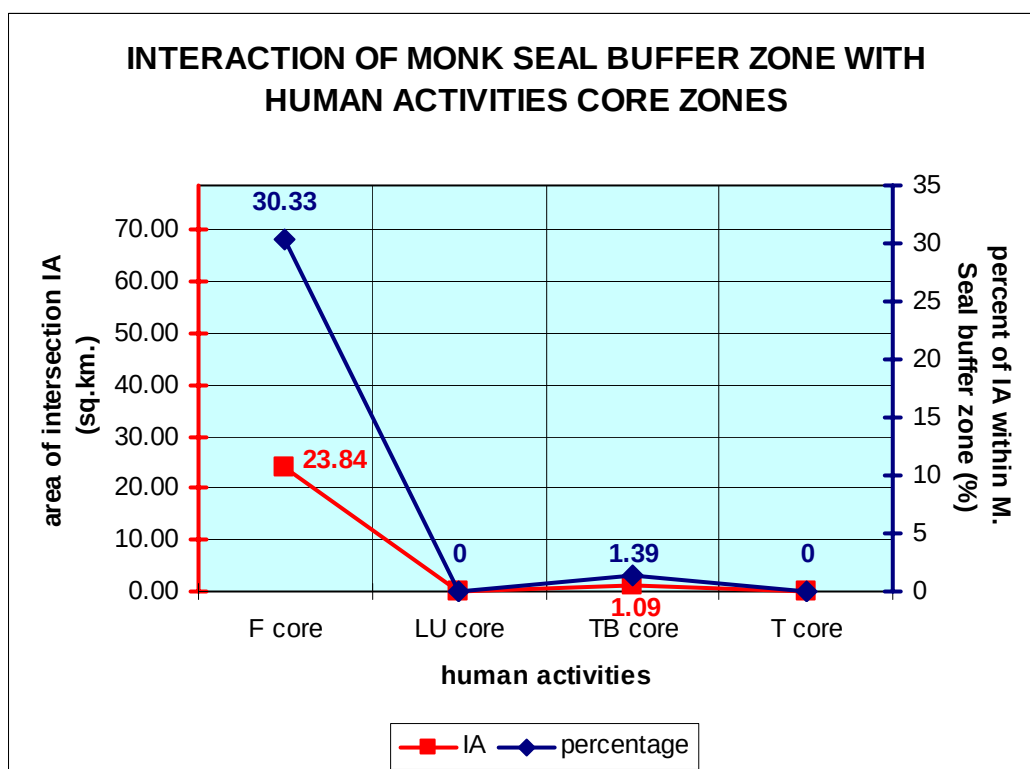


Figure 3.16 Buffer-to-core interactions between *M. monachus* and human activities.

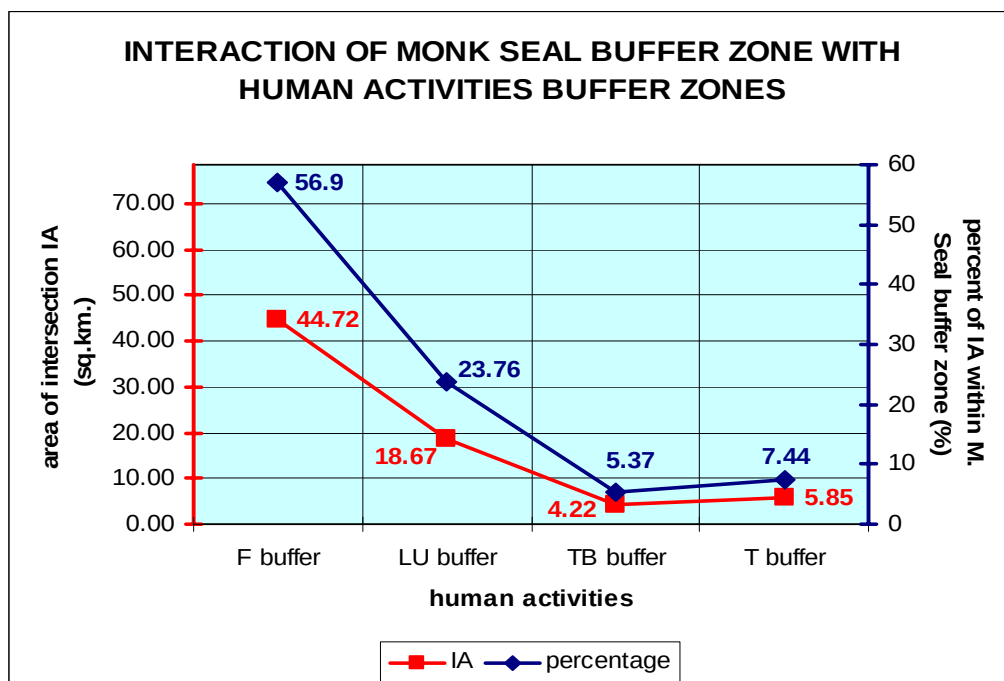


Figure 3.17 Buffer-to-buffer interactions between *M. monachus* and human activities.

3.2 Fisheries

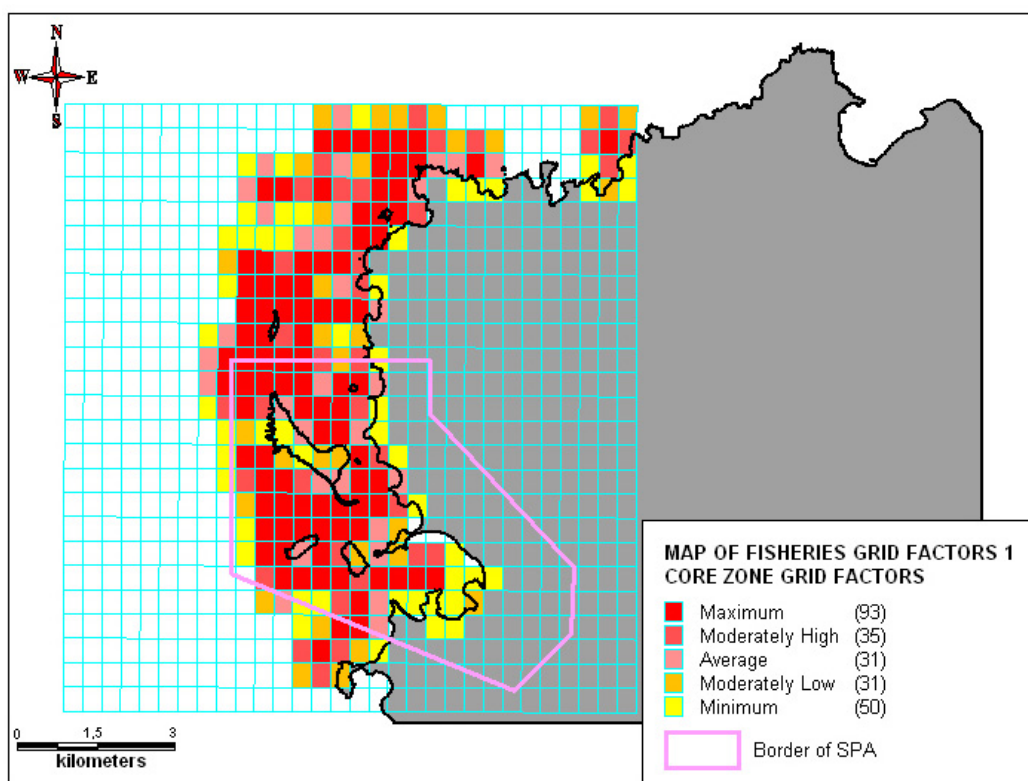


Figure 3.18 Map of fisheries core zone grid factors.

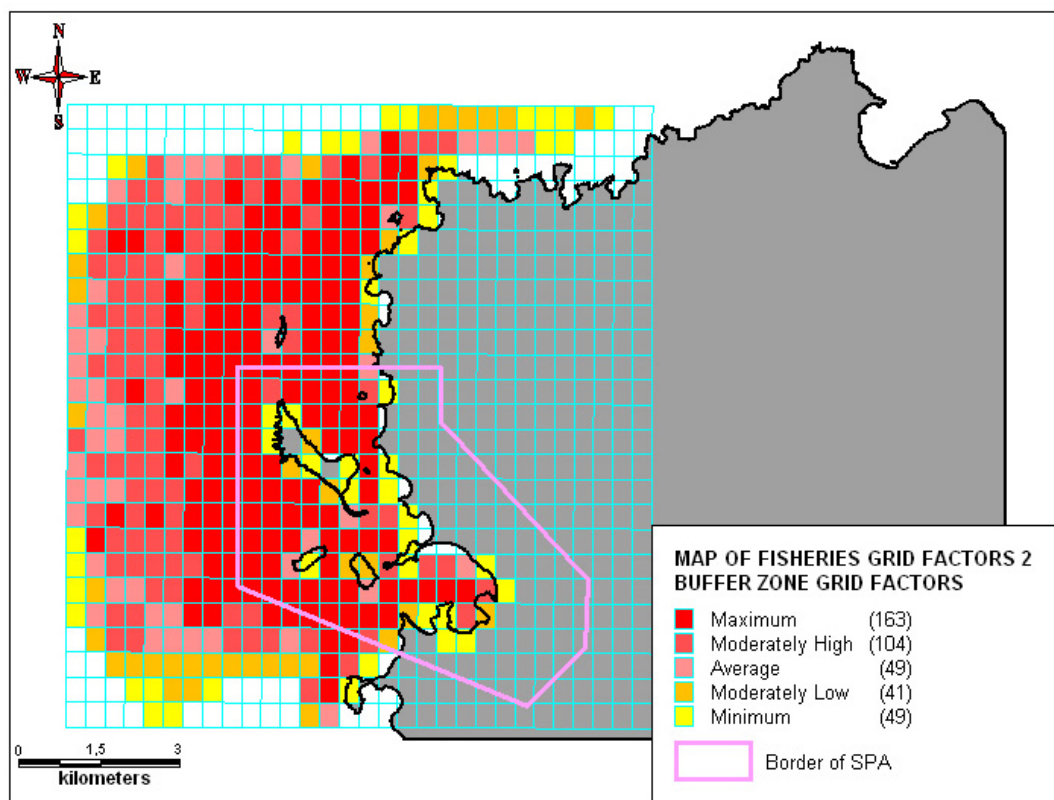


Figure 3.19 Map of fisheries buffer zone grid factors.

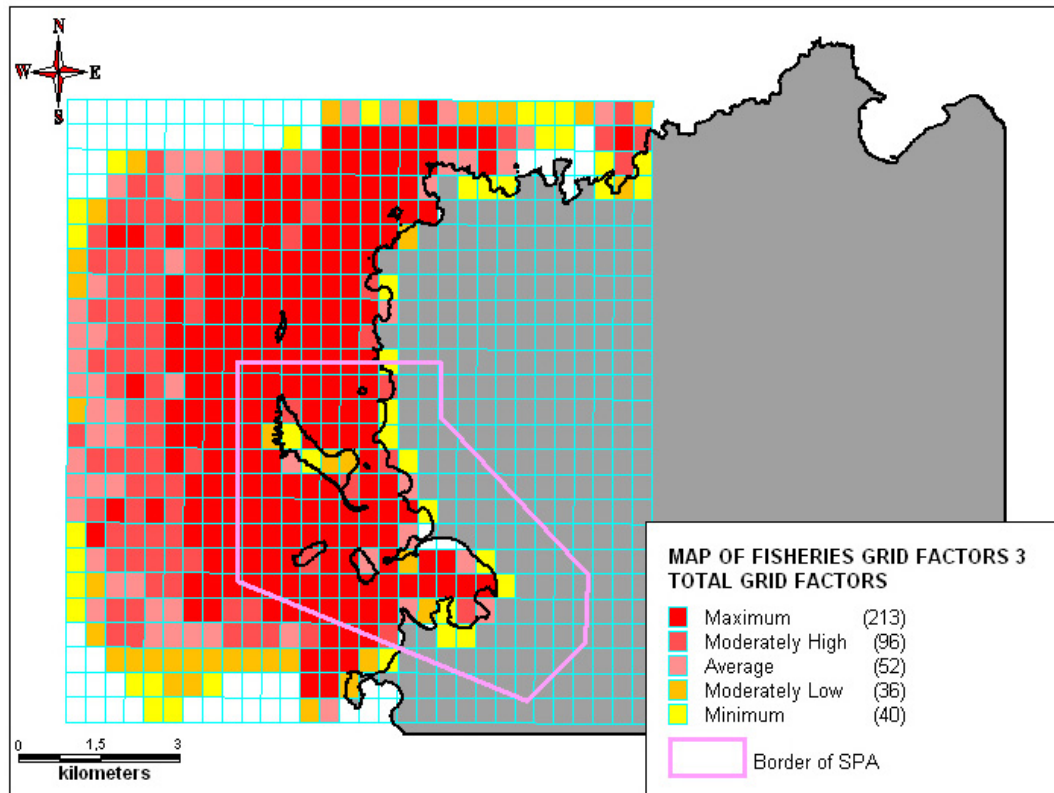


Figure 3.20 Map of fisheries total grid factors.

Fishing activity uses a large marine area with a dominant grid factor of maximum value: core zone uses 240 grid cells 93 of which are in the maximum grid factor range (Figure 3.22) and buffer zone uses 406 grid cells 163 of which are in the maximum grid factor range (Figure 3.23). When total grid factors are considered, 213 of 437 grid cells have grid factors between 0.8 and 1 (Figure 3.24). The area use frequency does not show considerable change throughout the year, but the questionnaires show that fishermen use the area more frequently in October (Figure 3.25).

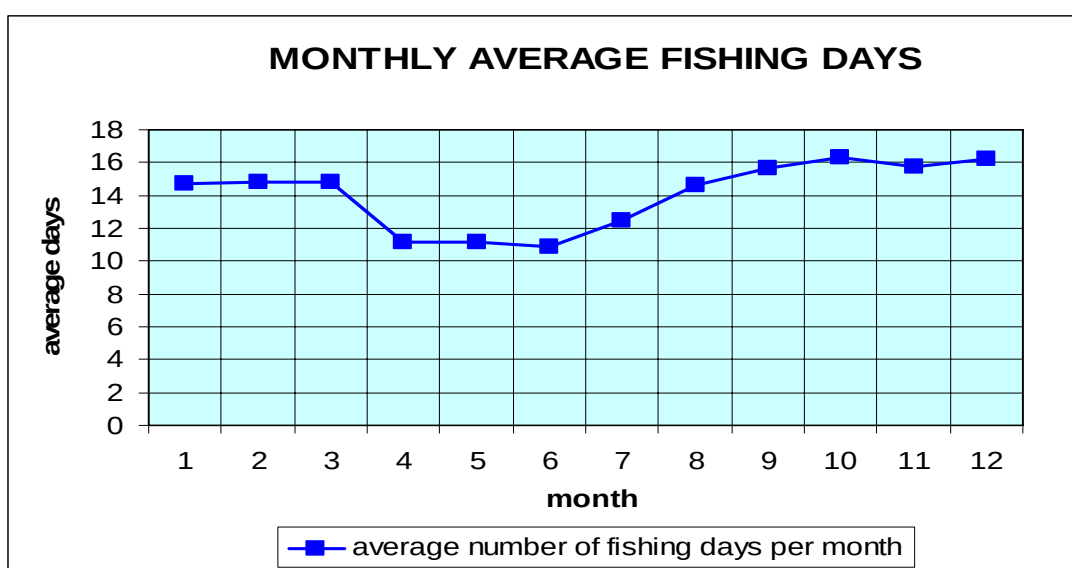


Figure 3.21 Monthly change of area usage frequency of fishermen.

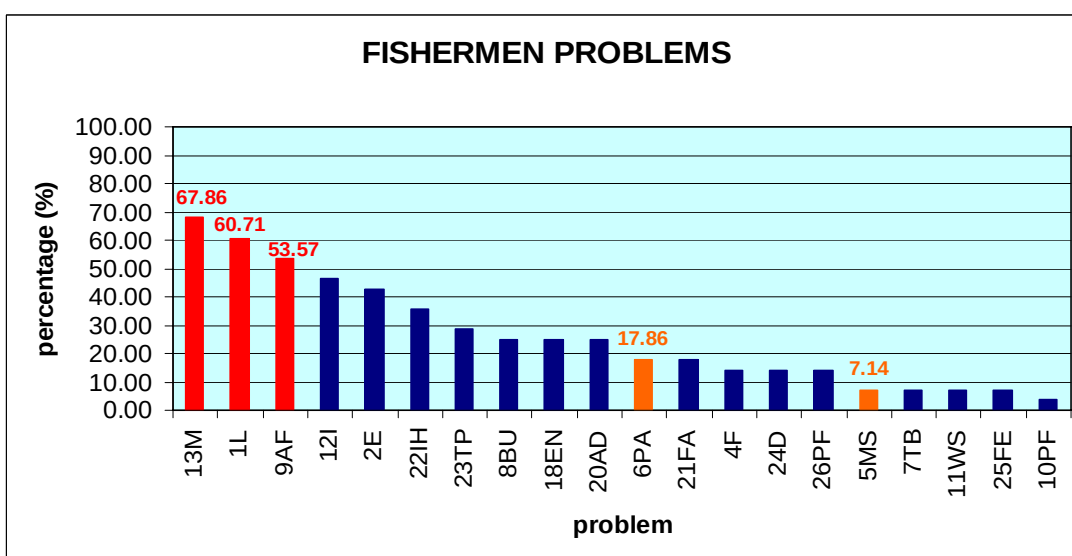


Figure 3.22 Problems met by fishermen.

Questionnaires show that fishermen are in maximum conflict with military activities (Figure 3.26 & Table 3.1). Almost 70% of fishermen complain about the restrictions originating from military activities. They also believe that legal arrangements are insufficient or do not meet their needs. 53.57% of fishermen also conflict with amateur fishermen. Only 5 fishermen (17.86%) think that SPA have no benefits and 2 fishermen (7.14%) complain about the monk seal because of the damage caused by the species to their nets.

Table 3.1 Problem list of fishermen.

PROBLEM ID	PROBLEM	ABBREVIATION	COUNT	PERCENTAGE (%)
13	Military	13M	19	67.86
1	Legal	1L	17	60.71
9	Amateur Fishing	9AF	15	53.57
12	Infrastructure	12I	13	46.43
2	Economical	2E	12	42.86
22	Illegal Hunting	22IH	10	35.71
23	Trawl, Purse-Seine	23TP	8	28.57
8	Beach Usage	8BU	7	25.00
18	Environmental	18EN	7	25.00
20	Administrative	20AD	7	25.00
6	Protected Areas	6PA	5	17.86
21	Limited Fishing Area	21FA	5	17.86
4	Financial	4F	4	14.29
24	Diving	24D	4	14.29
26	Port	26PF	4	14.29
5	Monk Seal	5MS	2	7.14
7	Touring Boats	7TB	2	7.14
11	Water Sports	11WS	2	7.14
25	Fishing Equipment	25FE	2	7.14
10	Artisanal Fishing	10PF	1	3.57

3.3 Tourism

Tourism core zone occupies 44 grid cells and none of them is more than 0.8 (Figure 3.23) while buffer zone occupies 169 grid cells 87 of which are in the maximum value range (Figure 3.24). The sector occupies totally 169 grid cells; 96 cells are calculated to have grid factors more than 0.8 (Figure 3.25). The tourist density per unit area makes a peak in August as the fullness of the facilities reaches to 74% in this month (Figure 3.26).

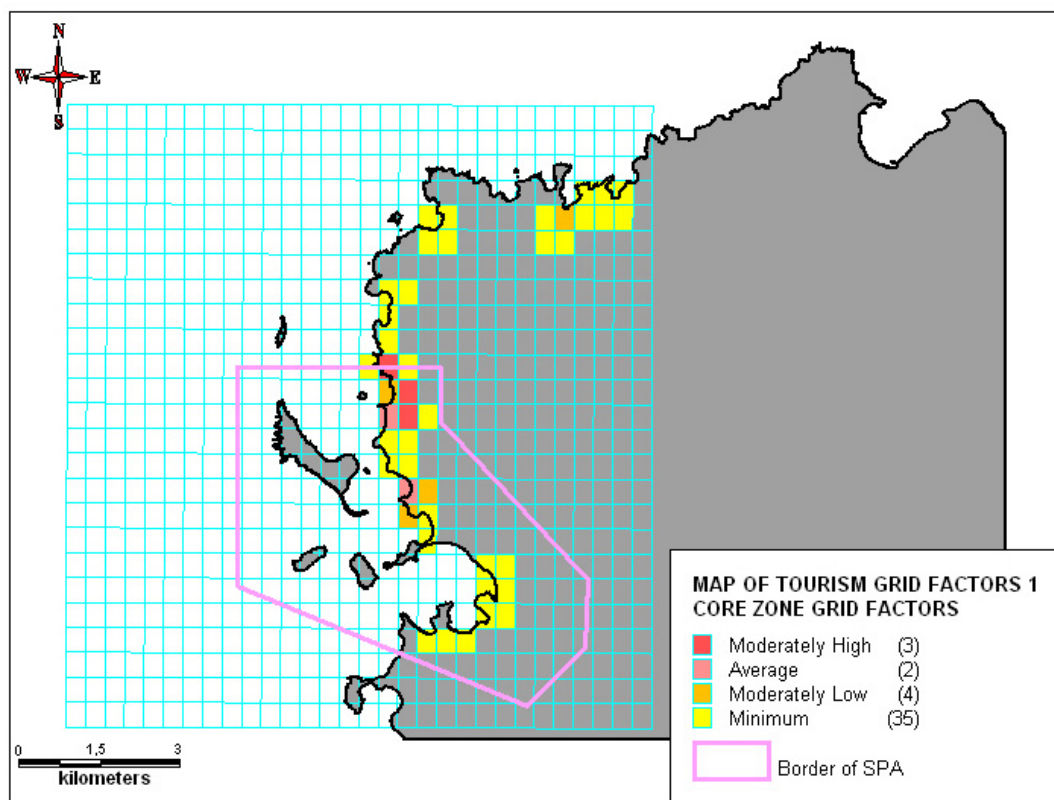


Figure 3.23 Map of tourism core zone grid factors.

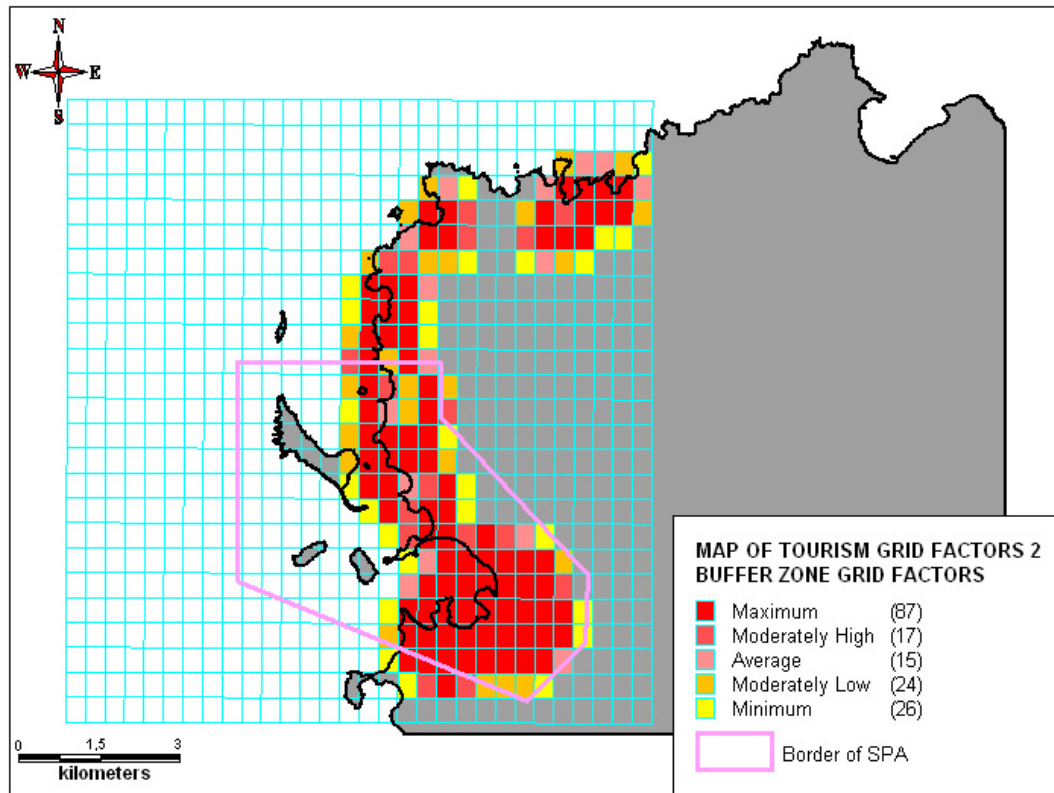


Figure 3.24 Map of tourism buffer zone grid factors.

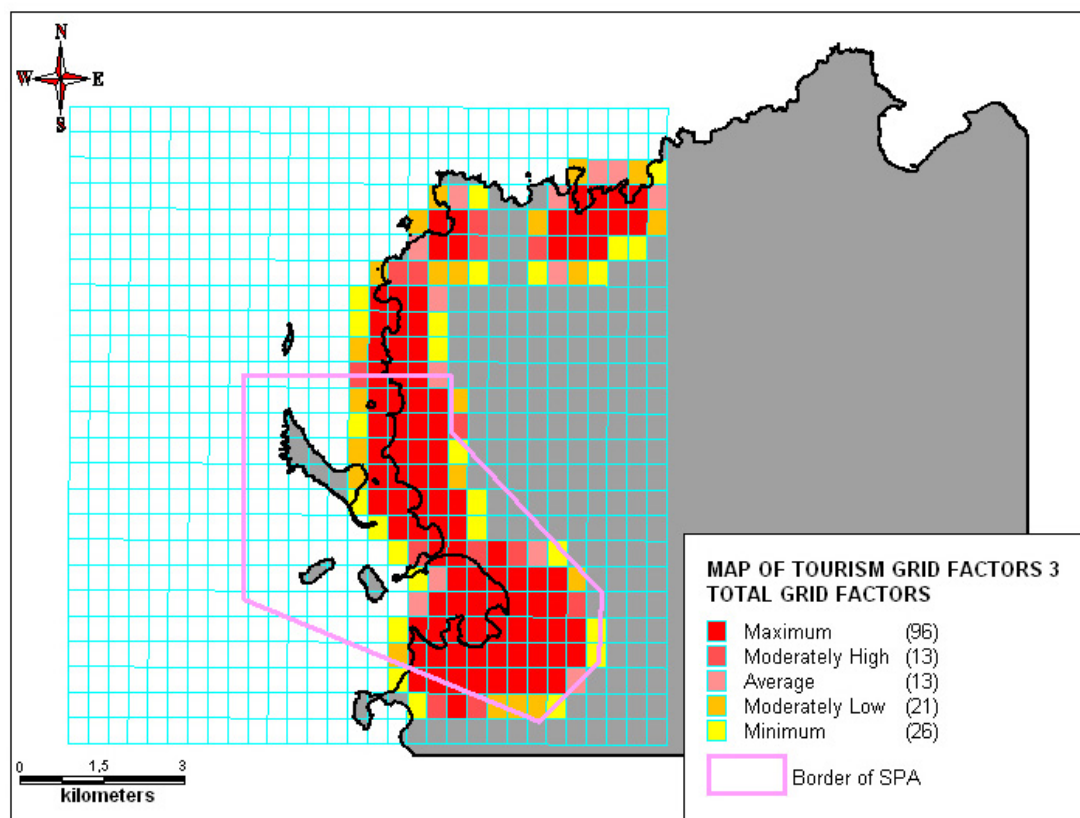


Figure 3.25 Map of tourism total grid factors.

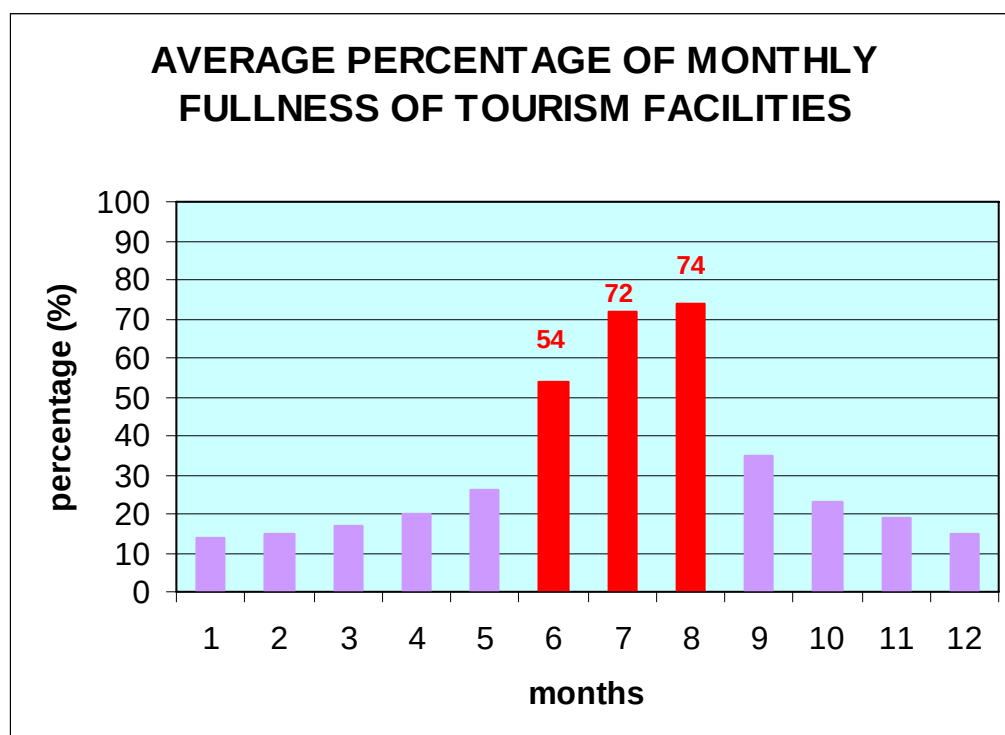


Figure 3.26 Monthly change in fullness of tourism facilities.

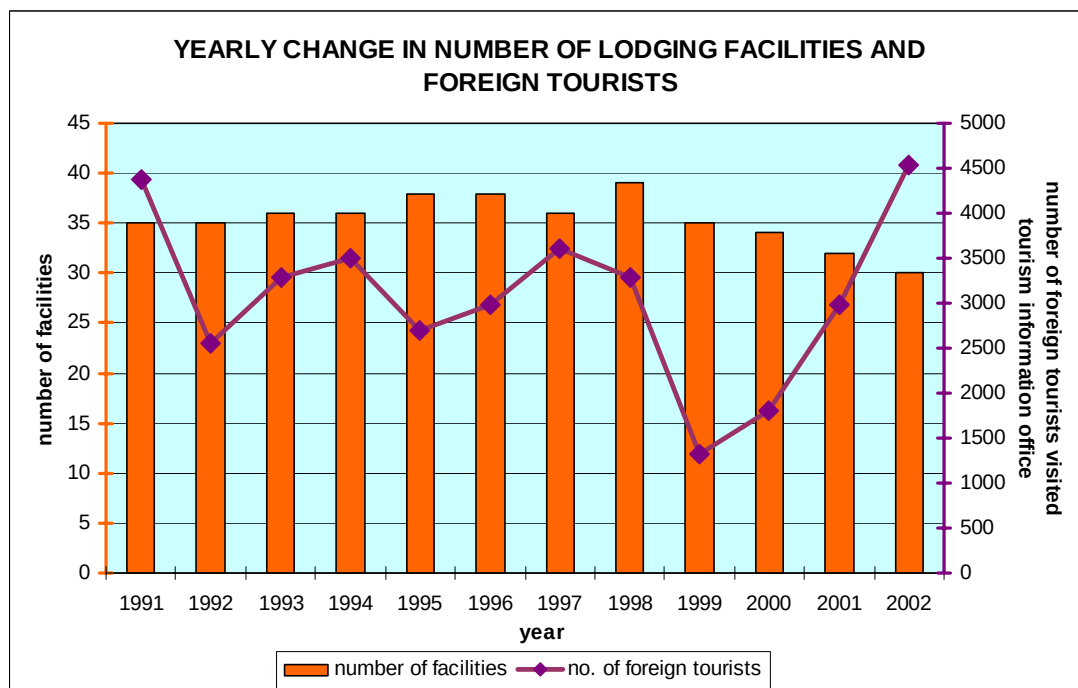


Figure 3.27 Temporal change in lodging facilities and foreign tourists.

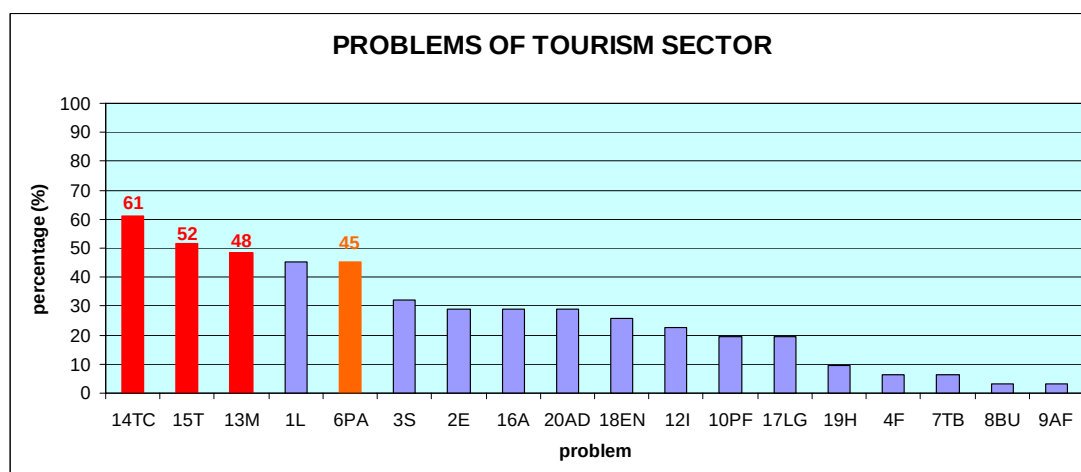


Figure 3.28 Problems met by tourism sector.

There is an increase trend in the number of foreign tourists after 1999 although the number of lodging facilities shows a slight decrease (Figure 3.27). Still, the major problem of the respondents is tourism capacity of the area (Figure 3.28 & Table 3.2). Two following major problems are transportation (52%) and military activities (48%). 14 respondents (45%) complained about the SPA and SIT areas as they restrict further investments.

Table 3.2 Problem list of tourism.

PROBLEM ID	PROBLEM	ABBREVIATION	COUNT	PERCENTAGE (%)
14	Tourism Capacity	14TC	19	61
15	Transportation	15T	16	52
13	Military	13M	15	48
1	Legal	1L	14	45
6	<i>Protected Areas</i>	6PA	14	45
3	Social	3S	10	32
2	Economical	2E	9	29
16	Advertisement	16A	9	29
20	Administrative	20AD	9	29
18	Environmental	18EN	8	26
12	Infrastructure	12I	7	23
10	Artisanal Fishing	10PF	6	19
17	Local Government	17LG	6	19
19	Historical	19H	3	10
4	Financial	4F	2	6
7	Touring Boats	7TB	2	6
8	Beach Usage	8BU	1	3
9	Amateur Fishing	9AF	1	3

3.4 Tour Boat Activity

Tour boat activity is the one uses the least area coverage among all human activities. It occupies 30 grid cells in core zone -1 cell with maximum value- (Figure 3.29); 89 grid cells in buffer zone -none have maximum value- (Figure 3.30); and 100 grid cells as total 3 of which have grid factors classified as maximum (Figure 3.31). The use density of the activity is maximum for three months: June, July and August (Figure 3.32). The major problems met by the activity are lack of infrastructure (75%), conflict with military activity (75%), legal issues (50%) and low tourism capacity (50%) (Figure 3.33 & Table 3.3). 38% of the respondents complain about the protected areas.

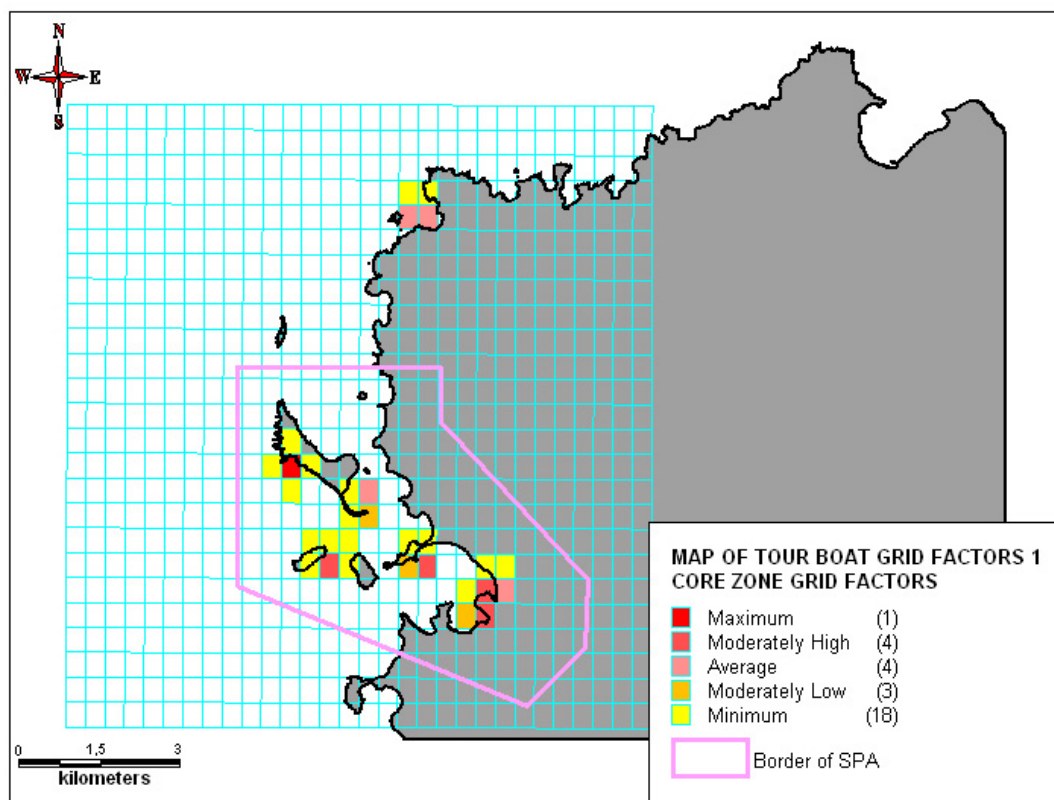


Figure 3.29 Map of tour boat core zone grid factors.

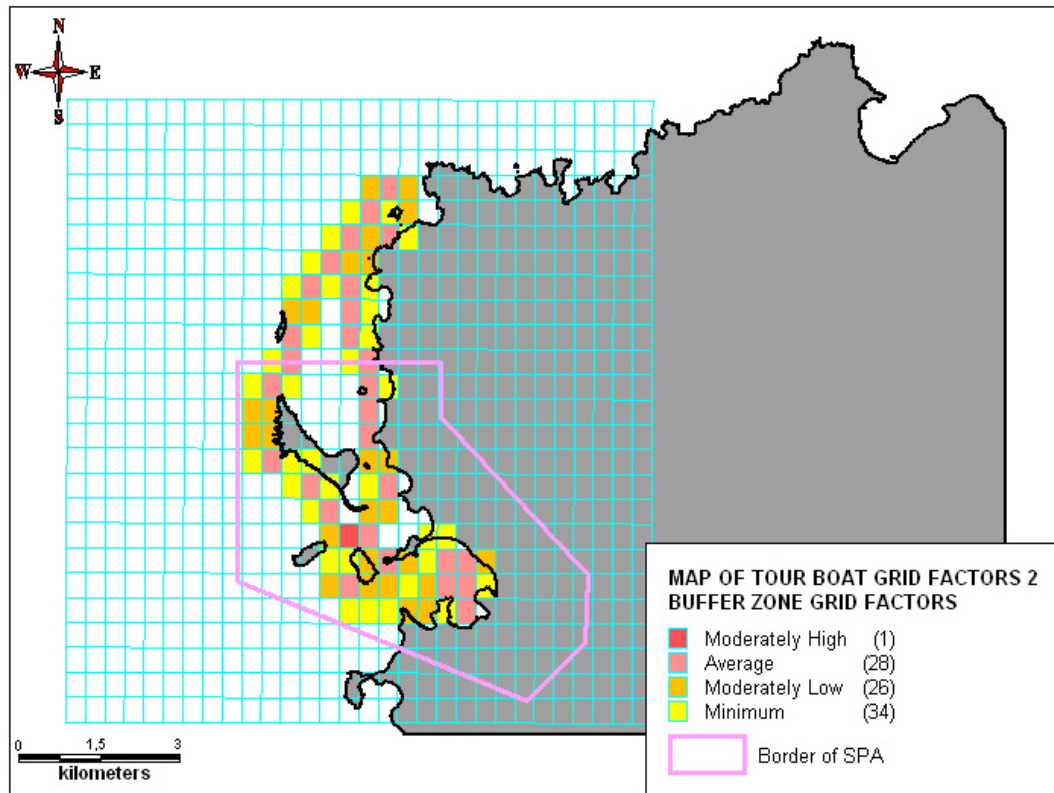


Figure 3.30 Map of tour boat buffer zone grid factors.

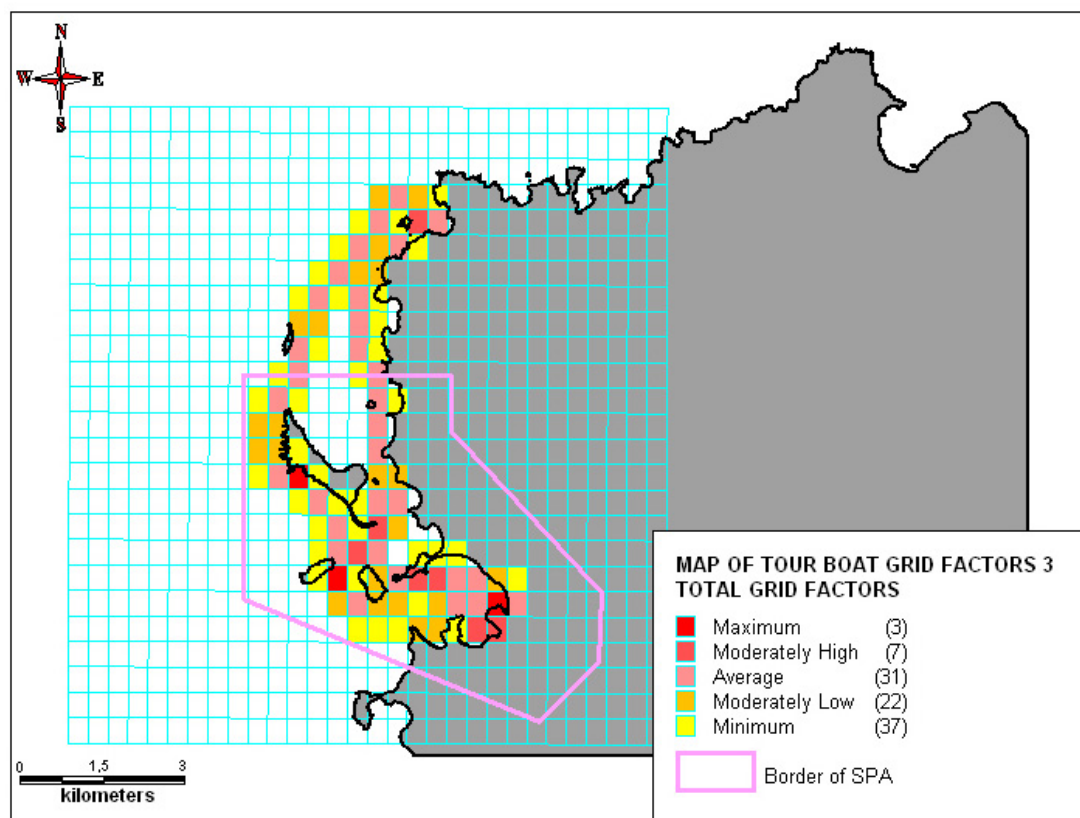


Figure 3.31 Map of tour boat total grid factors.

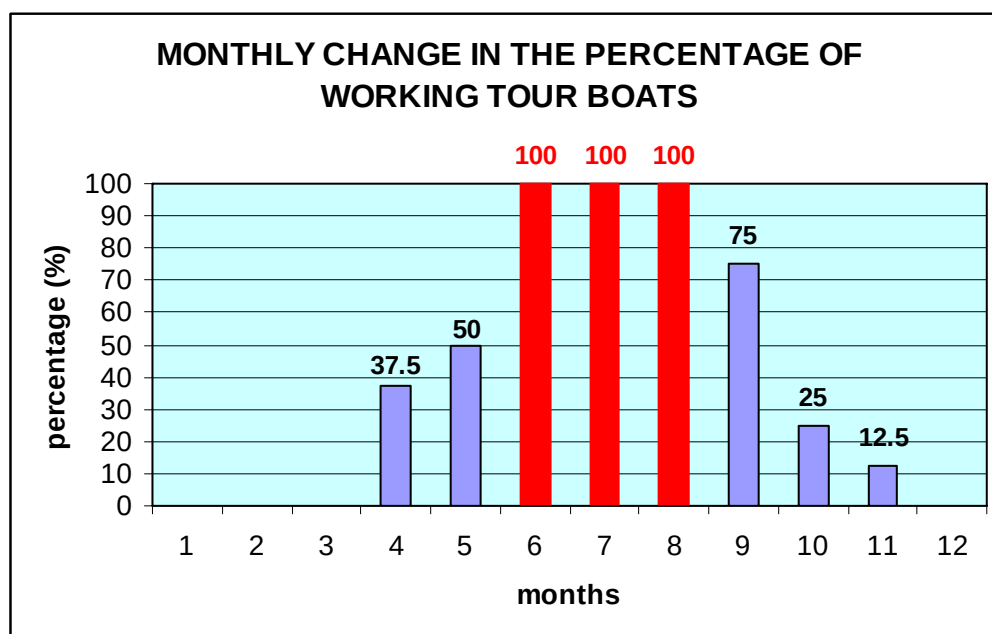


Figure 3.32 Monthly change in the percentage of working tour boats.

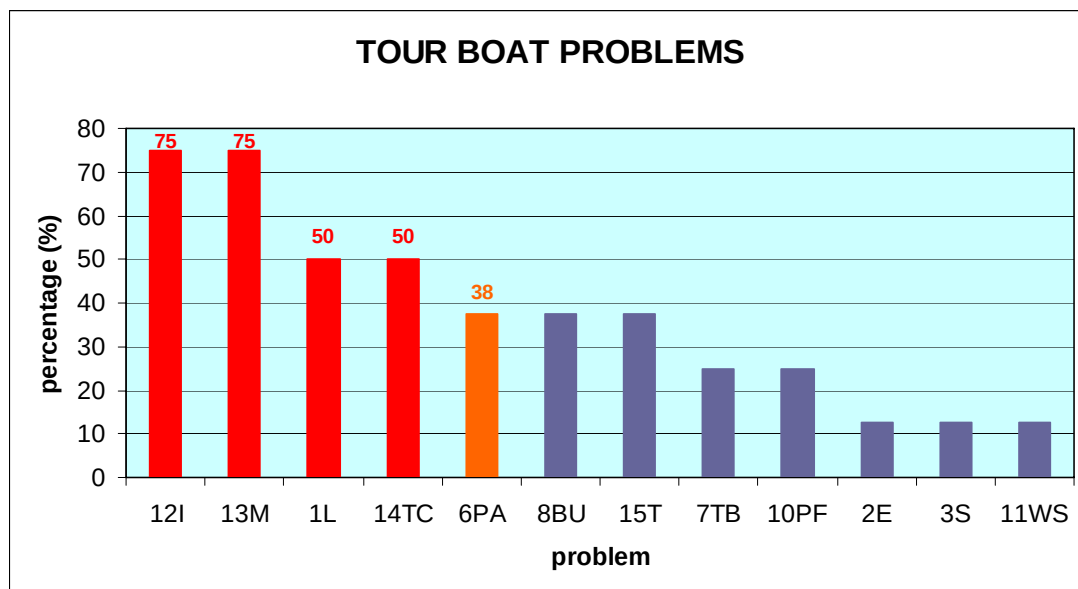


Figure 3.33 Problems met by tour boat activity.

Table 3.3 Problem list of tour boat activity.

PROBLEM ID	PROBLEM	ABBREVIATION	COUNT	PERCENTAGE (%)
12	Infrastructure	12I	6	75
13	Military	13M	6	75
1	Legal	1L	4	50
14	Tourism Capacity	14TC	4	50
6	<i>Protected Areas</i>	6PA	3	38
8	Beach Usage	8BU	3	38
15	Transportation	15T	3	38
7	Touring Boats	7TB	2	25
10	Artisanal Fishing	10PF	2	25
2	Economical	2E	1	13
3	Social	3S	1	13
11	Water Sports	11WS	1	13

3.5 Land Use Activities

Land use activities cover a large area mainly on the coastal strip. Activity occupies 122 core grid cells 9 of which have maximum grid factor (Figure 3.34), 360 buffer grid cells 239 of which have maximum grid factor (Figure 3.35) and 362 grid cells as total 292 of which have maximum grid factor (Figure 3.36). The entire coastline is densely used by the activities defined in land use.

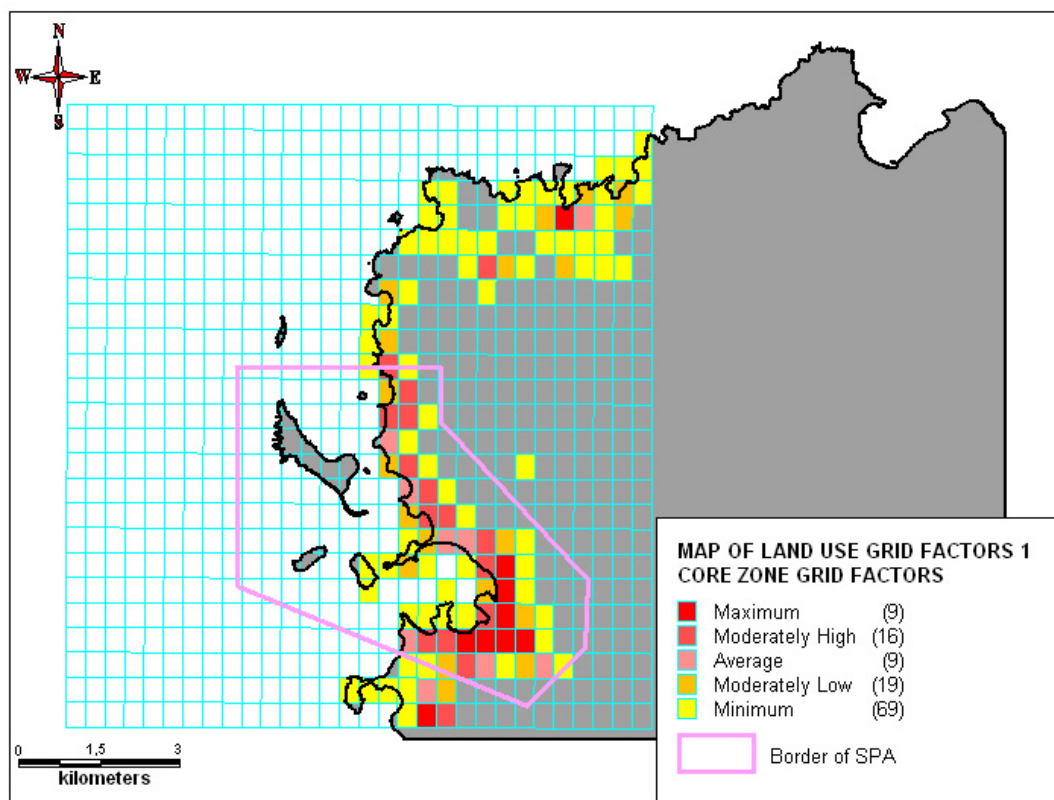


Figure 3.34 Map of land use core zone grid factors.

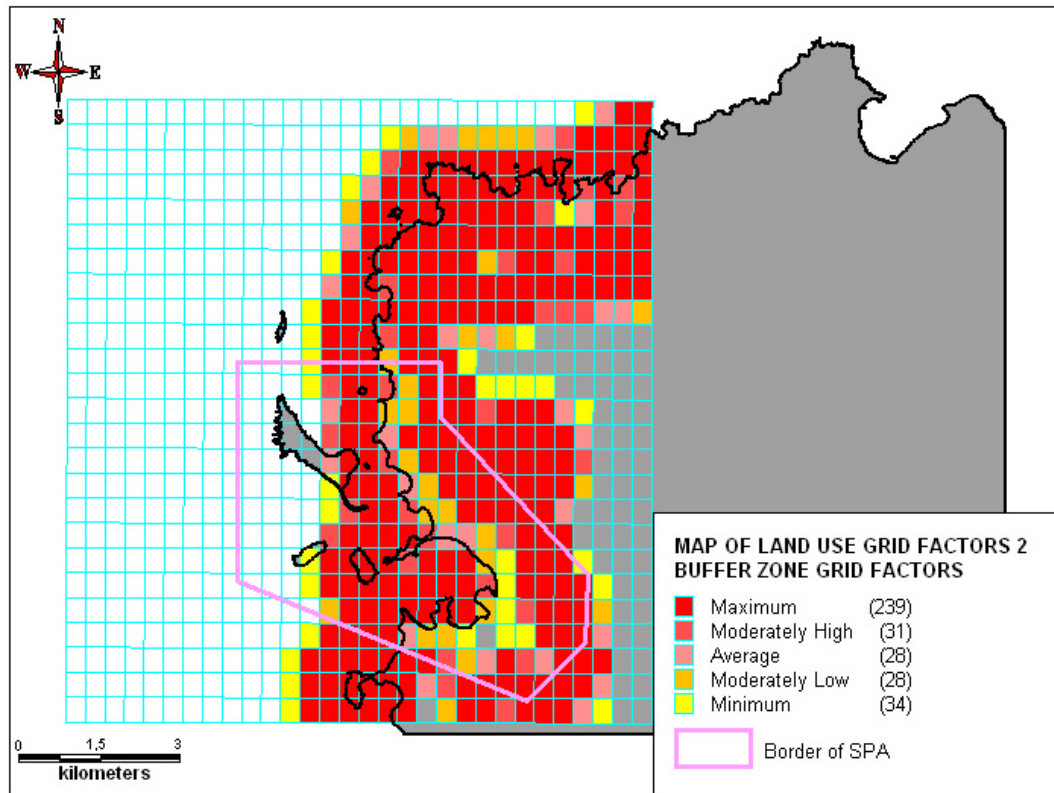


Figure 3.35 Map of land use buffer zone grid factors.

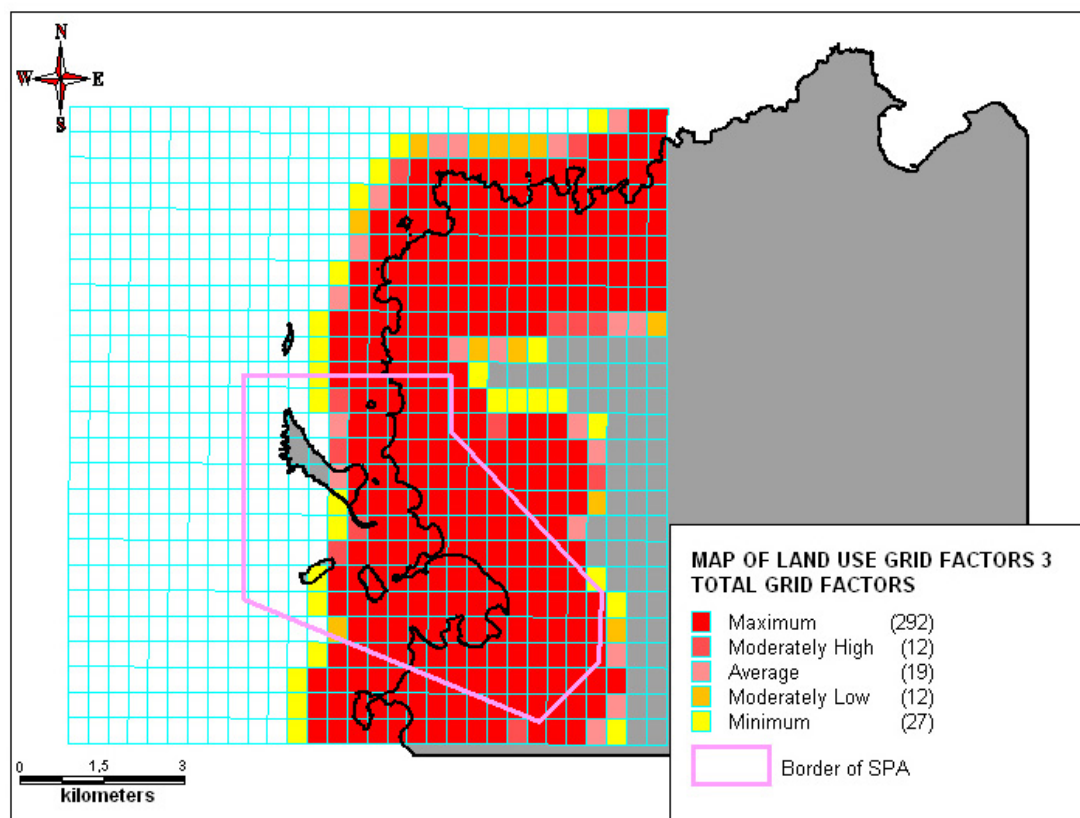


Figure 3.36 Map of land use total grid factors.

Table 3.4 & 3.5 give the distribution of grid cells used within each activity type mentioned from Section 3.1 to 3.5.

Table 3.4 Distribution of grid cell numbers according to activity type and grid factor.

	Number of Grid Cells Classified According to Grid Factors					
Activity Type	maximum	moderately high	average	moderately low	minimum	total number of grid cells used
MS buffer	444	21	11	16	22	514
MS core	3	3	4	8	22	40
MS total	462	13	8	13	22	518
F buffer	163	104	49	41	49	406
F core	93	35	31	31	50	240
F total	213	96	52	36	40	437
T buffer	87	17	15	24	26	169
T core	0	3	2	4	35	44
T total	96	13	13	21	26	169
TB buffer	0	1	28	26	34	89
TB core	1	4	4	3	18	30
TB total	3	7	31	22	37	100
LU buffer	239	31	28	28	34	360
LU core	9	16	9	19	69	122
LU total	292	12	19	12	27	362

Table 3.5 Distribution of grid cell percentages according to activity type and grid factor.

	Percentage of Grid Cells Classified According to Grid Factors (%)				
Activity Type	maximum	moderately high	average	moderately low	minimum
MS buffer	86.38	4.09	2.14	3.11	4.28
MS core	7.50	7.50	10.00	20.00	55.00
MS total	89.19	2.51	1.54	2.51	4.25
F buffer	40.15	25.62	12.07	10.10	12.07
F core	38.75	14.58	12.92	12.92	20.83
F total	48.74	21.97	11.90	8.24	9.15
T buffer	51.48	10.06	8.88	14.20	15.38
T core	0.00	6.82	4.55	9.09	79.55
T total	56.80	7.69	7.69	12.43	15.38
TB buffer	0.00	1.12	31.46	29.21	38.20
TB core	3.33	13.33	13.33	10.00	60.00
TB total	3.00	7.00	31.00	22.00	37.00
LU buffer	66.39	8.61	7.78	7.78	9.44
LU core	7.38	13.11	7.38	15.57	56.56
LU total	80.66	3.31	5.25	3.31	7.46

3.6 Interaction of Human Activities

The interactions between each activity were identified in terms of intersection areas among all activity types and were mapped in Section 2.4.3.2. These interactions are also analyzed from the point of each activity in order to demonstrate how much area of an activity is occupied by other activity types. This relation is presented in terms of percentages of intersection areas within activity zones and within union areas of each relation.

Fisheries interact with all other human activities except for three interaction types: fisheries core to tourism core (F_c-T_c), fisheries buffer to tourism core (F_b-T_c) and fisheries buffer to land use core (F_b-LU_c) interactions (Figure 3.37). Land use occupies maximum area within fisheries in fisheries core to land use buffer (F_c-LU_b) and fisheries buffer to land use buffer (F_b-LU_b) interaction types with a percentage of 48.24% and 22.25% respectively.

Tourism intersection areas are zero for tourism core to fisheries core (T_c-F_c), tourism core to fisheries buffer (T_c-F_b), tourism core to tour boat buffer (T_c-TB_b) and

tourism core to land use buffer (T_c-LU_b) interactions (Figure 3.38). Like fisheries, land use again occupies maximum area within tourism in core to core (T_c-LU_c) and buffer to buffer (T_b-LU_b) interactions. The percentages of occupied tourism areas by land use are 97.05% in core to core intersection and 8.12% in buffer to buffer intersection.

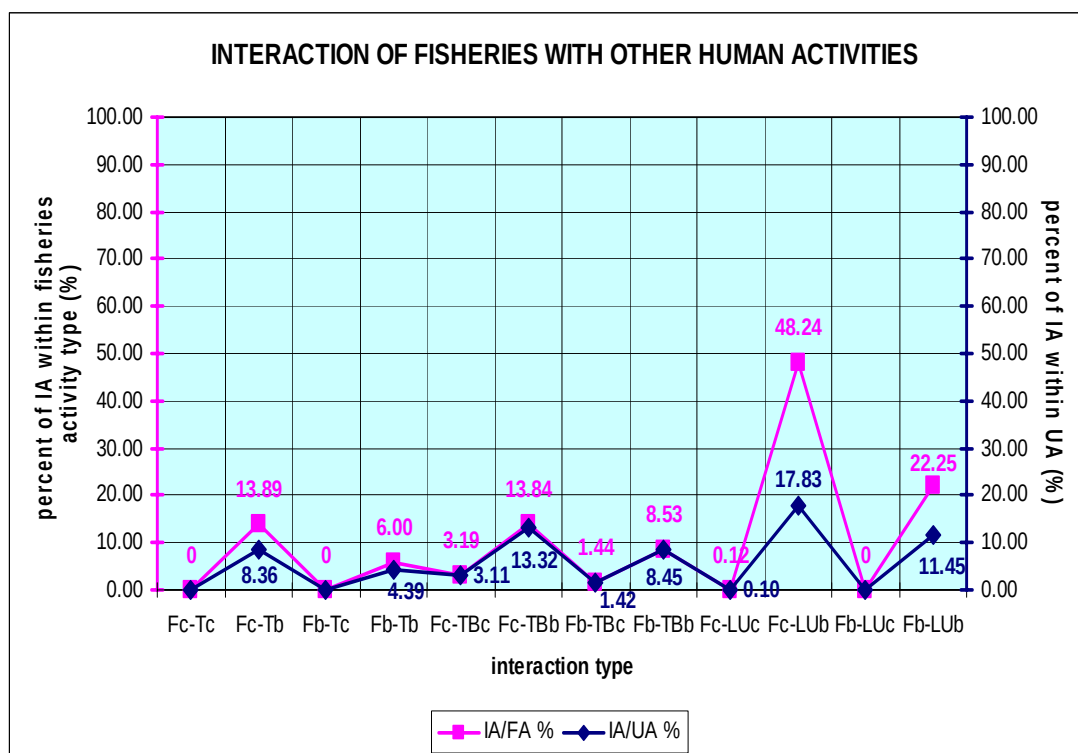


Figure 3.37 Interaction of fisheries with other human activities (IA: intersection area, UA: union area, FA: fisheries activity areas, capital letters in x-axis: F: fisheries, T: tourism, TB: tour boat, LU: land use, small letters in x-axis: c: core zone, b: buffer zone).

Tour boat activity does not intersect with other human activities in tour boat buffer to tourism core (TB_b-T_c) and tour boat buffer to land use core (TB_b-LU_c) interaction types (Figure 3.39). The maximum occupation rates are calculated for tour boat buffer to fisheries buffer (TB_b-F_b) and tour boat core to land use buffer (TB_c-LU_b) interaction types. The percentages are 90.33% for the former and 85.05% for the latter.

Interaction of land use activity with other activities is empty set for land use core to fisheries buffer (LU_c-F_b), land use buffer to tourism core (LU_b-T_c) and land use

core to tour boat buffer (LU_c-TB_b) interactions (Figure 3.40). Land use core to tourism buffer (LU_c-T_b) intersection area occupies the maximum area in land use activities (66.89%) and is followed by land use buffer to tourism buffer (LU_b-T_b) with an occupation rate of 29.31%.

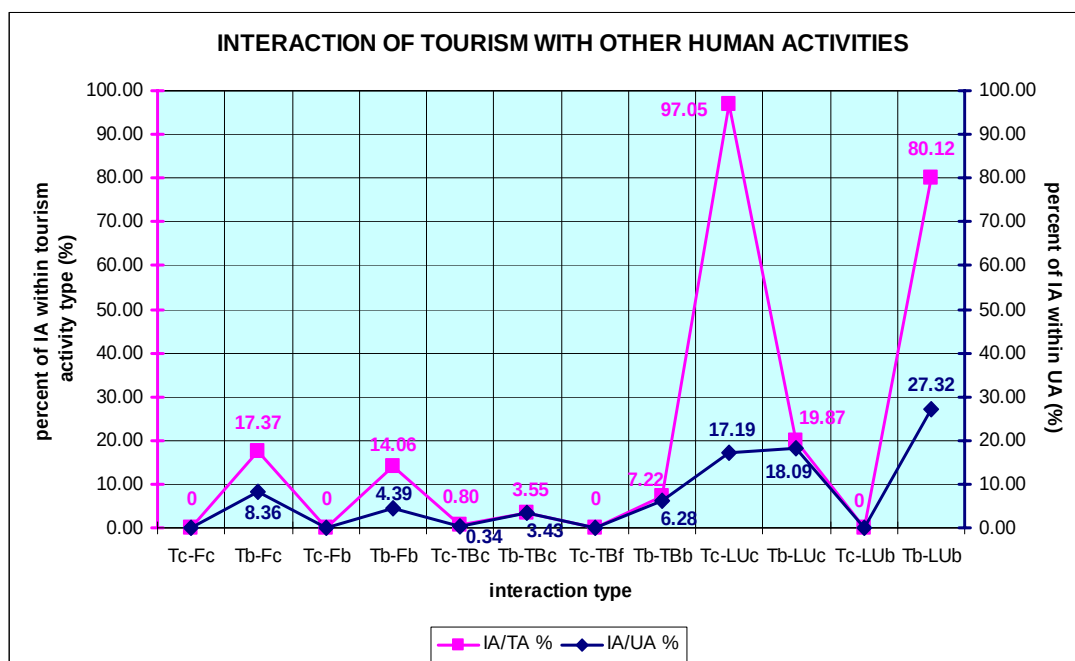


Figure 3.38 Interaction of tourism with other human activities (IA: intersection area, UA: union area, TA: tourism activity areas).

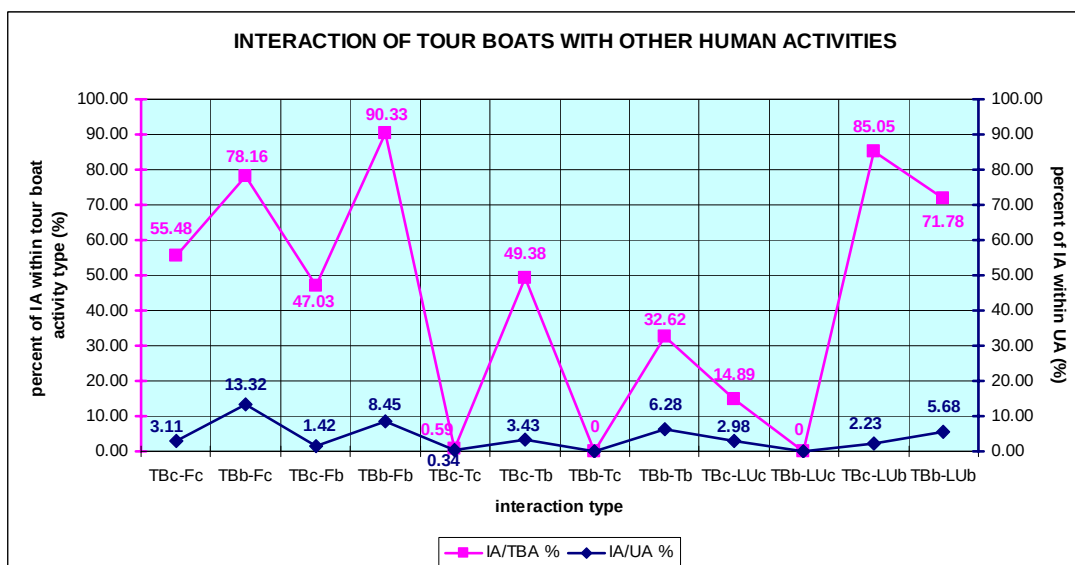


Figure 3.39 Interaction of tour boats with other human activities (IA: intersection area, UA: union area, TBA: tour boat activity areas).

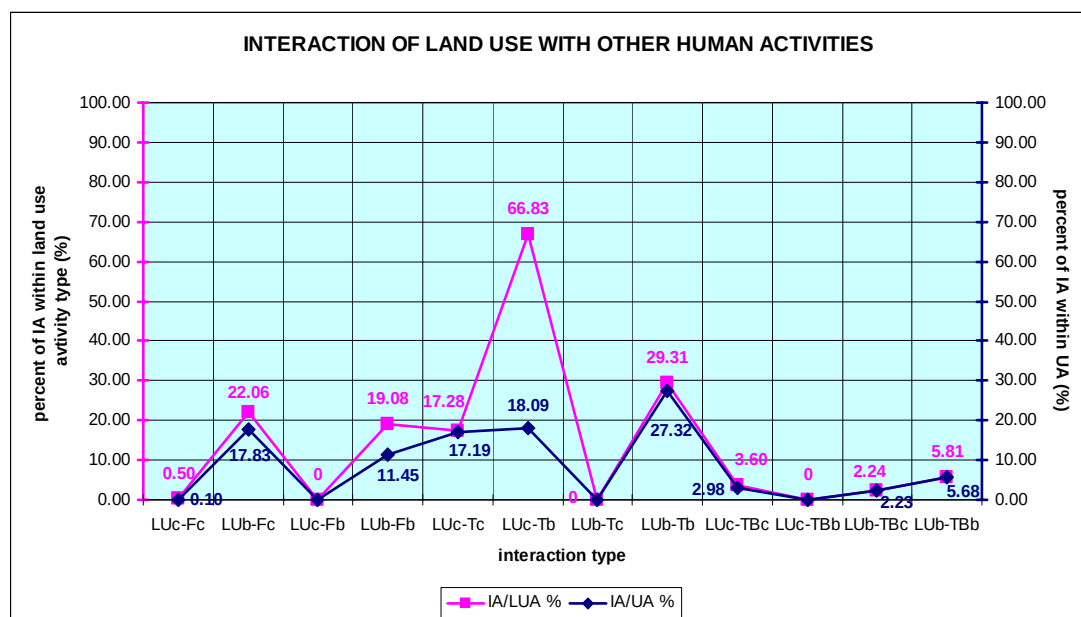


Figure 3.40 Interaction of land use with other human activities (IA: intersection area, UA: union area, LUA: land use activity areas, capital letters in x-axis: F: fisheries, T: tourism, TB: tour boat, LU: land use, small letters in x-axis: c: core zone, b: buffer zone).

3.7 Cumulative Zonal Pressure of Human Activities

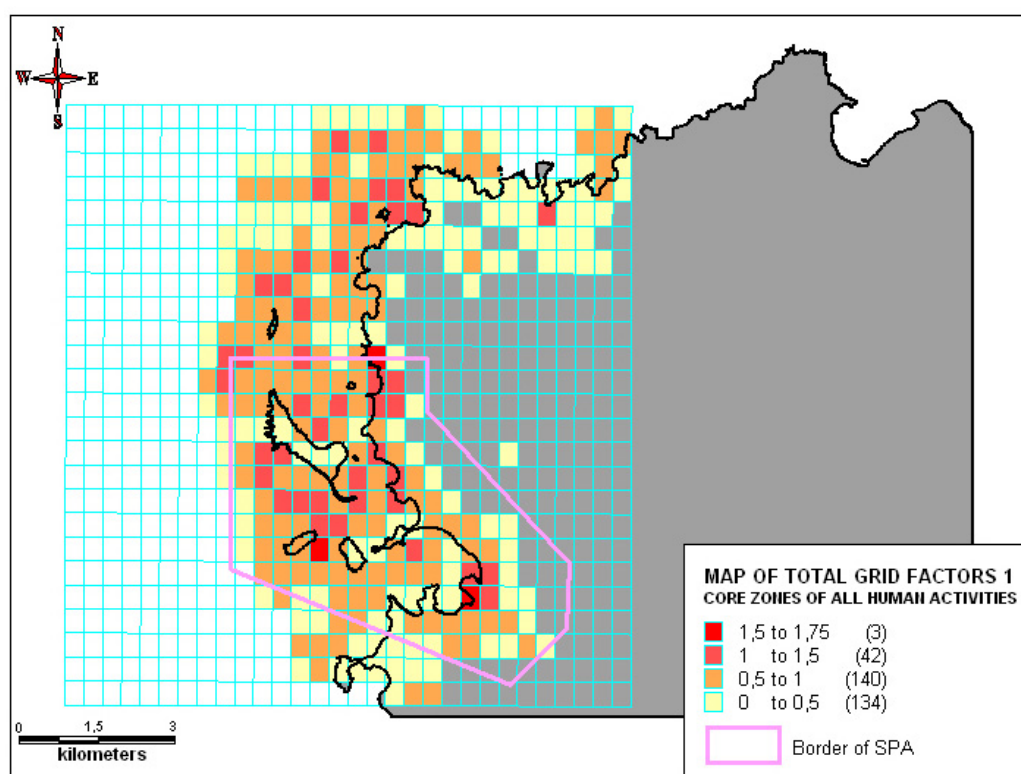


Figure 3.41 Map of cumulative of grid factors for all human core zones.

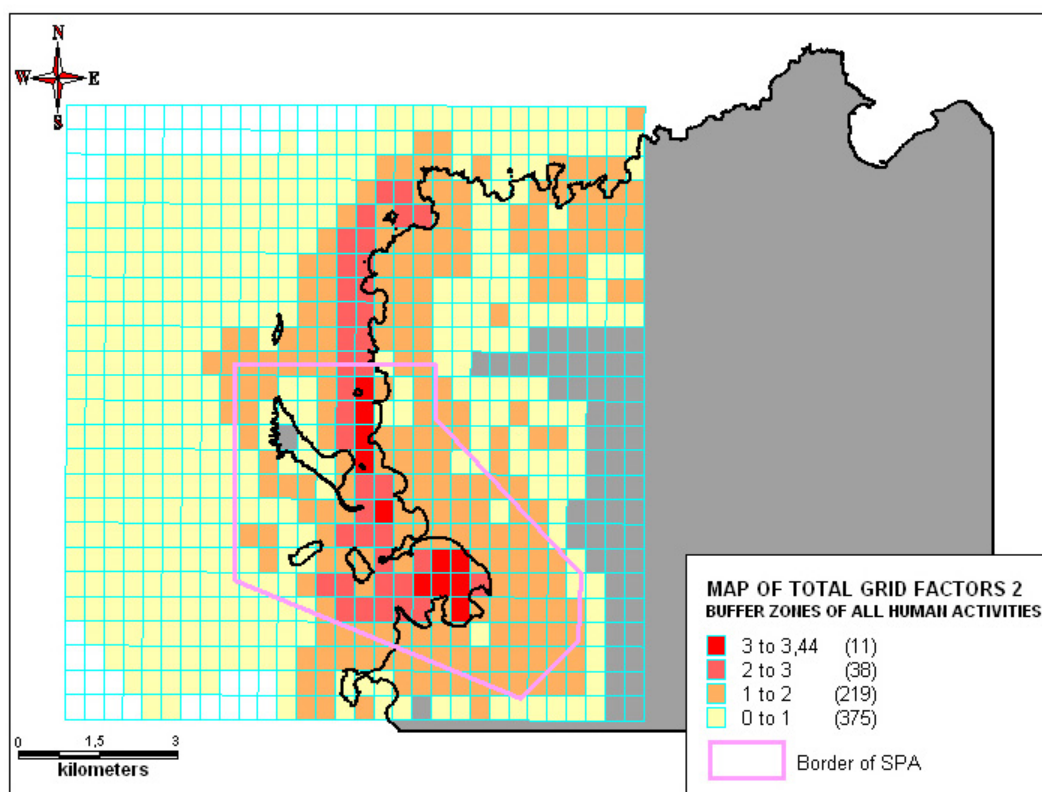


Figure 3.42 Map of cumulative of grid factors for all human buffer zones.

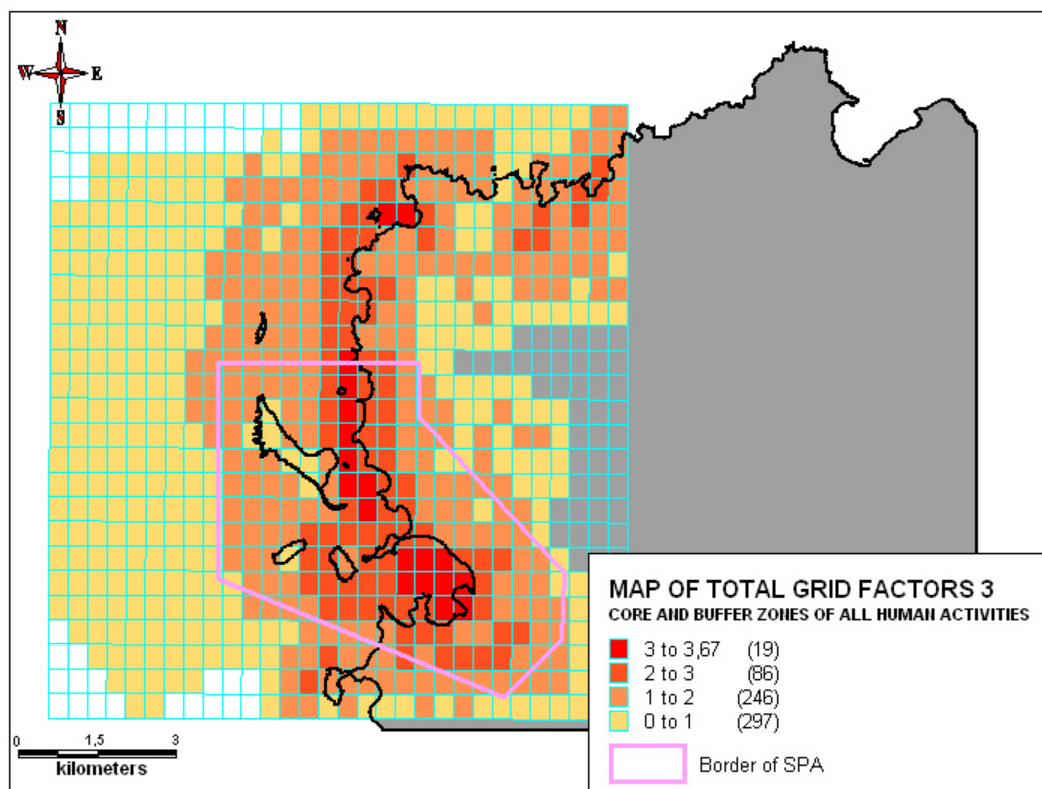


Figure 3.43 Map of cumulative of grid factors for all human activity types.

The cumulative zonal pressure of human activities is expressed in terms of total of grid factors. The core zones of all human activities use 319 grid cells and the cumulative of grid factors for core zones gives 45 grid cells having grid factors between 1 and 1.75 (Figure 3.41, Table 3.6 & 3.7). 274 grid cells have lower grid factors. The buffer zones use 643 grid cells 268 of which have grid factors between 1 and 3.44 (Figure 3.42). When core and buffer zones are considered at the same time, the number of grid cells used increases to 648 and 351 of these exceed 1 for their grid factors (Figure 3.43).

Table 3.6 Distribution of grid cell numbers according to zone type and total grid factors.

Number of Grid Cells Classified According to Total Grid Factors of Human Activity Types					
Zone Type	GF>3	2<GF<3	1<GF<2	1>GF	total number of grid cells used
core	0	0	45	274	319
buffer	11	38	219	375	643
total	19	86	246	297	648

Table 3.7 Distribution of grid cell percentages according to zone type and total grid factors.

Percentage of Grid Cells Classified According to Total Grid Factors of Human Activity Types				
Zone Type	GF>3	2<GF<3	1<GF<2	1>GF
core	0.00	0.00	14.11	85.89
buffer	1.71	5.91	34.06	58.32
total	2.93	13.27	37.96	45.83

3.8 Zonal Diversity of Human Activities

Activity diversity within each grid cell is mapped for core, buffer and union of zones. Core zone diversity is maximum (four activities) at 4 grid cells -three at the centre of the district, one at the bay in front of the Kartdere Valley- with 4 human activities (Figure 3.44, Tables 3.8 & 3.9). Buffer zone diversity is maximum at 36 grid cells at the coastal strip (Figure 3.45). When the union of core and buffer zones is considered, it is determined that 42 grid cells show maximum diversity (Figure 3.46) followed by 59 grid cells containing any type of three human activities, both occupying all the coastline from Deveboynu Cape to Aslanburnu Cape.

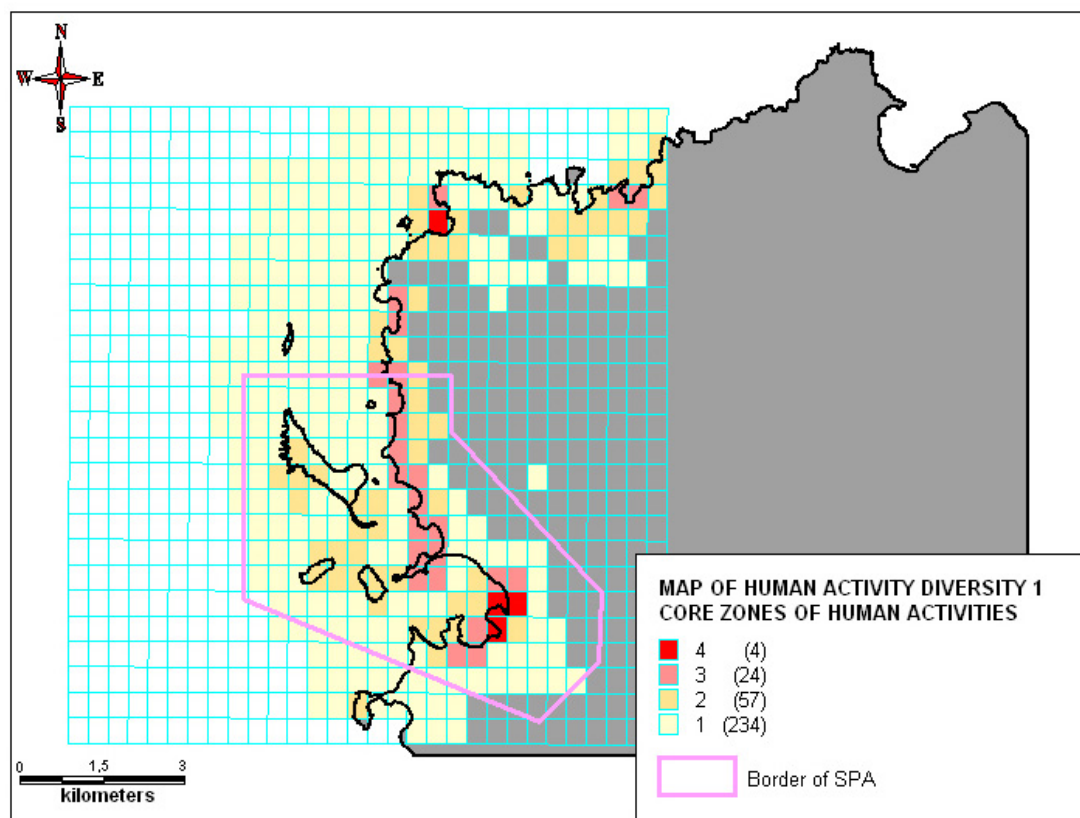


Figure 3.44 Map of human activity diversity for core zones.

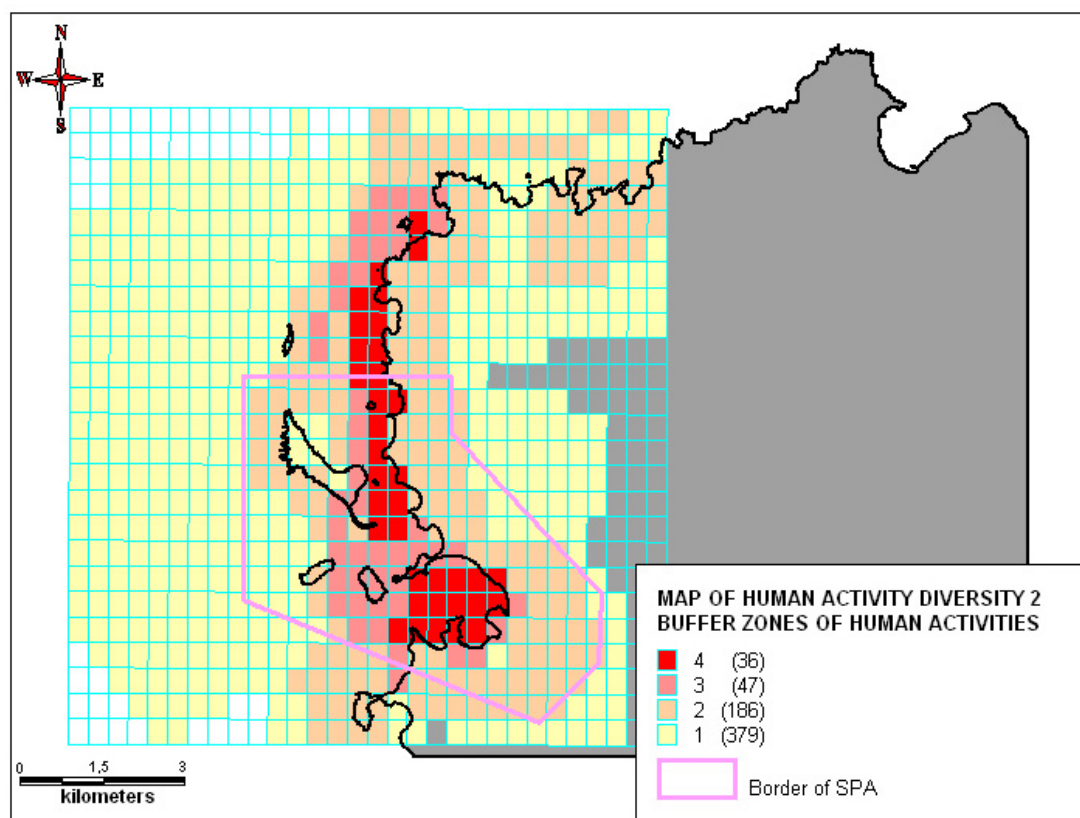


Figure 3.45 Map of human activity diversity for buffer zones.

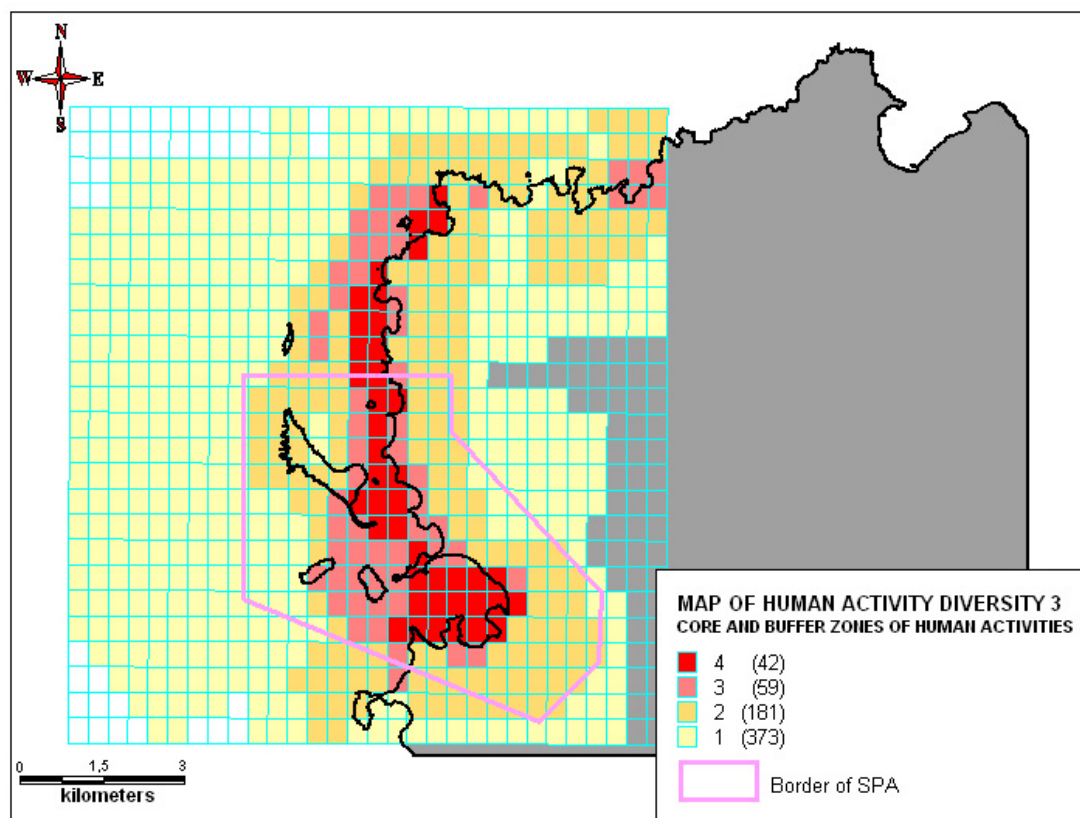


Figure 3.46 Map of total human activity diversity.

Table 3.8 Distribution of grid cell numbers according to zone type and activity diversity.

Number of Grid Cells Classified According to Number of Human Activity Types					
Zone Type	4	3	2	1	total number of grid cells used
core	4	24	57	234	319
buffer	36	47	186	379	648
total	42	59	181	373	655

Table 3.9 Distribution of grid cell percentages according to zone type and activity diversity.

Percentage of Grid Cells Classified According to Number of Human Activity Types				
Zone Type	4	3	2	1
core	1.25	7.52	17.87	73.35
buffer	5.56	7.25	28.70	58.49
total	6.41	9.01	27.63	56.95

3.9 Zonal Economics

The yearly income of fisheries according to landing data shows that the activity uses the largest area among others, but has the least yearly income per grid cell (Figure 3.47). The maximum income of the activity per grid cell is 6,479.07 YTL/year and the average is 4,647.60 YTL/year (Table 3.10). Tour boat activity uses the least area and the maximum income and mean income per grid cell are 16,754.82 YTL/year and 6,000.01 YTL/year respectively (Figure 3.48). Tourism has the maximum annual income per grid cell (Figure 3.49) with the value 166,625.14 YTL/year/grid cell and the mean income is 117,824.43 YTL/year/grid cell.

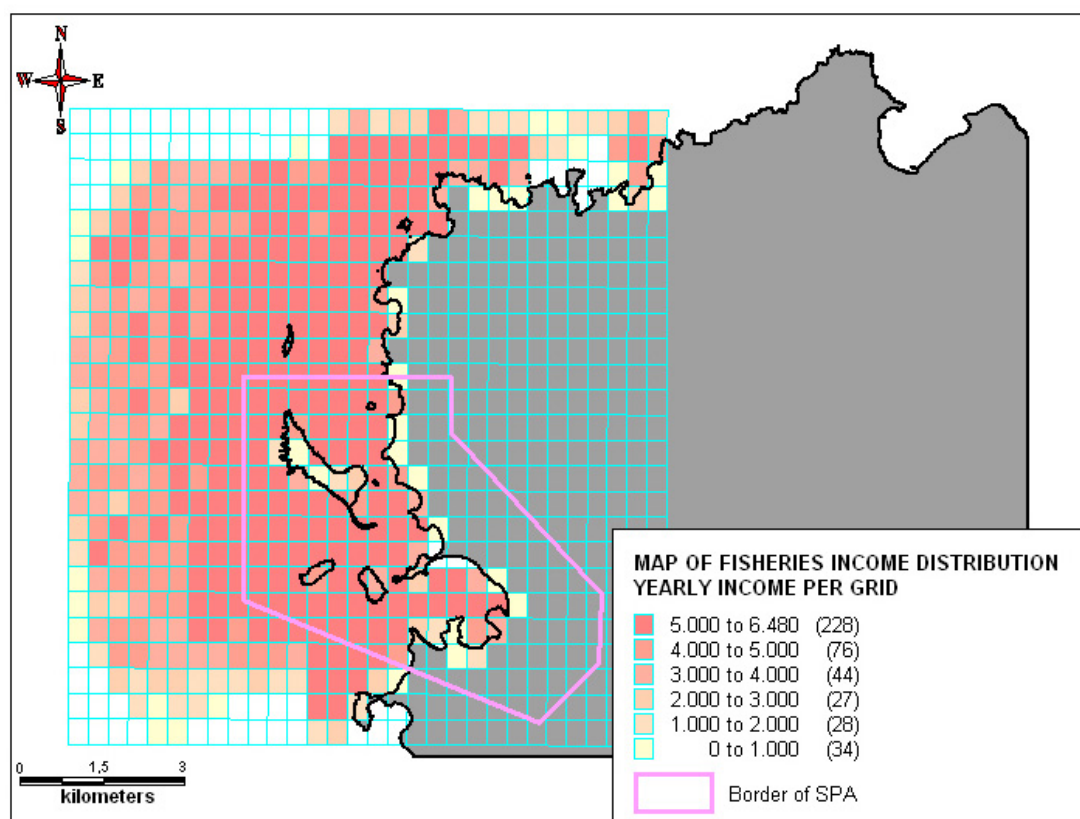


Figure 3.47 Map of fisheries zonal economics.

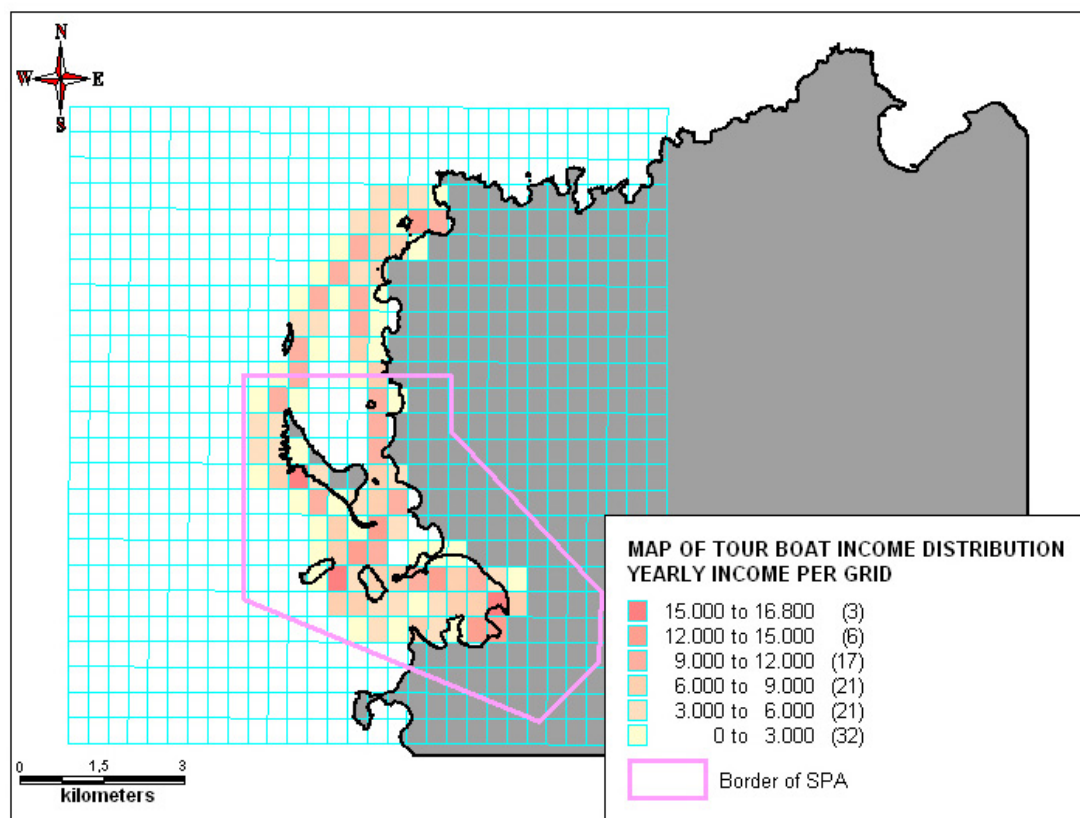


Figure 3.48 Map of tour boat activity zonal economics.

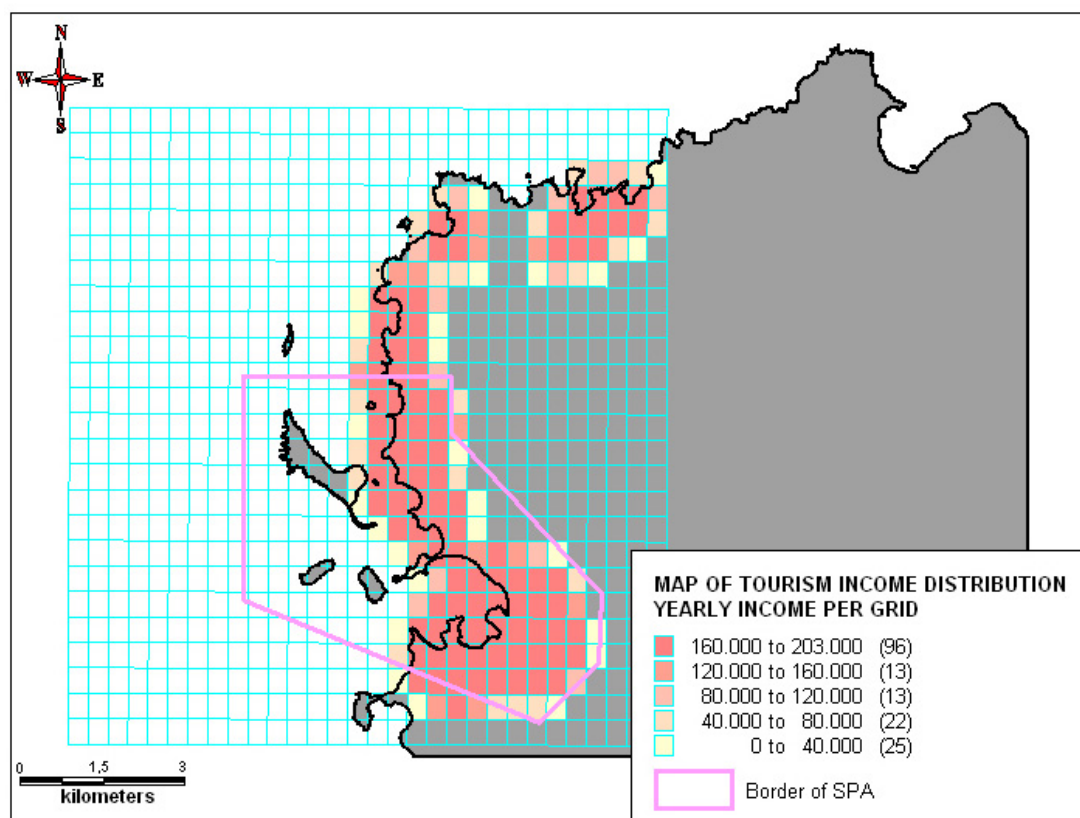


Figure 3.49 Map of tourism zonal economics.

Table 3.10 Annual income statistics.

Category of Statistics	Fisheries	Tourism	Tour Boat
Number of grid cells used	437.00	169.00	100.00
Minimum yearly grid cell income	3.81	10.21	10.00
Maximum yearly grid cell income	6,479.07	166,625.14	16,754.82
Total yearly income	2,031,002.83	19,912,329.27	600,000.73
Mean yearly income per grid cell	4,647.60	117,824.43	6,000.01
Standard deviation	1,971.12	59,078.54	4,212.96
Coefficient of variation	42.41	50.14	70.22

CHAPTER FOUR

DISCUSSION AND CONCLUSIONS

4.1 The Criteria Developed

The survival of even one individual is very important as it contributes to almost 1% of the population inhabiting in Turkish coasts (104 individuals are estimated by Güçlüsoy et. al, 2004) Thus, two criteria are developed for area management considering species specific issues that may contribute to the recovery of the species. These are:

- **Elimination of all type of human activities within the defined core zones of *M. monachus*.** Since these zones were defined as zero tolerance areas for the species, it is concluded that the core zones have to be closed to all negative effects that may be caused by direct human interference. Thus, a zonation should be made providing that both core and buffer zones of human activities does not intersect the core zones of the species in order to decrease habitat degradation. This zonation should be based on zeroing of total grid factors in the grid cells which intersect with the core zones.
- **Minimization of human interference in the defined buffer zone of *M. monachus* by zonal regulations.** This interaction-allowed zone includes the feeding and movement areas of the species where the interactions are diverse and distributed. A zonation should be made in the marine area in order to decrease the total human pressure on the species. This zonation should consider the distribution of the incidental sightings (Figure 3.10) as they are effort-free sightings collected from the public; they are the reports of actual interactions.

A zonation plan, which also designs core and buffer zones together with no-entry and no-take zones within the SPA, should be developed considering both of these two criteria together with the synergistic and antagonistic interrelations.

4.1.1 Mainland Core Zone of *M. monachus*

The zone is characterized by 16 grid cells all of which intersect at least one core or buffer human activity type. The numbers of grid cells used by each activity are given in Table 4.1. The maximum human core activity diversity within these cells is 3 (Figure 4.1) whereas buffer activity diversity is 4 (Figure 4.2). When the total of activity types is considered, the coastal strip is observed to be critical for zoning since the diversity of human activities is 3 or 4 along the coastline (Figure 4.3). The cumulative of the grid factors resulted from this character of usage is 37.52 (Figures 4.4 to 4.6). The zeroing of this value will result in a reduction in annual income of fisheries by 2.25% (Figure 4.7), of tourism by 10.58% (Figure 4.8) and of tour boat activity by 5.42% (Figure 4.9).

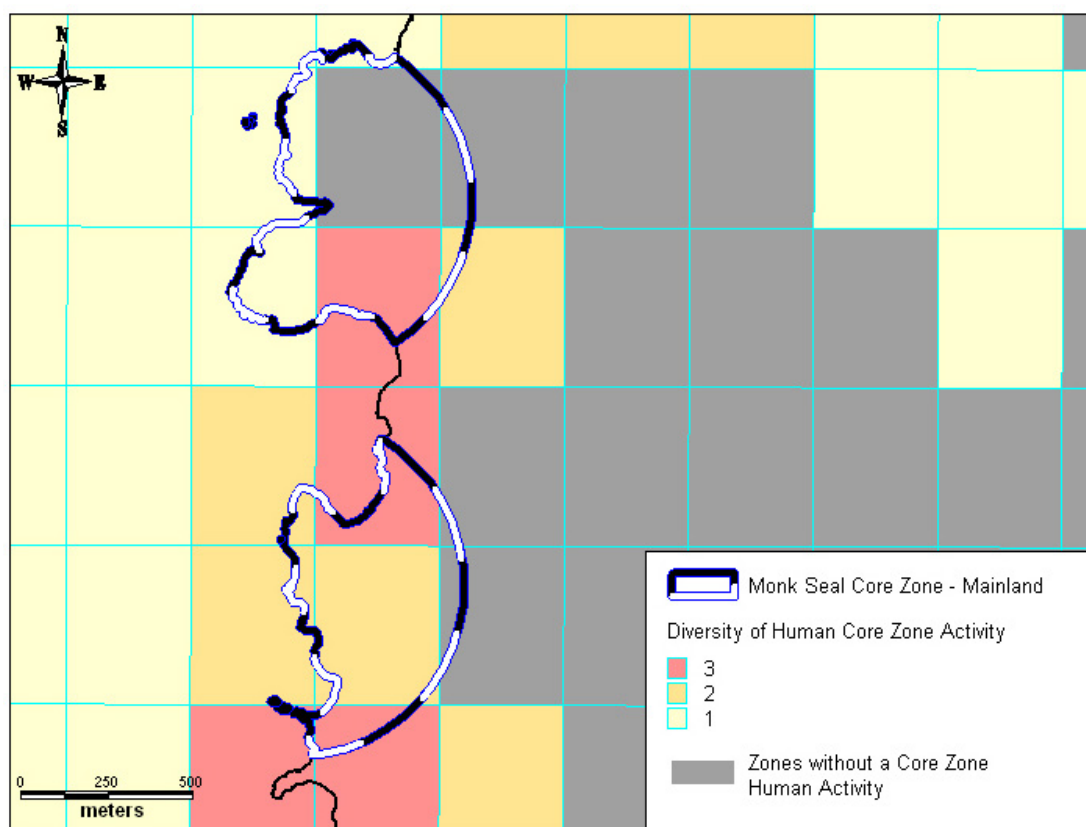


Figure 4.1 Map of diversity of human core zone activities at mainland core zone.

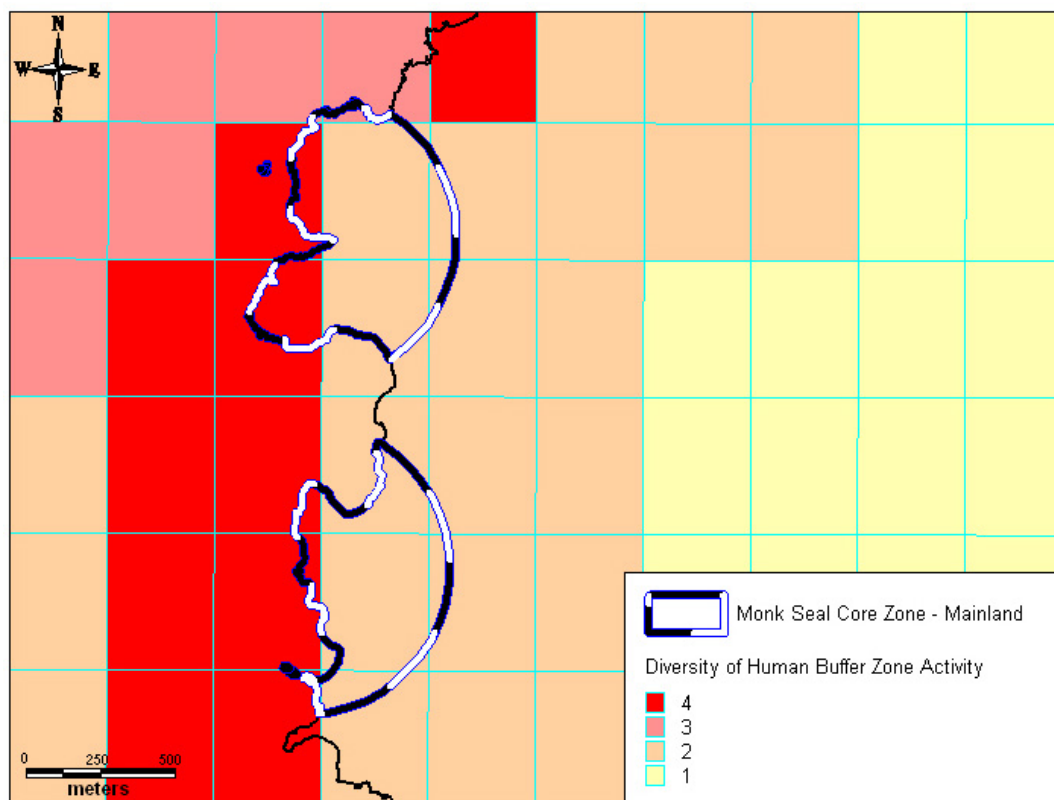


Figure 4.2 Map of diversity of human buffer zone activities at mainland core zone.

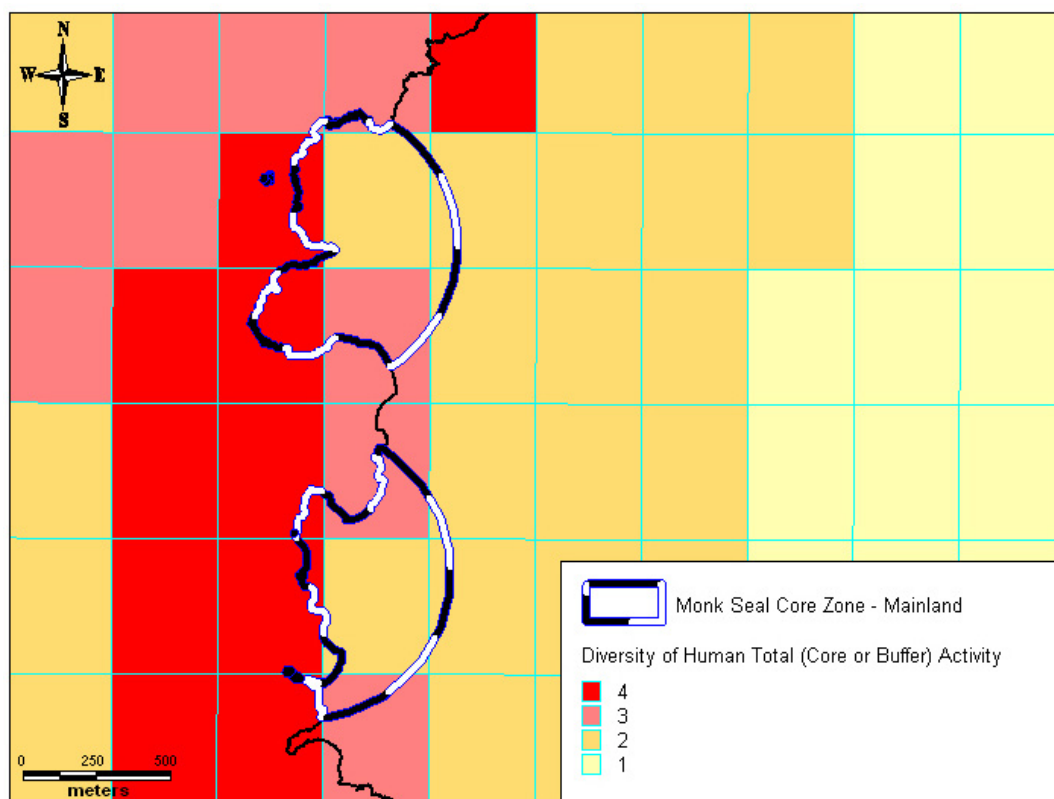


Figure 4.3 Map of diversity of human activities at mainland core zone.

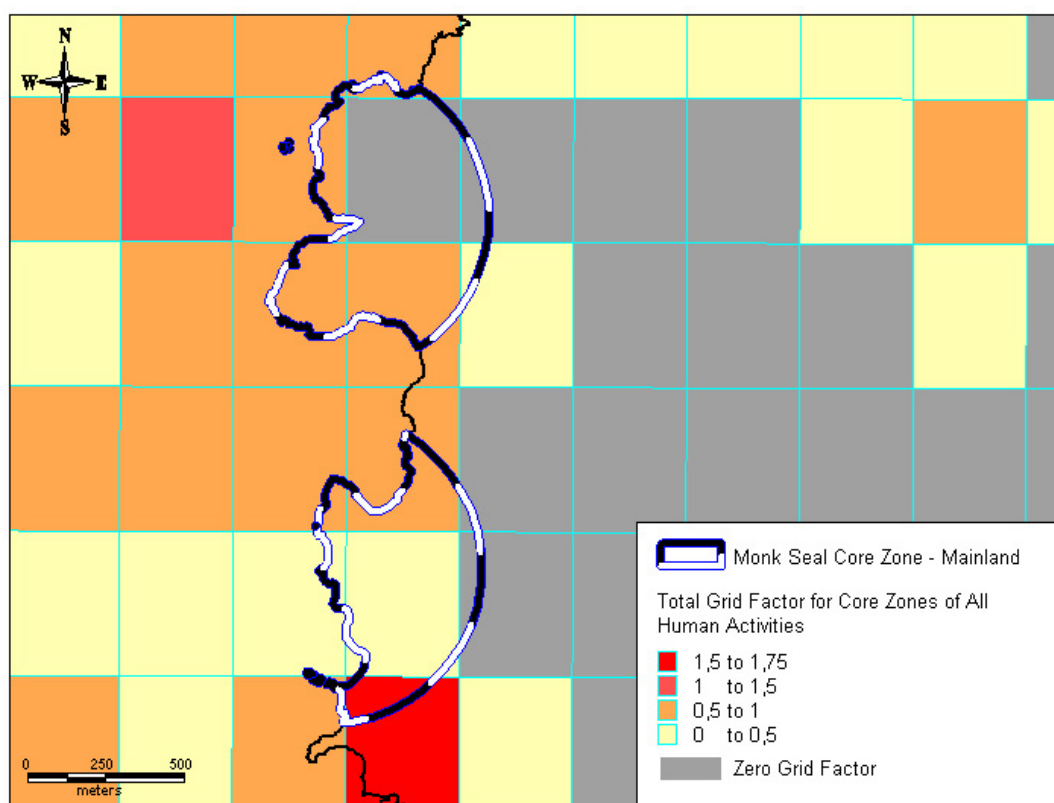


Figure 4.4 Map of total core grid factors at mainland core zone.

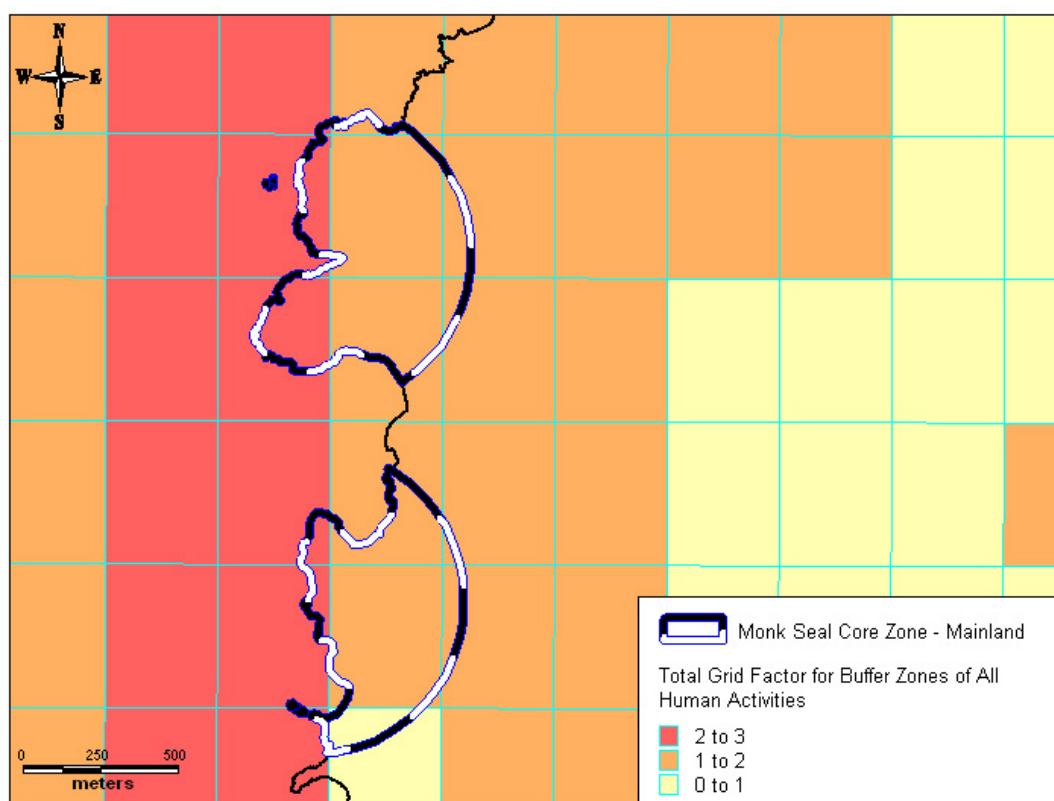


Figure 4.5 Map of total buffer grid factors at mainland core zone.

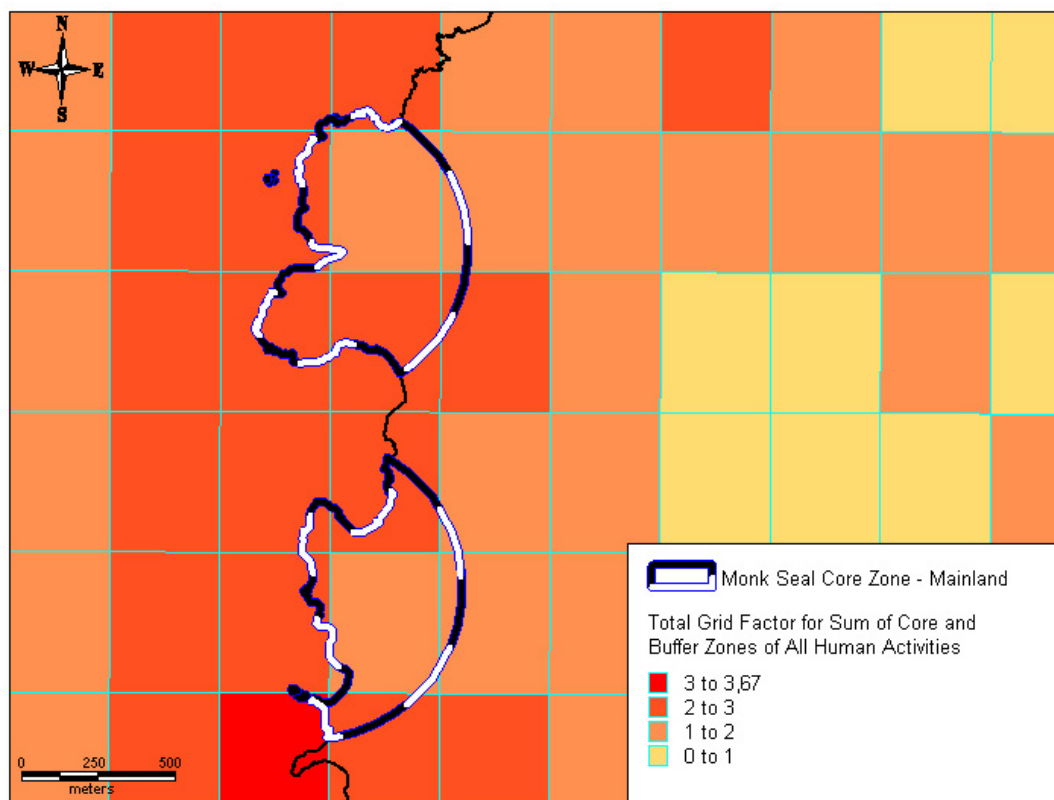


Figure 4.6 Map of total (core + buffer) grid factors at mainland core zone.

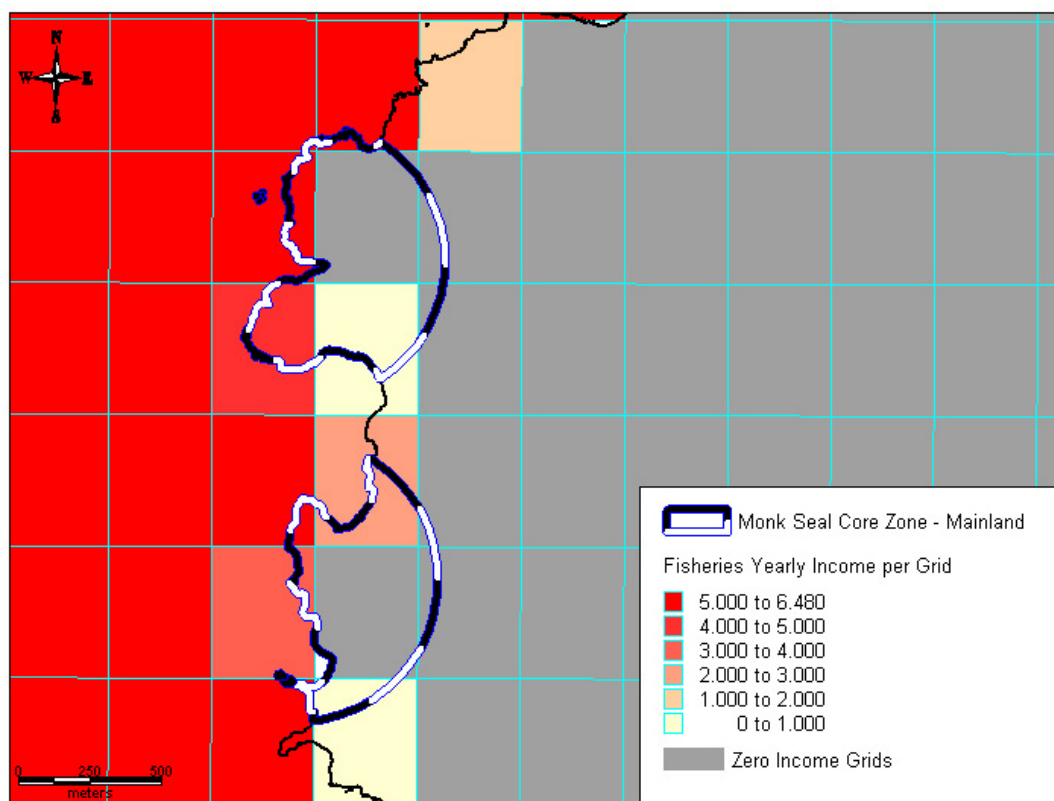


Figure 4.7 Map of annual zonal income of fisheries at mainland core zone.

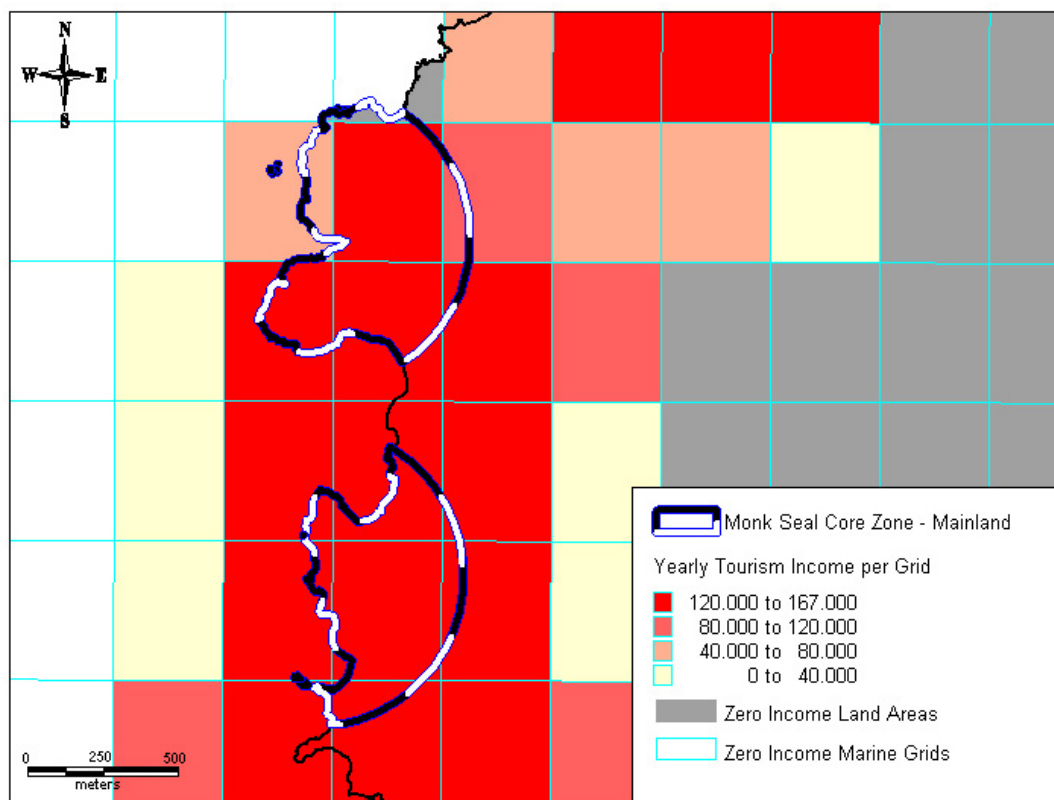


Figure 4.8 Map of annual zonal income of tourism at mainland core zone.

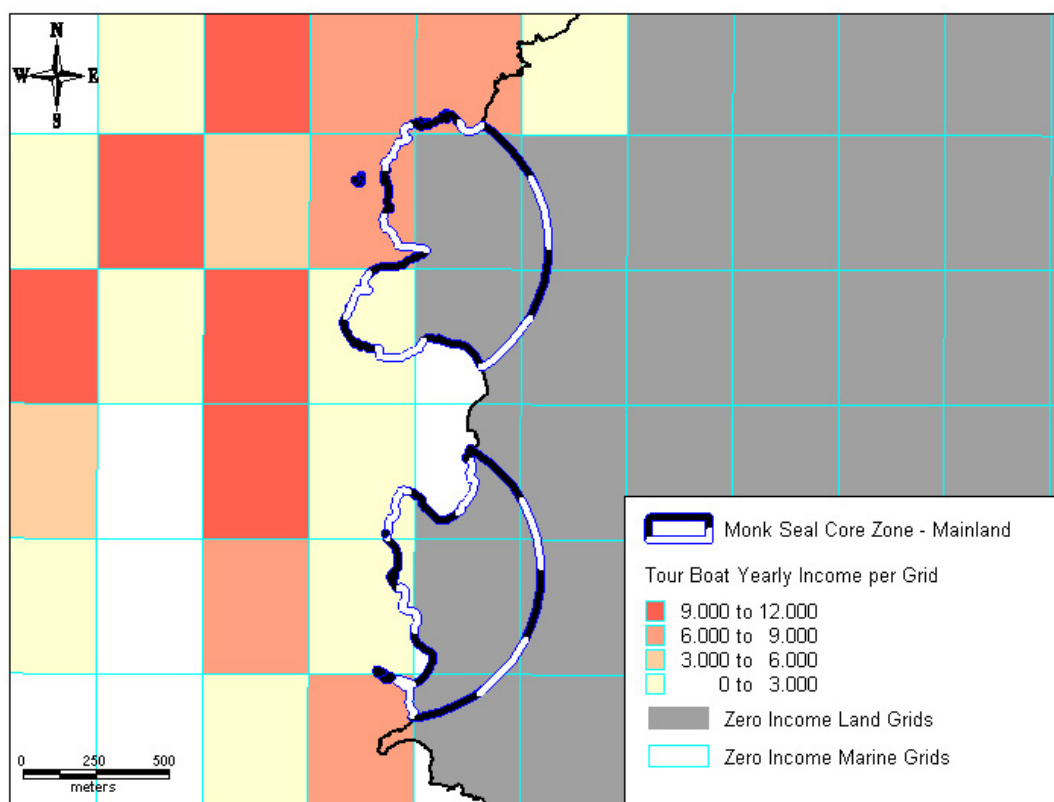


Figure 4.9 Map of annual zonal income of tour boat activity at mainland core zone.

Table 4.1 Human on mainland core zone (N: number of grid cells used, GF_T: cumulative grid factor, I_Z: annual income of used grid cells, I_T: annual total income of the sector)

	Fisheries	Tourism	Tour Boat	Land Use
N	10.00	14.00	7.00	16.00
GF_T	7.06	12.65	1.81	16.00
I_Z (YTL/year)	45,765.59	2,107,337.13	32,525.39	-
I_T (YTL/year)	2,031,002.83	19,912,329.27	600,000.73	-
I_Z / I_T percent (%)	2.25	10.58	5.42	-

4.1.2 Hayırsız Island Core Zone of *M. monachus*

The zone is characterized by 4 grid cells all of which intersect at least one core or buffer human activity type. The numbers of grid cells used by each activity are given in Table 4.2. According to core zone analysis, only fisheries core zone is within the grid cells (Figure 4.10), but buffer activity diversity is 2 at the eastern coast (Figure 4.11). Zoning will be more easily compared to other core zones of the species because of less diversity (Figure 4.12). The cumulative of the grid factors resulted from this character of usage is 4.75 (Figures 4.13 to 4.15). The zeroing of this value will result in a reduction in annual income of fisheries by 1.28% (Figure 4.16) and of tour boat activity by 2.25% (Figure 4.17).

Table 4.2 Human on Hayırsız Island core zone (N: number of grid cells used, GF_T: cumulative grid factor, I_Z: annual income of used grid cells, I_T: annual total income of the sector)

	Fisheries	Tourism	Tour Boat	Land Use
N	4.00	0.00	2.00	0
GF_T	4.00	0.00	0.75	0
I_Z (YTL/year)	25,916.27	0.00	13,528.68	-
I_T (YTL/year)	2,031,002.83	19,912,329.27	600,000.73	-
I_Z / I_T percent (%)	1.28	0.00	2.25	-

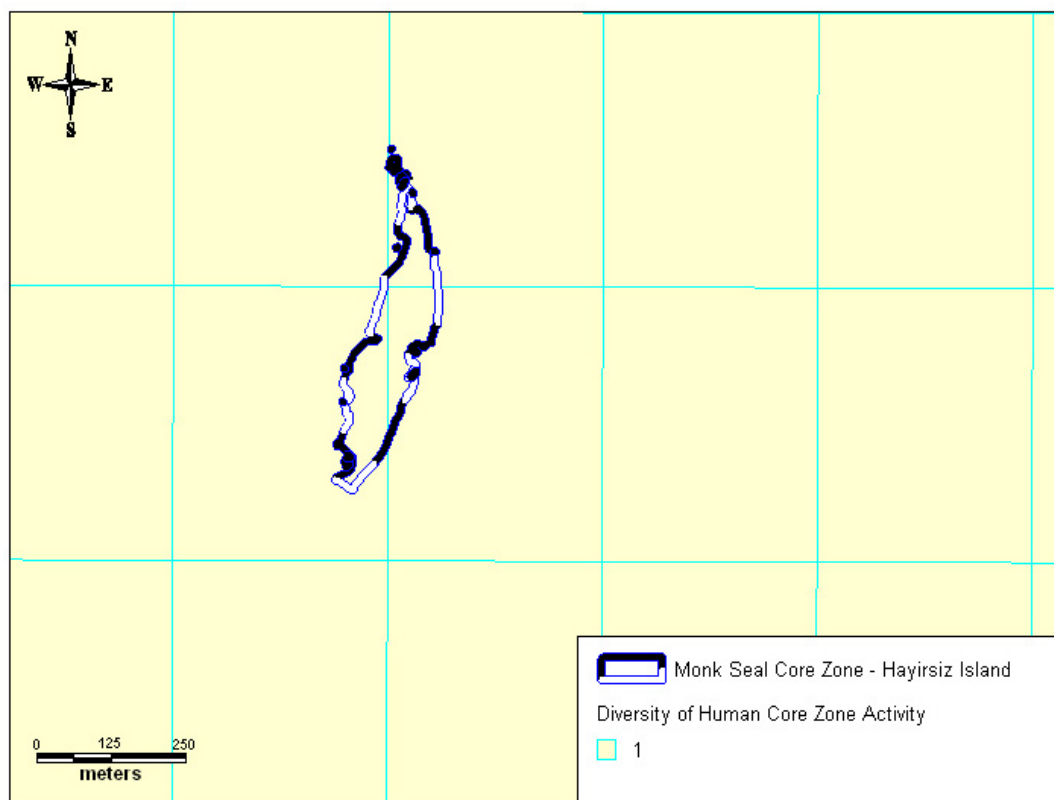


Figure 4.10 Map of diversity of human core zone activities at Hayırsız Island core zone.

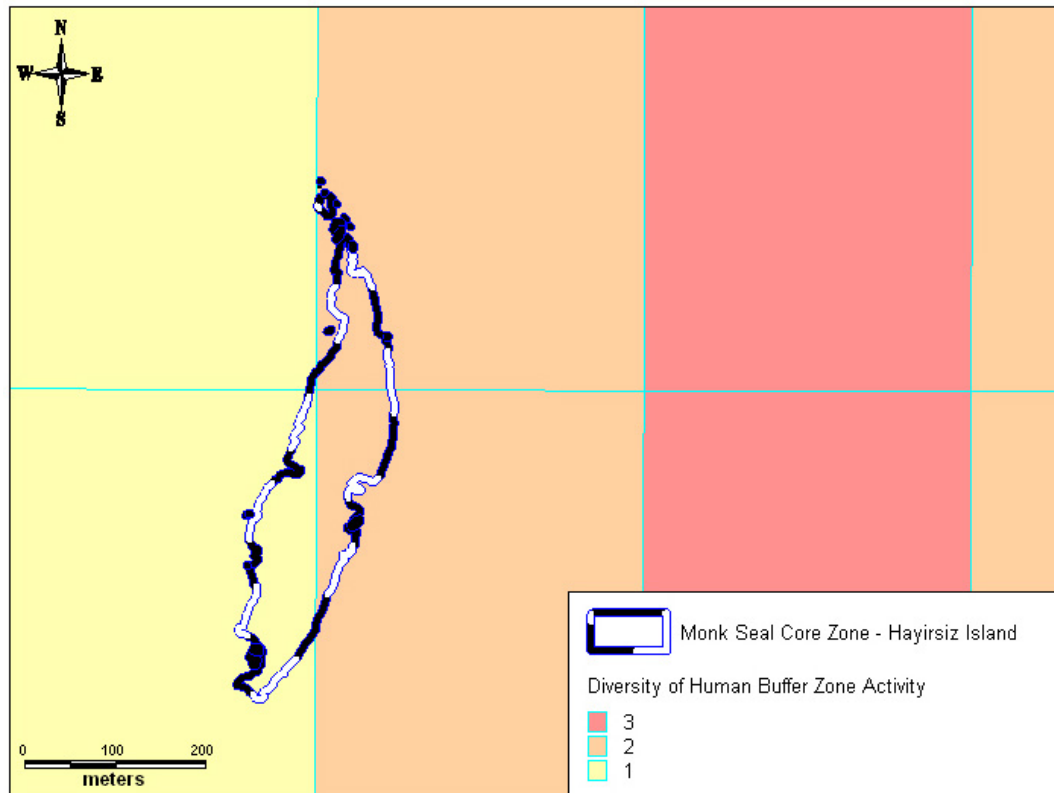


Figure 4.11 Map of diversity of human buffer zone activities at Hayırsız Island core zone.

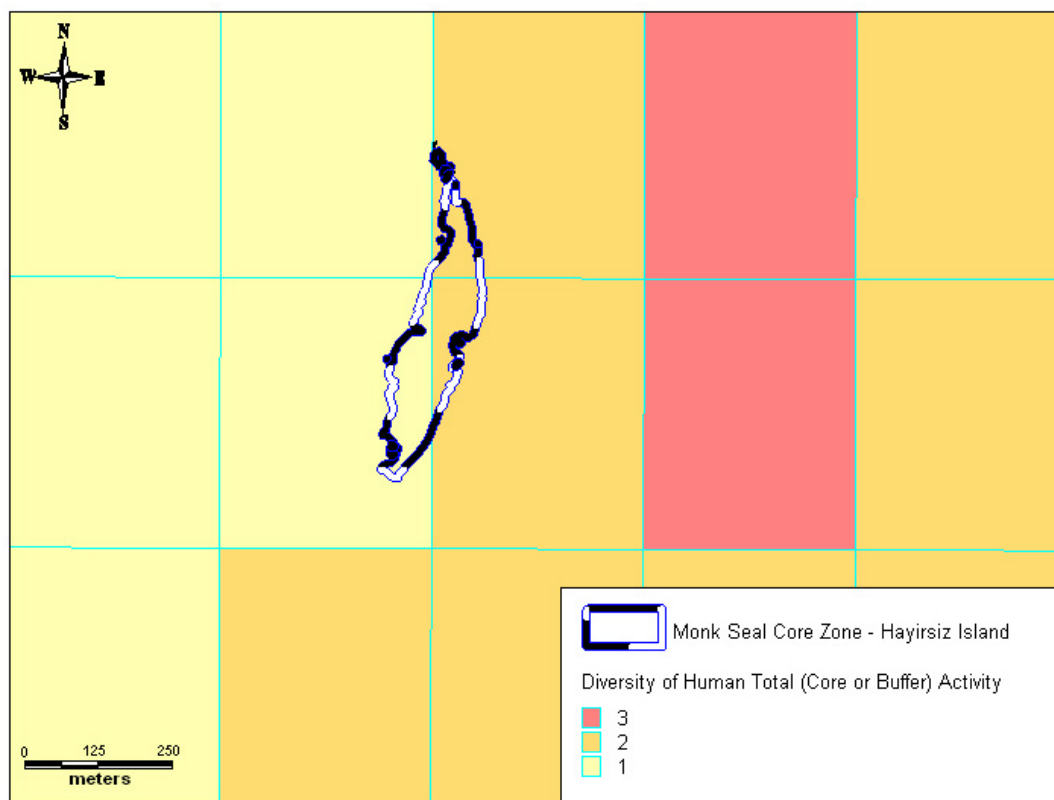


Figure 4.12 Map of diversity of human activities at Hayırsız Island core zone.

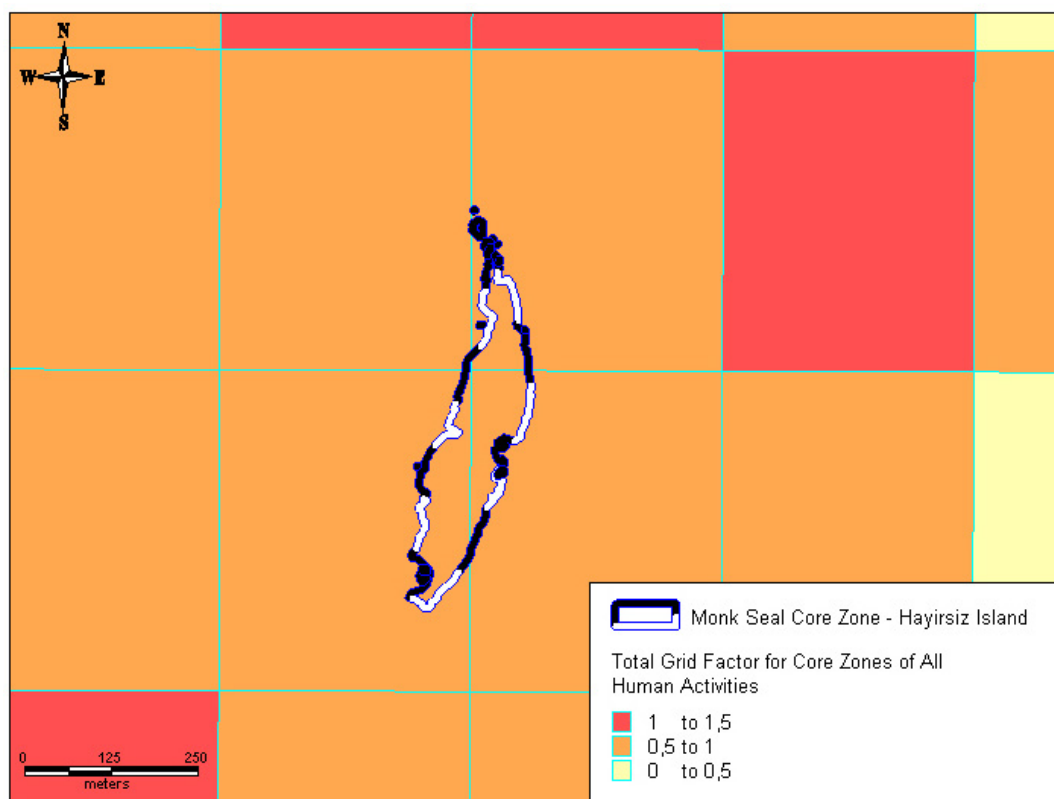


Figure 4.13 Map of total core grid factors at Hayırsız Island core zone.

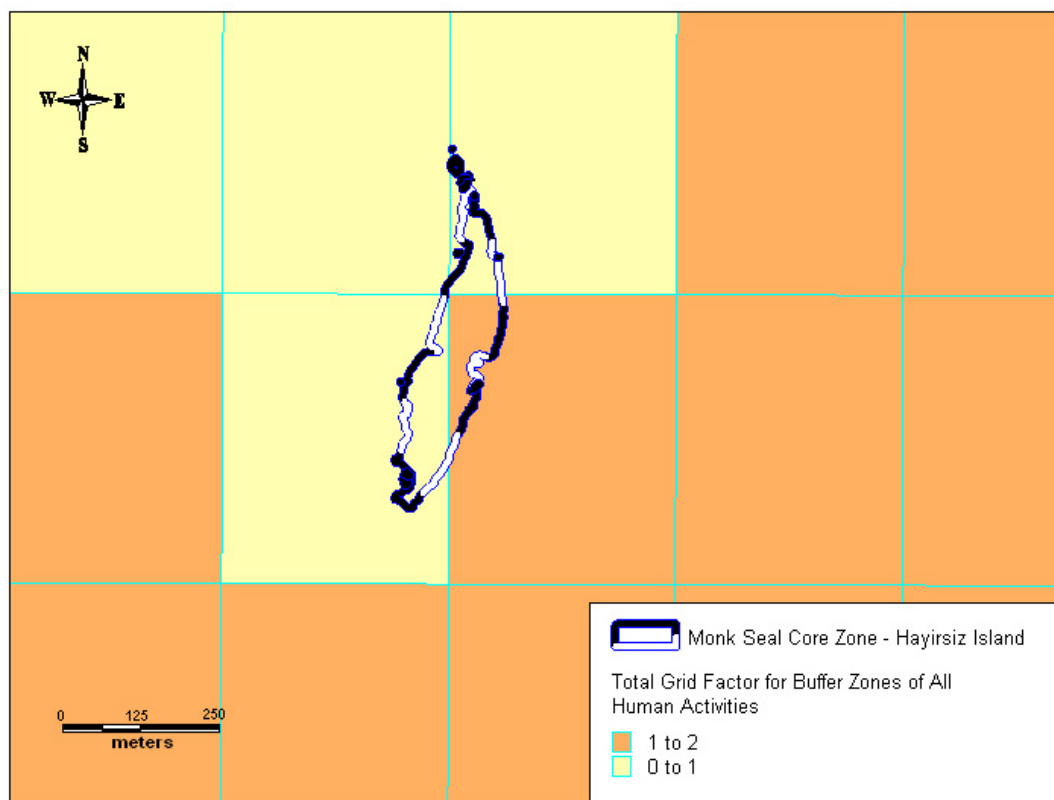


Figure 4.14 Map of total buffer grid factors at Hayırsız Island core zone.

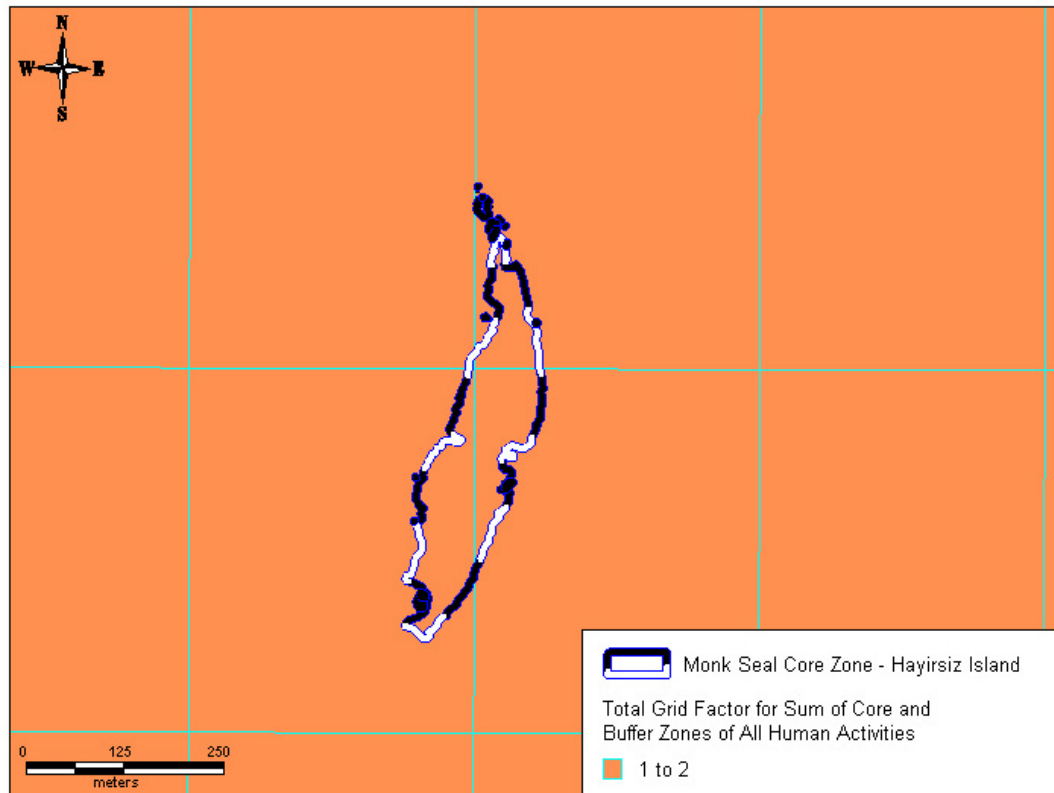


Figure 4.15 Map of total (core + buffer) grid factors at Hayırsız Island core zone.

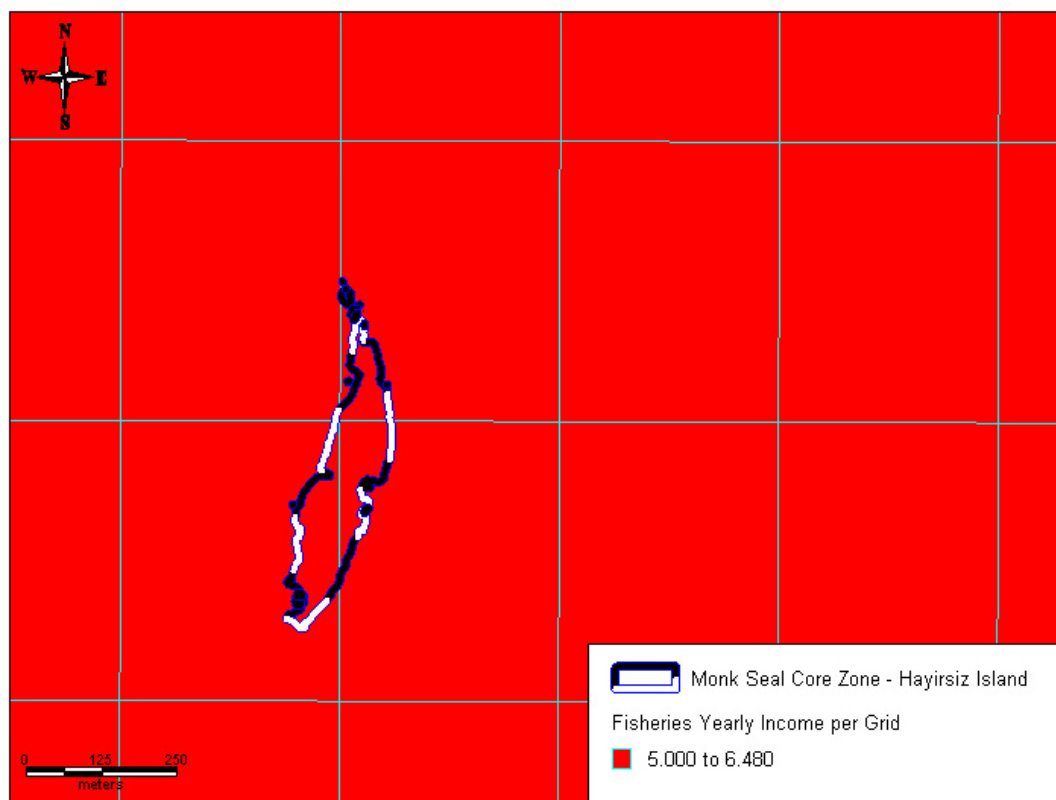


Figure 4.16 Map of annual zonal income of fisheries at Hayırsız Island core zone.

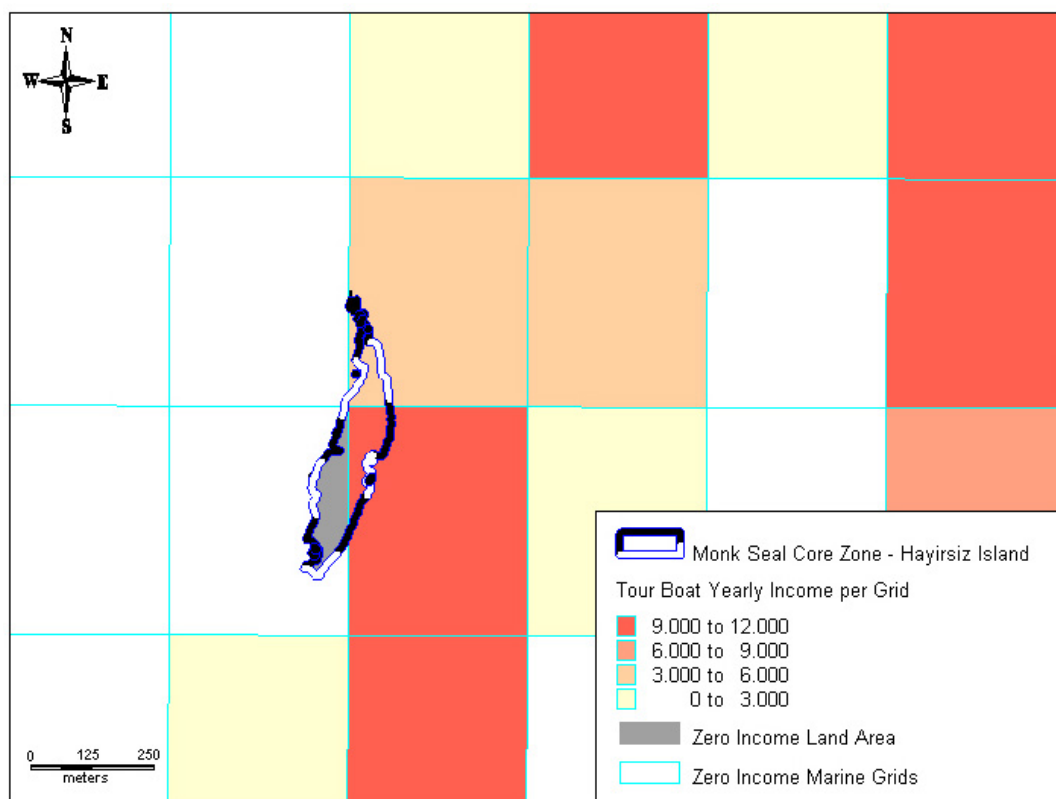


Figure 4.17 Map of annual zonal income of tour boat activity at Hayırsız Island core zone.

4.1.3 Orak Island Core Zone of *M. monachus*

The zone is characterized by 16 grid cells all of which intersect at least one core or buffer human activity type. The numbers of grid cells used by each activity are given in Table 4.3. The maximum human core activity diversity within these cells is 2 (Figure 4.18) whereas buffer activity diversity is 4 at the “Orak” of the island (Figure 4.19). Critical areas for zoning are the coasts closer to the mainland as the diversity of human activities is 3 or 4 here (Figure 4.20). The cumulative of the grid factors resulted from this character of usage is 18.82 (Figures 4.21 to 4.23). The zeroing of this value will result in a reduction in annual income of fisheries by 3.37% (Figure 4.24), of tourism by 0.38% (Figure 4.25) and of tour boat activity by 11.36% (Figure 4.26).

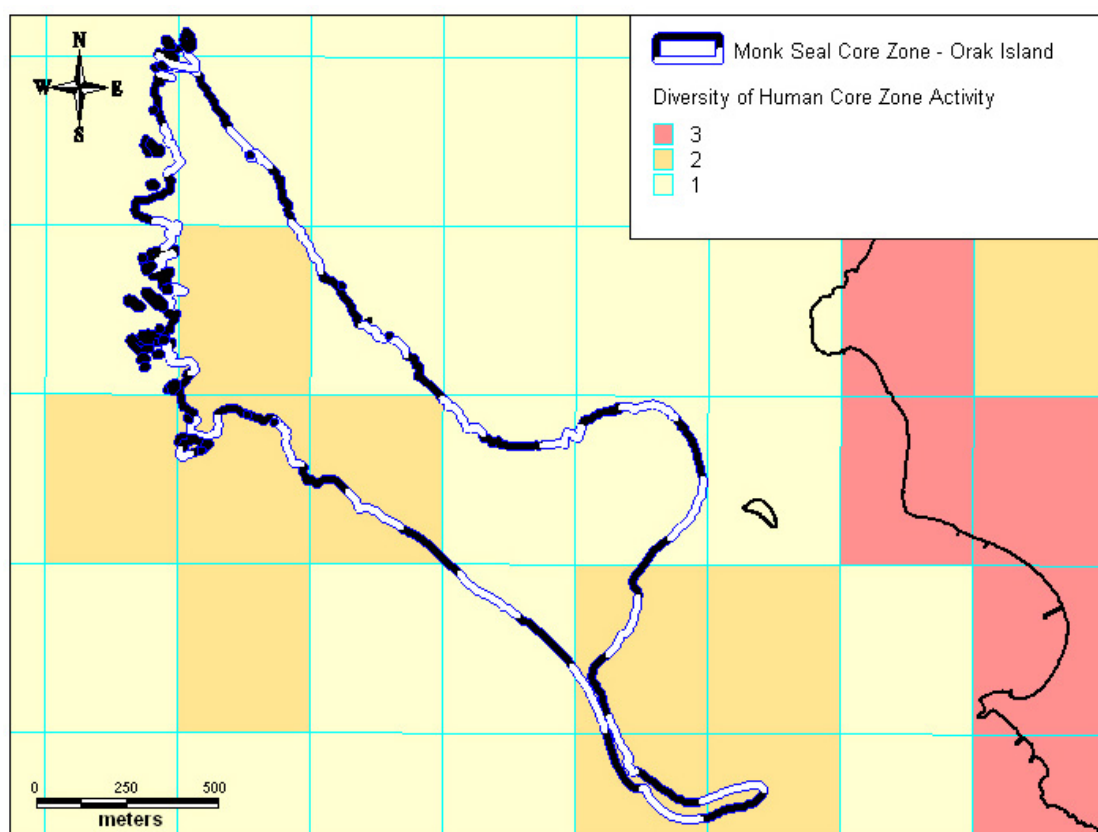


Figure 4.18 Map of diversity of human core zone activities at Orak Island core zone.

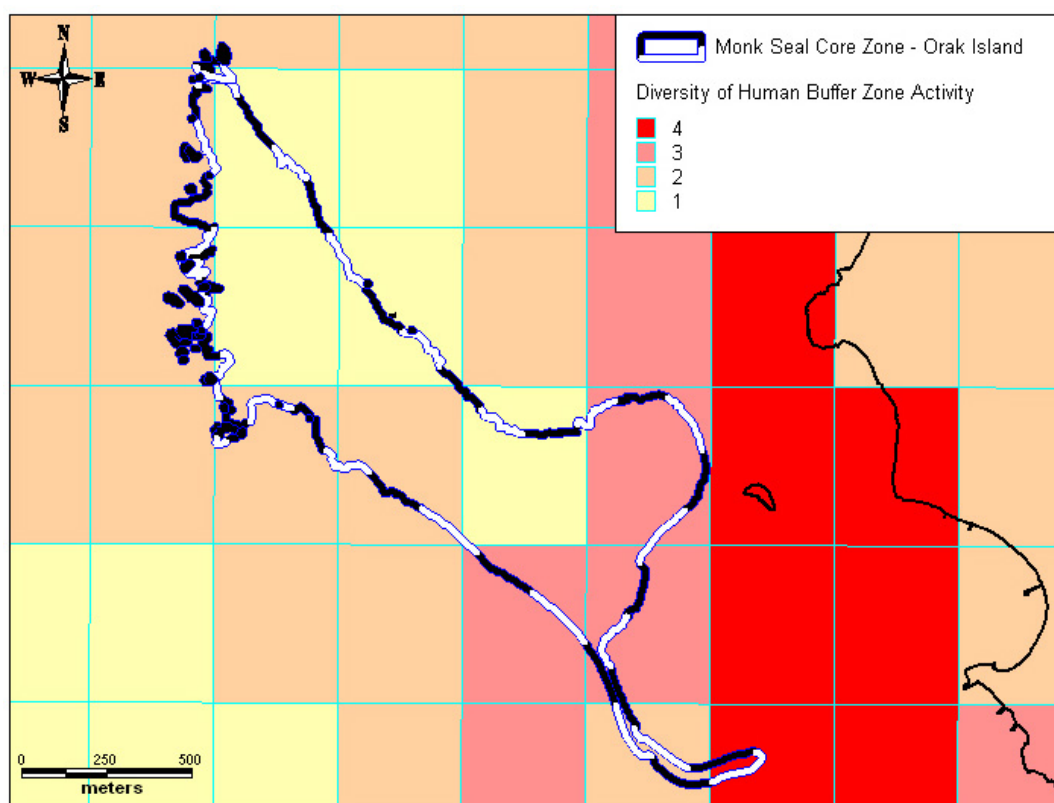


Figure 4.19 Map of diversity of human buffer zone activities at Orak Island core zone.

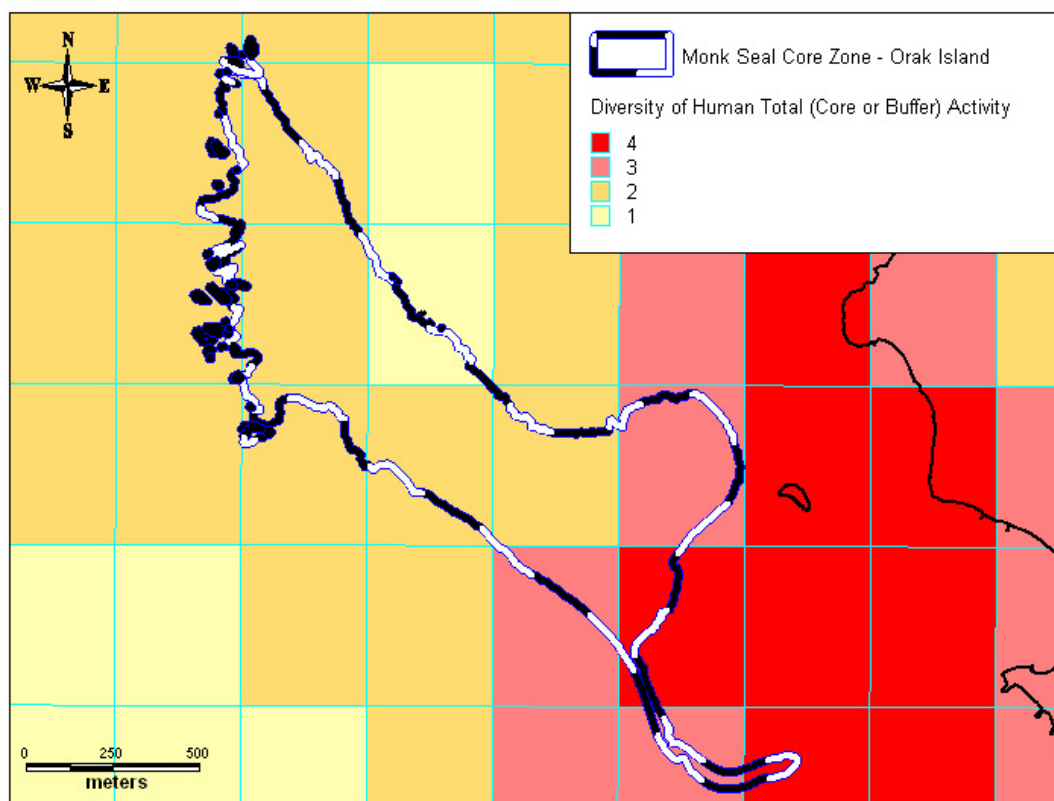


Figure 4.20 Map of diversity of human activities at Orak Island core zone.

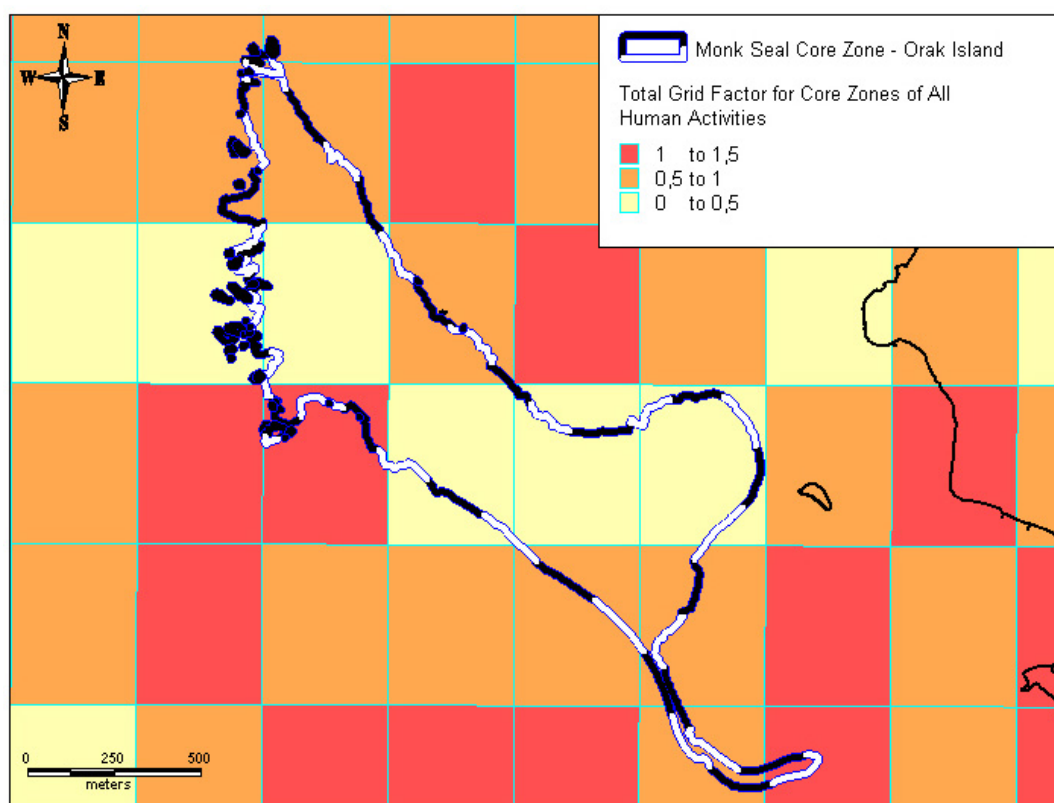


Figure 4.21 Map of total core grid factors at Orak Island core zone.

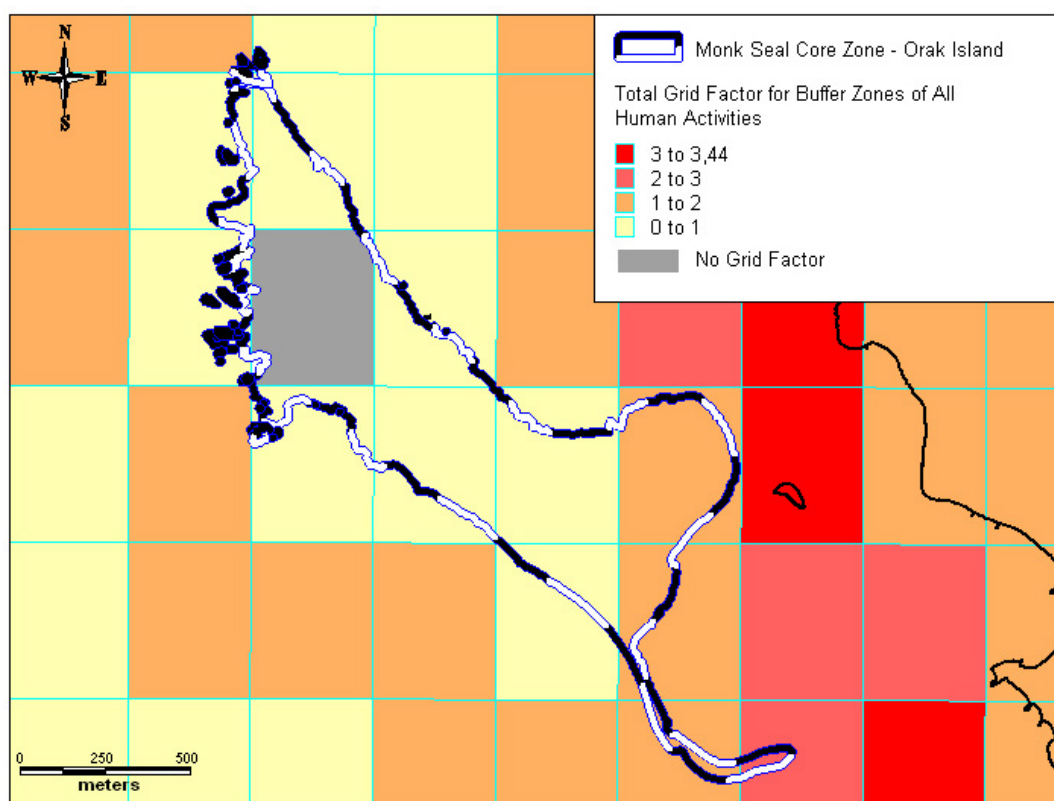


Figure 4.22 Map of total buffer grid factors at Orak Island core zone.

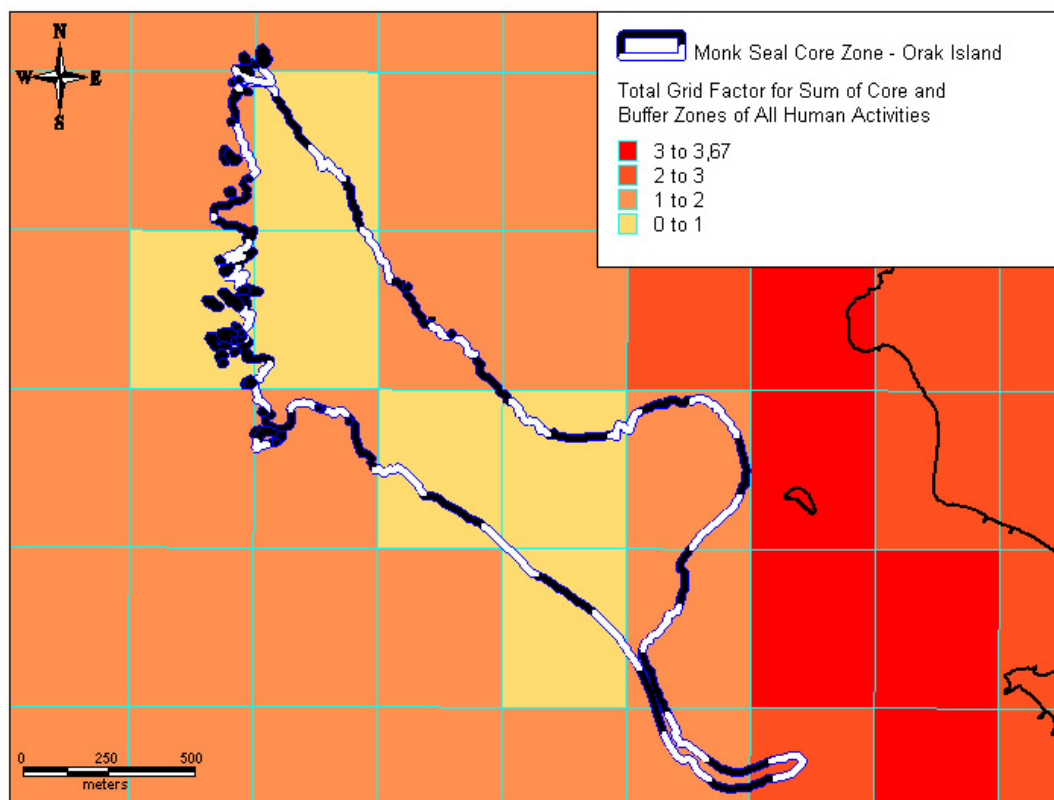


Figure 4.23 Map of total (core + buffer) grid factors at Orak Island core zone.

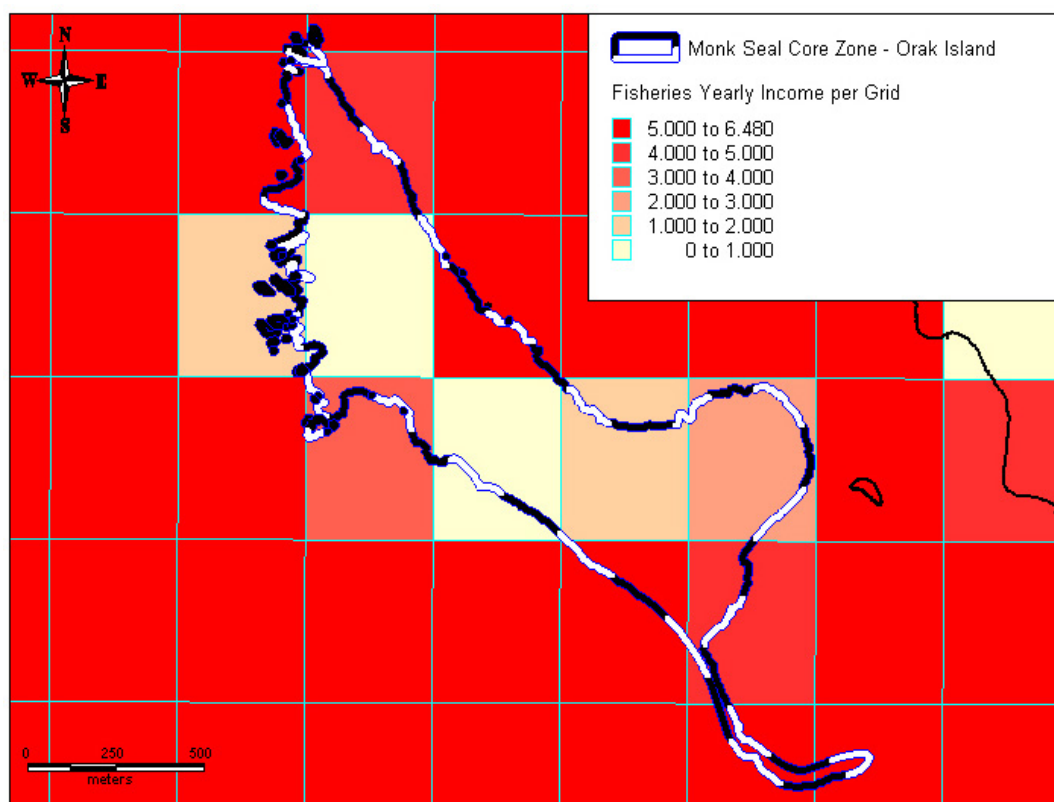


Figure 4.24 Map of annual zonal income of fisheries at Orak Island core zone.

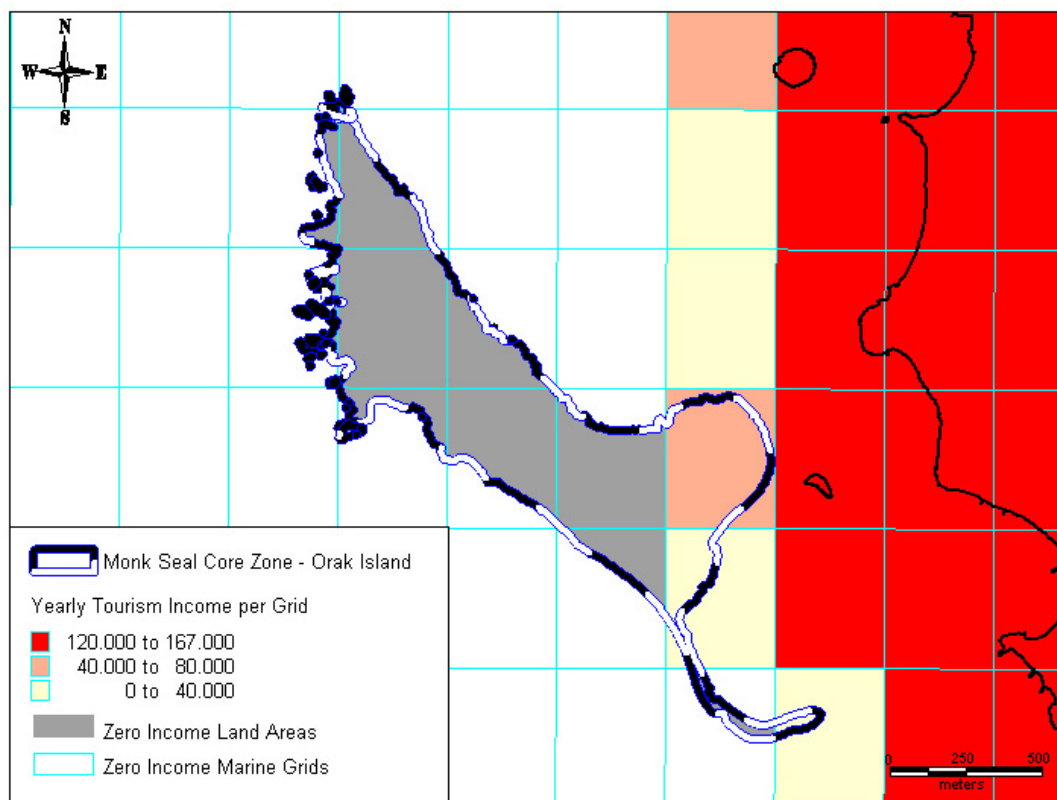


Figure 4.25 Map of annual zonal income of tourism at Orak Island core zone.

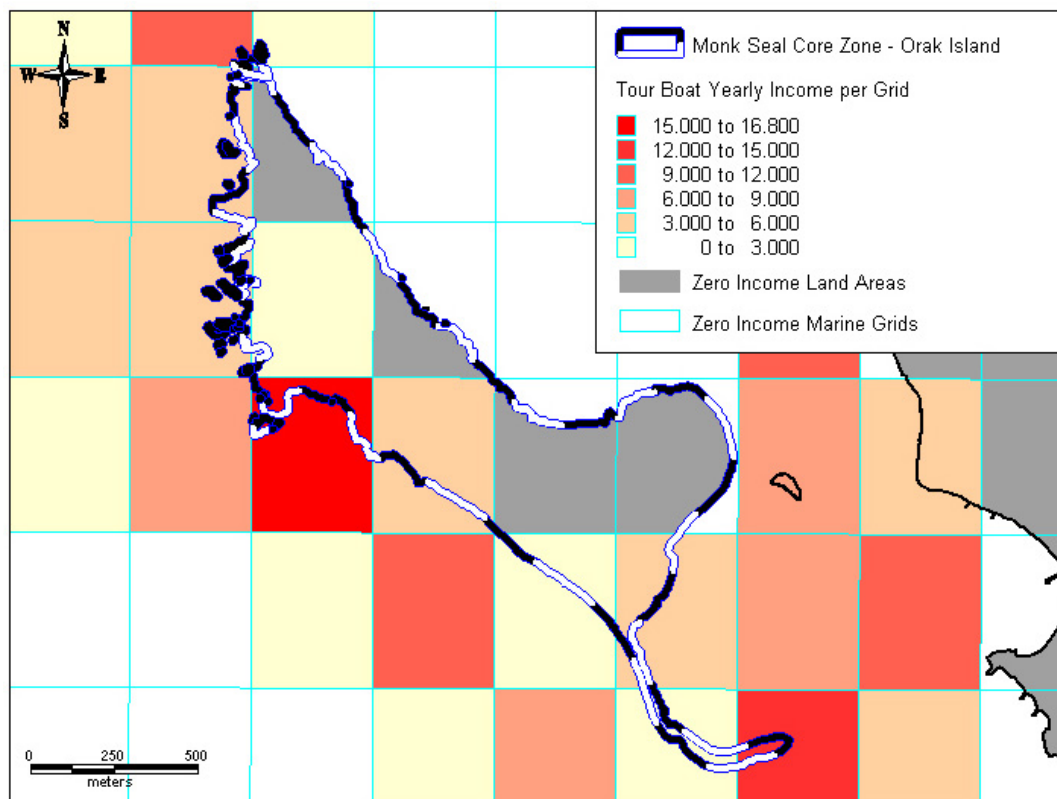


Figure 4.26 Map of annual zonal income of tour boat activity at Orak Island core zone.

Table 4.3 Human on Orak Island core zone (N: number of grid cells used, GF_T: cumulative grid factor, I_Z: annual income of used grid cells, I_T: annual total income of the sector)

	Fisheries	Tourism	Tour Boat	Land Use
N	16.00	3.00	12.00	6.00
GF_T	10.56	0.45	3.79	4.02
I_Z (YTL/year)	68,431.10	75,625.00	68,159.12	-
I_T (YTL/year)	2,031,002.83	19,912,329.27	600,000.73	-
I_Z / I_T percent (%)	3.37	0.38	11.36	-

4.1.4 İncir Island Core Zone of *M. monachus*

The zone is characterized by 4 grid cells all of which intersect at least one core or buffer human activity type. The numbers of grid cells used by each activity are given in Table 4.4. The human core activity diversity is 2 throughout the island (Figure 4.27) whereas buffer activity diversity is 3 (Figure 4.28). The entire island is critical for zoning as the total diversity (core or buffer) of human activities is 3 (Figure 4.29). The cumulative of the grid factors resulted from this character of usage is 8.8 (Figures 4.30 to 4.32). The zeroing of this value will result in a reduction in annual income of fisheries by 1.13% (Figure 4.33) and of tour boat activity by 3.79% (Figure 4.34).

Table 4.4 Human on İncir Island core zone (N: number of grid cells used, GF_T: cumulative grid factor, I_Z: annual income of used grid cells, I_T: annual total income of the sector)

	Fisheries	Tourism	Tour Boat	Land Use
N	4.00	0.00	4.00	4.00
GF_T	3.54	0.00	1.26	4.00
I_Z (YTL/year)	22,905.05	0.00	22,741.10	-
I_T (YTL/year)	2,031,002.83	19,912,329.27	600,000.73	-
I_Z / I_T percent (%)	1.13	0.00	3.79	-

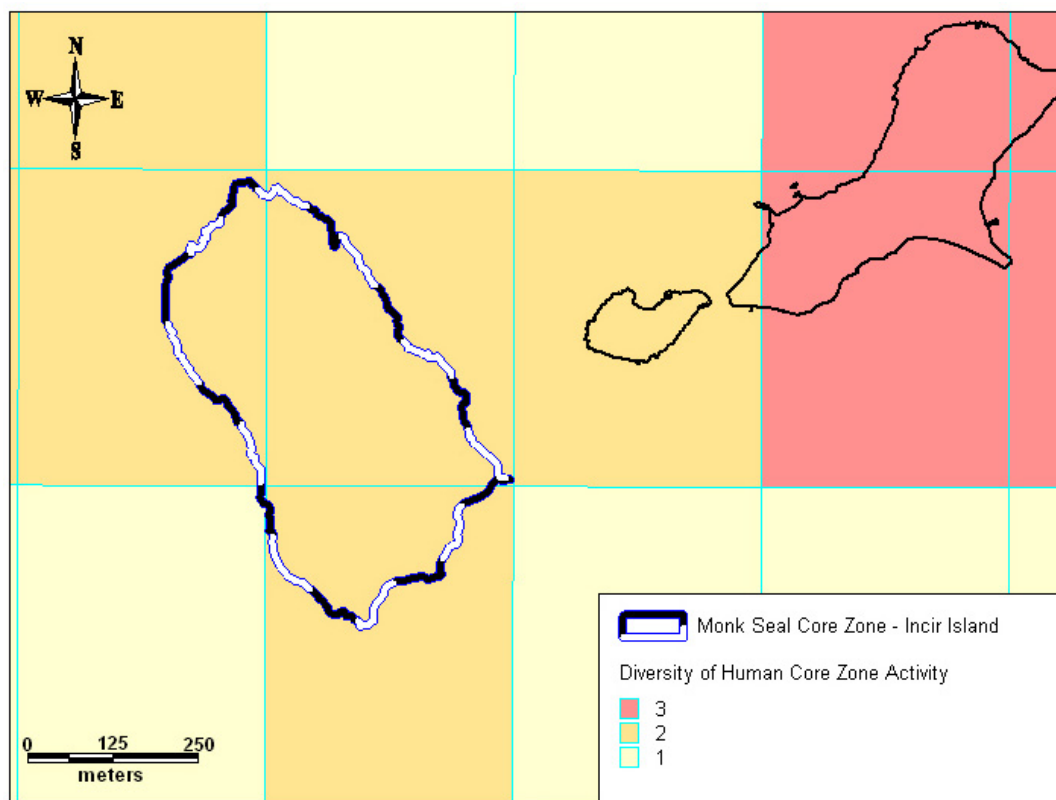


Figure 4.27 Map of diversity of human core zone activities at İncir Island core zone.

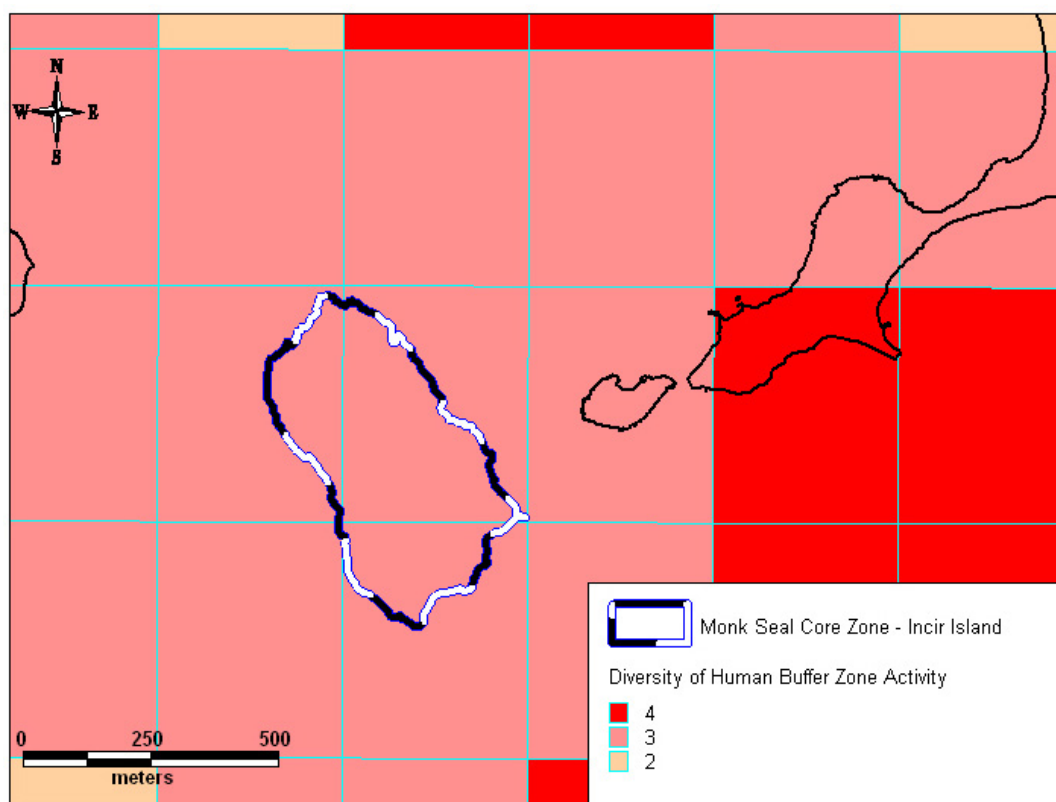


Figure 4.28 Map of diversity of human buffer zone activities at İncir Island core zone.

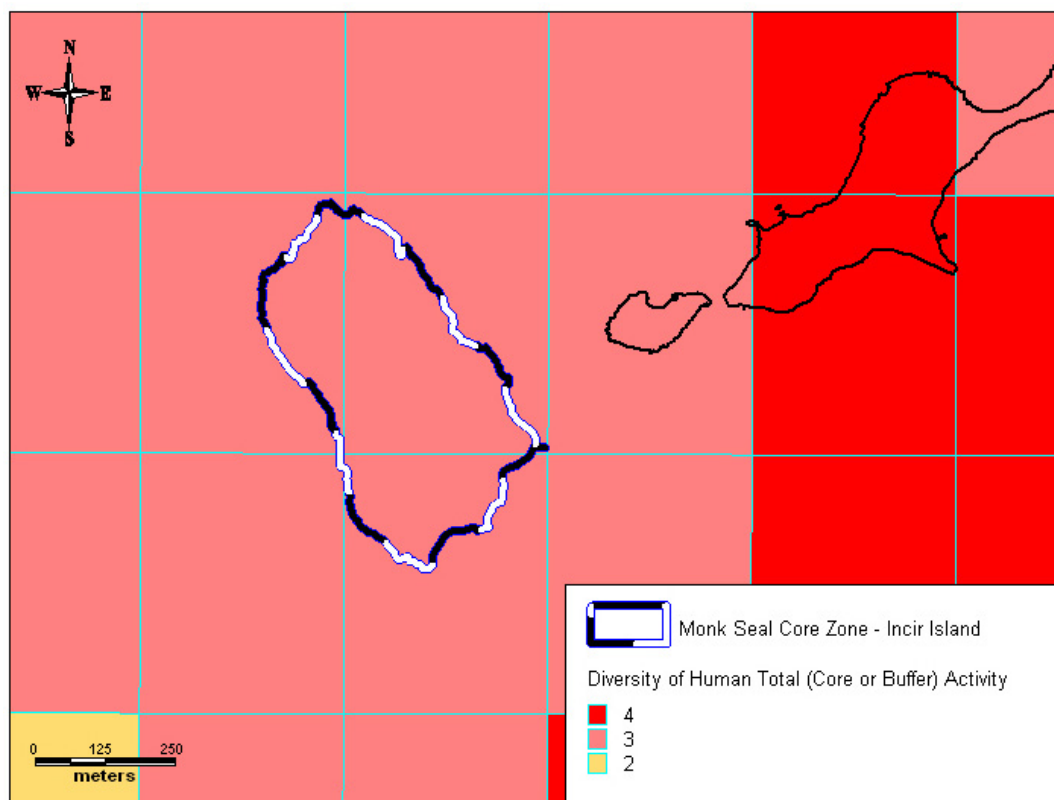


Figure 4.29 Map of diversity of human activities at Incir Island core zone.

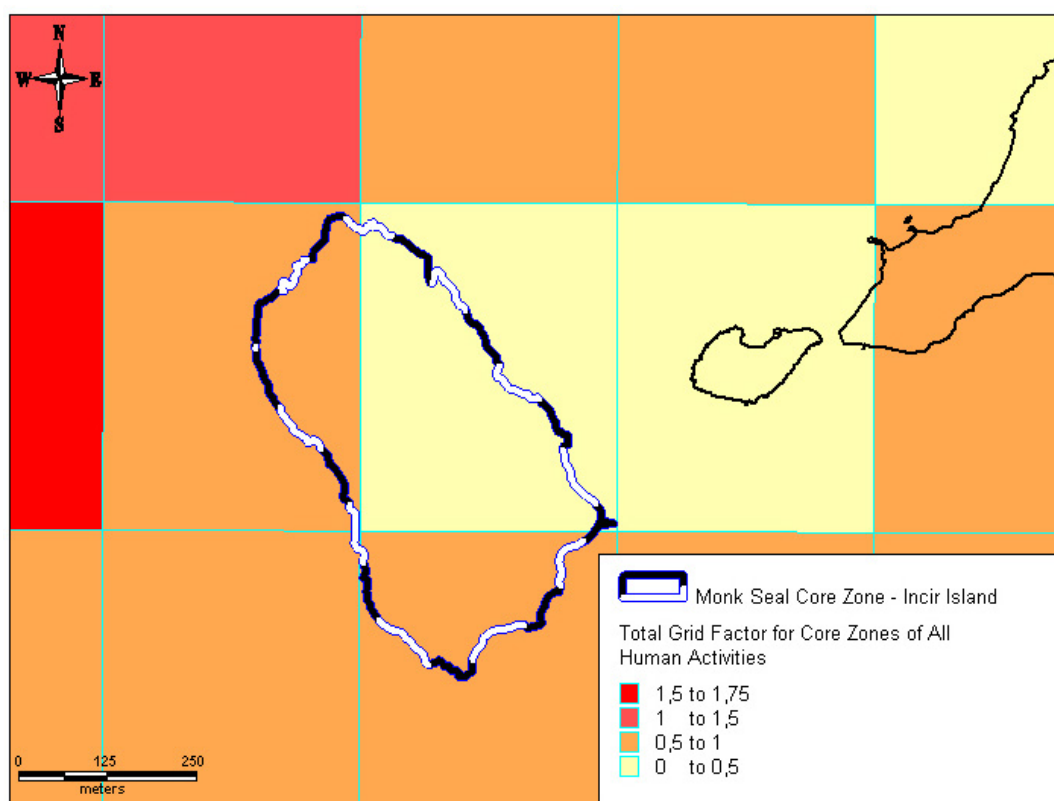


Figure 4.30 Map of total core grid factors at Incir Island core zone.

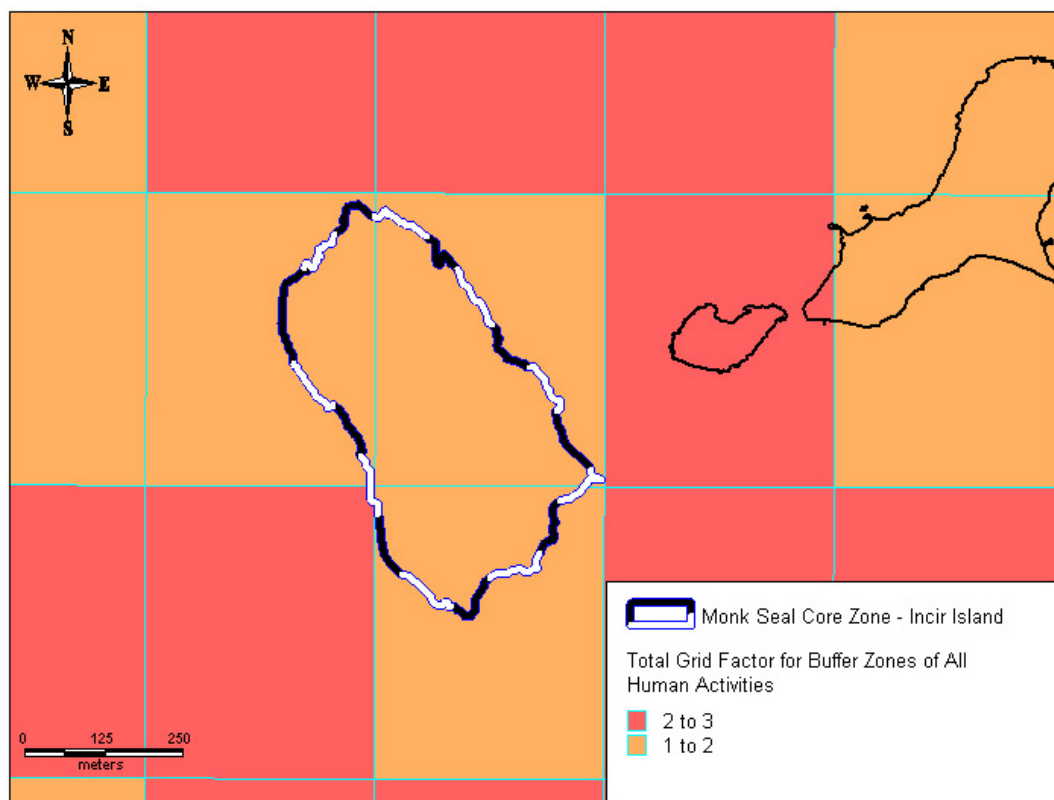


Figure 4.31 Map of total buffer grid factors at Incir Island core zone.

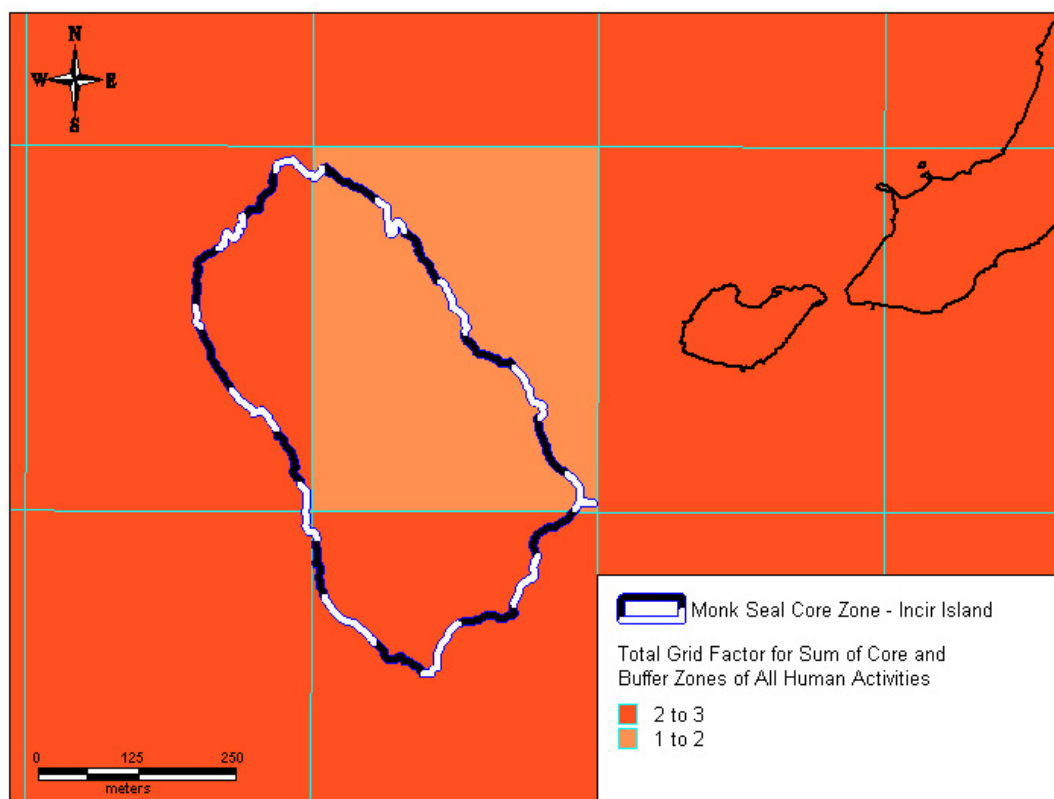


Figure 4.32 Map of total (core + buffer) grid factors at Incir Island core zone.

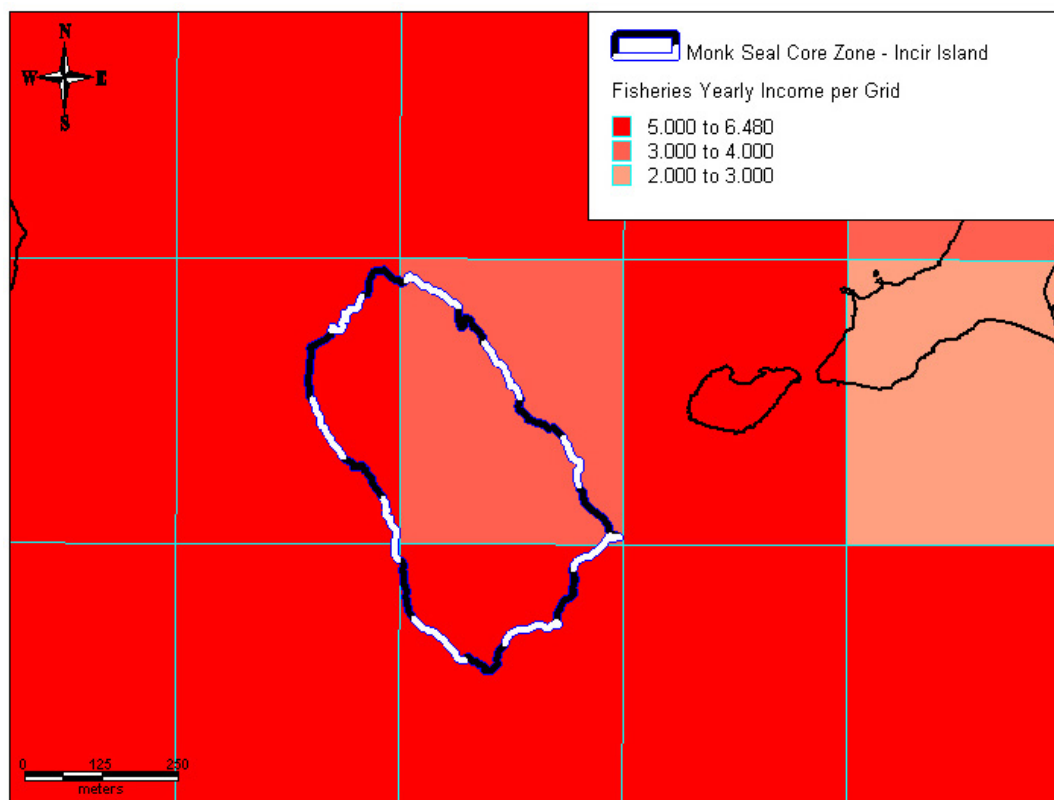


Figure 4.33 Map of annual zonal income of fisheries at İncir Island core zone.

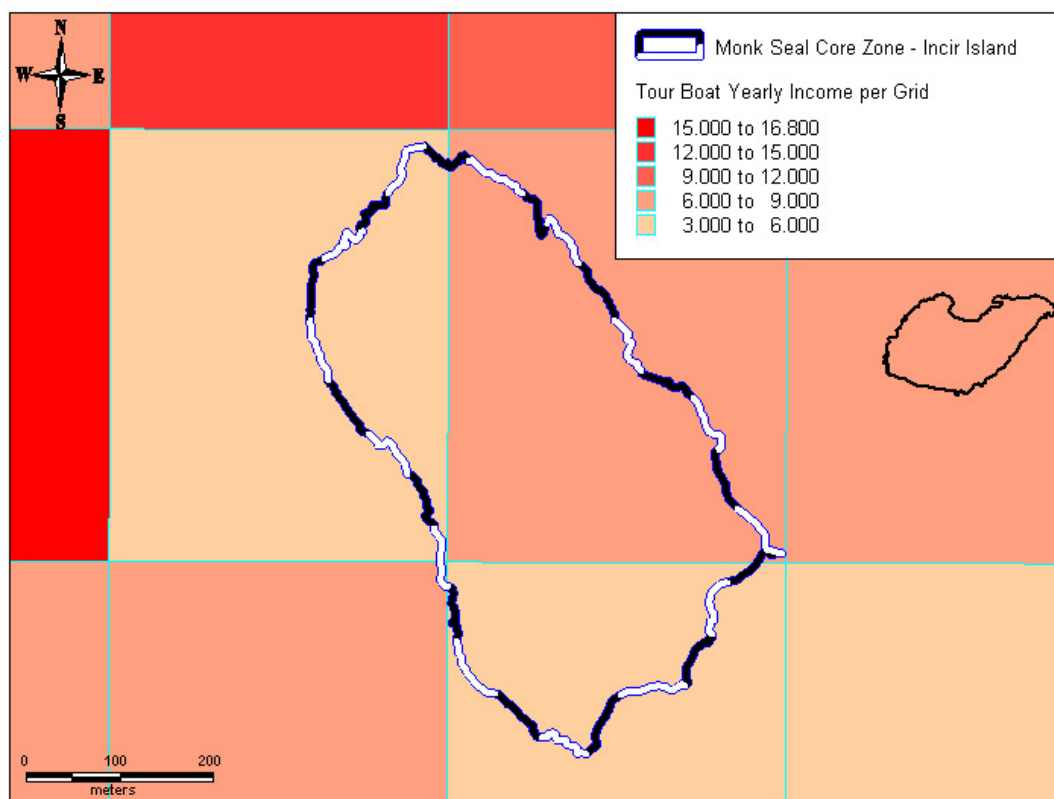


Figure 4.34 Map of annual zonal income of tour boat activity at İncir Island core zone.

4.1.5 Buffer Zone of *M. monachus*

The buffer zone defined for the species includes all the marine area around the islands and of Foça coasts and this approach is verified by the sighting data of the species. The species is pressurized by all human activities at the coastline and the interaction decreases to the west from the coastline by the decrease in the number of human activities (Figure 3.43 & 3.46). The pressure caused by human activities are inevitable in this “mobility area” of the species, but should be arranged by zonal analysis. The grid cells with cumulative grid factor greater than 1.00 should be cared in zonation.

4.2 Conclusions beyond the Criteria

- Beyond being an evidence for the distribution of *M. monachus*, incidental sighting areas of the species (Figure 3.10) are the zones where species interact with human. The coincidence of these areas with grid cells having higher cumulative grid factors (Figure 3.43) and diversity (Figure 3.46) supports this statement. The probability of interaction increases with increasing frequency of observation in the grid cells.
- The diversity of human activities is high at the centre of the district. This is normal as there are a lot of human activities in such areas. But, it is also remarkable that the diversity is constant along the coast to the north (Figure 3.46). The case should be perceived as poor management of the coastal strip. The area demonstrated by the grid cells intersecting the coastline needs zonation with an uppermost importance not only for the species specific issues, but also for human activity management considerations.
- Foça is one of the most important habitats of the Mediterranean Monk Seal with its islands and mainland. The human activities, especially fisheries, frequently overlap with the coastal and marine habitats of the species. The highness of

frequency is a concrete evidence for questioning the efficiency and/or sufficiency of SPA and other management tools that have concurrently been applied.

- The total sighting data in Figure 3.12 show that there is a need to extend the border of the SPA northwardly to be able to include all core zones of *M. monachus*. The core and buffer zones of the protected area should be designed according to IUCN guidelines. The west of Hayırsız Island and Orak Island, where sightings are most frequent, should be included in the core zone as no-entry and no-take zones. The core zone(s) of the protected area should be designed as shelters for the species from the species-specific management point of view as well as ecosystem management considerations. Buffer zone(s) must be designed to manage human activities and their densities in the area. The carrying-capacity of the ecosystem and sustainable use of the natural resources should be the primary objectives in the designation.

- The total sighting data also shows that there is a remarkable increase in the sightings in 1996. The reason for this peak is the increased frequency in area usage of the species with the pups born in 1996 and 1997, probably for feeding. Therefore, the management of the protected area should include a time component in addition to zonal preferences which will consider the birth time interval of the species.

- In addition to spatial and temporal restrictions, fishing gears used by fishermen should also be regulated for the areas closely bordered with core zones in order to avoid deaths caused by entanglement. This regulation may be temporary for covering the nursery periods of the pups and juveniles or permanent for the whole year in these areas.

- Although fishery has direct interaction with the species in the sense of resource competition and area usage and is the cause of accidental or deliberate deaths, land use activities, especially tourism, may have more critical effects and pressure on the species because of habitat destruction. When the grid factors of tourism (Figure 3.25) and land use (Figure 3.36) activities are analyzed, it is

observed that the entire coastline is intensively used by these “land-based” activities, without leaving suitable areas for species for nesting. This high zonal dependency, together with high activity diversity (Figure 3.46) along the coastline, is probably the cause of the case that species uses the caves as far away as possible from human activities (See Figure 3.4 for cave check data). Consequently, the core zones of the species, particularly those on the mainland, should be secured via some measures for preventing any deliberate access into the zones.

- Turkish local and national governments should take strict conservation measures in order to protect the habitat of the species to help recovery of the species. This is the responsibility for the future generations which has been defined, secured and granted as an obligation according to national and international laws.
- A self-funding strategy for the protected area should be developed. User-fee system is recommended as a solution, but other innovative approaches must be analyzed.
- A detailed fisheries management plan is needed in the context of integrated coastal zone management plan. Objectives and indicators should be well defined for the area in order to reduce the costs of the fishermen and increase the income per effort. Coastal area planning should also optimize benefit-cost relations of the tourism sector considering the conservation needs. Local communities should be involved at all stages of the management and conservation efforts. An advisory mechanism including NGOs and academicians should be established for future management planning and monitoring.
- An effective monitoring system is essential in order to observe the changes in trends and species status. This may help to react in case of urgent interferences. Scientific research and educational activities should be increased in the area and may be directed for monitoring purposes.

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APPENDICES

APPENDIX 1

Evolution of International Prescriptions on ICM (adopted from Cicin-Sain & Knecht, 1998)

CONVENTION	REMARKS
United Nations Conference on the Human Environment (Stockholm, 1972)	- many of the more than 100 nations attending prepared national reports on environmental conditions in their countries - increased environmental awareness, might have contributed to the establishment of environmental departments or ministries - establishment of the United Nations Environment Program (UNEP) - accelerated the adoption of several pending international agreements dealing with ocean dumping, vessel-source pollution, and trade in endangered species
Third United Nations Conference on the Law of the Sea-UNCLOS (1973-1982 and Subsequent Actions)	- the Exclusive Economic Zone (EEZ) - the concept of "sovereignty" in the context of the EEZ - the archipelagic state and the concept of archipelagic waters - formal recognition of the common heritage of mankind - establishment of the International Seabed Authority - comprehensive international environmental law - a new regime for marine scientific research - the most advanced framework for technological cooperation and development
United Nations Conference on Environment and Development -UNCED (Rio de Janeiro, 1992)	- virtually every nation on Earth (178 nations) was represented - Rio Declaration on Environment and Development (Earth Summit) - the Convention on Climate Change - the Convention on Biological Diversity - Agenda 21 - statement of Forest Principles - central concepts: interdependence, integrated management, sustainable development

APPENDIX 2

Types of fisheries (Source: FAO Fisheries Glossary).

Industrial fisheries	Capital-intensive fisheries using relatively large vessels with a high degree of mechanization and that normally have advanced fish finding and navigational equipment. Such fisheries have a high production capacity and the catch per unit effort is normally relatively high. In some areas of the world industrial fisheries is synonymous with fisheries for species that are used for reduction to fishmeal and fish oil (e.g. the trawl fishery for sandeel in the North Sea).
Small-scale fisheries	Labour-intensive fisheries using relatively small crafts (if any) and little capital and equipment per person-on-board. Most often family-owned. May be commercial or for subsistence (see below). Usually low fuel consumption. Often equated with artisanal fisheries.
Artisanal fisheries	Typically traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital, relatively small fishing vessels, making short fishing trips, close to shore, mainly for local consumption. In practice, definition varies between countries, e.g. from gleaning or a one-person canoe in poor developing countries, to more than 20 m. trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. Sometimes referred to as small-scale fisheries. In general, though by no means always, using relatively low level technology. Artisanal and industrial fisheries frequently target the same resources that may give rise to conflict.
Recreational (sport) fisheries	Harvesting fish for personal use, leisure, and challenge (e.g. as opposed to profit or research). Recreational fishing does not include sale, barter or trade of all or part of the catch.
Commercial fisheries	Fisheries undertaken for profit and with the objective to sell the harvest on the market, through auction halls, direct contracts, or other forms of trade.
Subsistence fisheries	A fishery where the fish caught are shared and consumed directly by the families and kin of the fishers rather than being bought by intermediaries and sold at the next larger market. Pure subsistence fisheries are rare as part of the products are often sold or exchanged for other goods or services.
Traditional fisheries	Fisheries established long ago, usually by specific communities that have developed customary patterns of rules and operations. Traditional fisheries reflect cultural traits and attitudes and may be strongly influenced by religious practices or social customs. Knowledge is transmitted between generations by word of mouth. They are usually small-scale and/or artisanal.

APPENDIX 3

Recent trends in world fisheries production and utilization (Source: FAO 2000).

	1994	1995	1996	1997	1998	1999
Production (million tonnes)						
Inland						
Capture	6.7	7.2	7.4	7.5	8.0	8.2
Aquaculture	12.1	14.1	16.0	17.6	18.7	19.8
Total inland	18.8	21.4	23.4	25.1	26.7	28.0
Marine						
Capture	84.7	84.3	86.0	86.1	78.3	84.1
Aquaculture	8.7	10.5	10.9	11.2	12.1	13.1
Total marine	93.4	94.8	96.9	97.3	90.4	97.2
Total capture	91.4	91.6	93.5	93.6	86.3	92.3
Total aquaculture	20.8	24.6	26.8	28.8	30.9	32.9
Total world fisheries	112.3	116.1	120.3	122.4	117.2	125.2
Utilization						
Human consumption (million tonnes)	79.8	86.5	90.7	93.9	93.3	92.6
Reduction to fishmeal and oil (million tonnes)	32.5	29.6	29.6	28.5	23.9	30.4
Human population (*10 ⁶)	5.6	5.7	5.7	5.8	5.9	6.0
Per-capita food fish supply (kg)	14.3	15.3	15.8	16.1	15.8	15.4

APPENDIX 4

Objectives of fishery management (Source: Jennings, Kaiser & Reynolds, 2001; based on Clark, 1985).

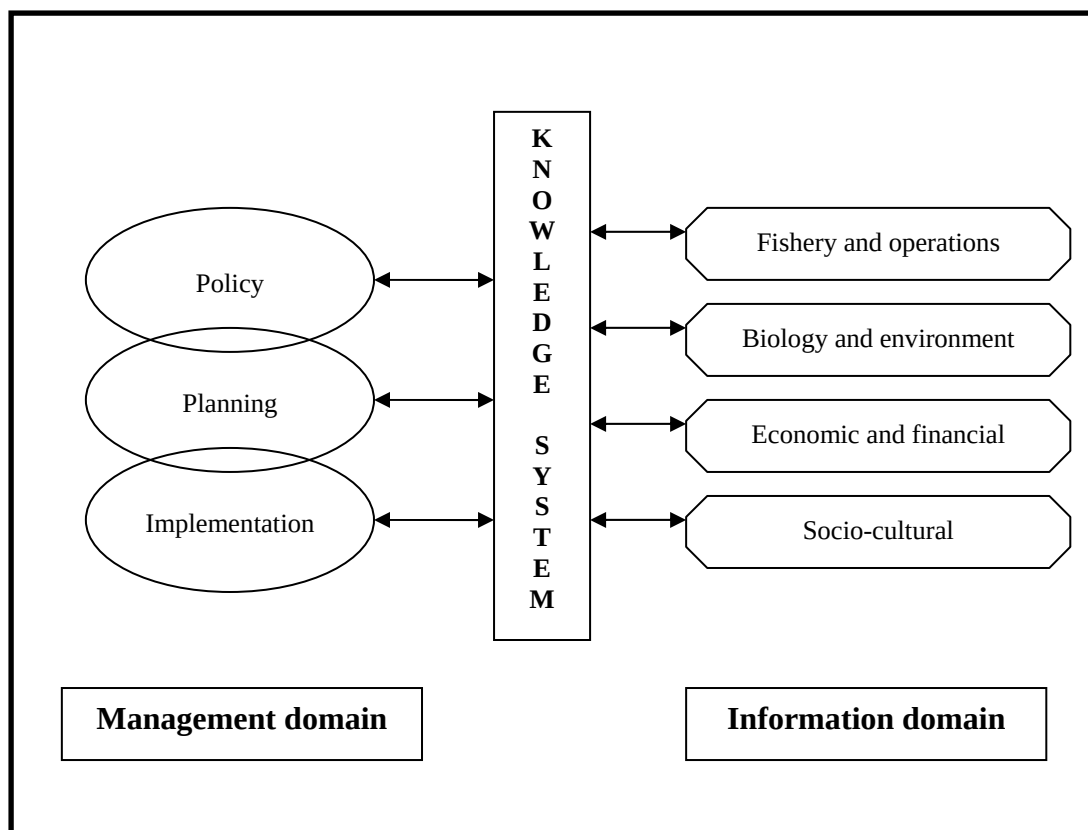
OBJECTIVE	BIOLOGICAL	ECONOMIC	SOCIAL	POLITICAL
Protect habitat	■			
Increase selectivity	■			
Prevent mortality of rare species	■			
Prevent ecosystem shifts	■			
Rebuild overexploited stock	■			
Reduce discarding	■			
Maximize protein supply	■		■	
Maximize income		■		
Maximize profit		■		
Maximize employment			■	
Keep prices low		■		
Minimize variability in catch			■	■
Minimize variability in income		■	■	
Reduce overcapacity			■	
Raise government revenue		■	■	■
Improve catch quality		■		
Increase exports		■		
Do not upset lobby groups			■	■
Do not upset fishers			■	■
Do not upset conservationists			■	■
Preserve status quo			■	■
Reduce conflicts			■	■
Boost sport fisheries			■	

APPENDIX 4 (CONT.)

Indicators that show whether a management objective has been met (Source: Jennings, Kaiser & Reynolds, 2001).

OBJECTIVE	INDICATOR
Protect habitat	Proportion of habitat impacted by fishing gears
Increase selectivity	Proportion of target species in total catch
Prevent mortality of rare species	Mortality rate and abundance of rare species
Prevent ecosystem shifts	Abundance and diversity of indicator species
Rebuild overexploited stock	Abundance of overexploited species
Reduce discarding	Proportion or quantity of material discarded
Maximize protein supply	Weight of landings
Maximize income	Total income from fishery
Maximize profit	Total profit from fishery
Maximize employment	Number of people working in fishery
Keep prices low	Price of fished species
Minimize variability in catch	Variation in yield per unit time
Minimize variability in income	Variation in income per unit time
Reduce overcapacity	Number of fishers or vessels in fishery
Raise government revenue	Value of taxes collected from fishers
Improve catch quality	Price paid per unit weight of catch
Increase exports	Value and volume of exports
Do not upset lobby groups	Person days spent campaigning
Do not upset fishers	Number of complaints to government
Do not upset conservationists	Number of complaints to government
Preserve status quo	Rate of change in profits or employment
Reduce conflicts	Number of prosecutions for conflict
Boost sport fisheries	Value of recreational fishery

APPENDIX 5



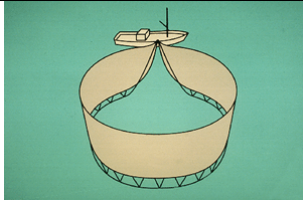
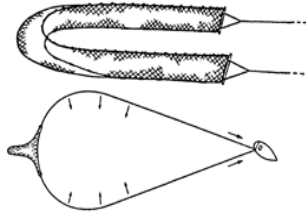
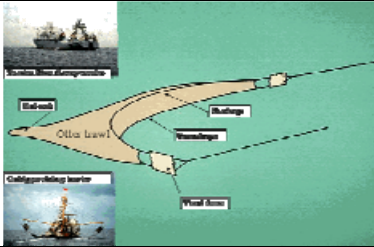
Schematic representation of a fisheries knowledge system (Evans & Grainger, 2005).

Fisheries information data (Adopted from Evans & Grainger, 2005).

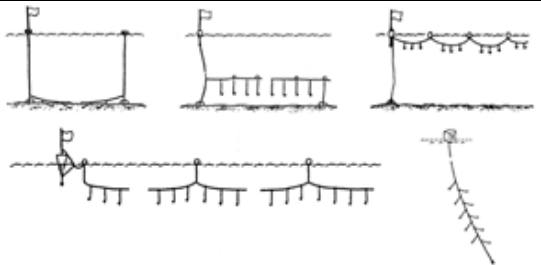
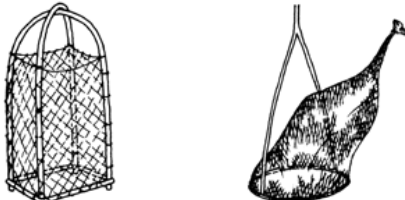
Fishery and operations information domain	1. Catch and discards, production and stock enhancement, 2. Fishing vessels and fishing gear, 3. Fishing effort and sightings, 4. Offences and prosecutions, and the dissemination of compliance information.
Biology and environment information domain	1. Stock size, 2. Stock structure, 3. Community structure, 4. Environment.
Economic and financial information domain	1. Price, value and employment, 2. Investment, subsidy and management, 3. Profitability, 4. Distribution of food, rent and trade.
Sociocultural information domain	1. Nature of access, community dependence and the social status of fishers, 2. Participant demographics and activities, 3. Distribution of income and food.

APPENDIX 6

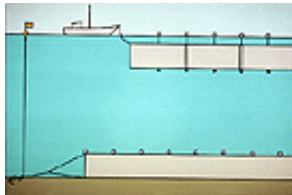
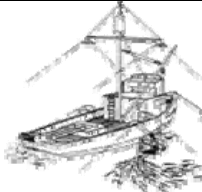
Types of gears (Source: FAO & UN Atlas of the Oceans).

Gear Type	Sub-category	Definition	Demonstration
Surrounding Nets	- lampara nets - purse seines - ring nets	Surrounding nets are large netting walls set for surrounding aggregated fish both from the sides and from underneath, thus preventing them from escaping by diving downwards.	
Seine Nets	- beach seines - boat seines	A seine net is a very long net, with or without a bag in the centre, which set either from the shore or from a boat for surrounding a certain area and is operated with two (long) ropes fixed to its ends (for hauling and herding the fish).	
Trawls	- bottom (beam, otter and pair) trawls - mid-water (otter and pair) trawls	- A bottom trawl is a cone-shaped net, which is towed in contact with the seabed. It consists of a body ending in a codend, which retains the catch. - A midwater trawl consists of a cone shaped body, normally made of four panels, ending in a codend with lateral wings extending forward from the opening.	
Dredges	- boat dredges - hand dredges - mechanized dredges	These are gears which are dragged along the bottom to catch shellfish. They consist of a mouth frame to which a holding bag constructed of metal rings or meshes is attached.	 Dredges

Types of gears (Source: FAO & UN Atlas of the Oceans).

Gear Type	Sub-category	Definition	Demonstration
Hook and Lines	- vertical lines - set longlines - drifting longlines - trolling lines - pole and lines	Hooks and lines are gear where the fish is attracted by a natural or artificial bait (lures) placed on a hook fixed to the end of a line or snood, on which they get caught.	
Lift Nets	- boat operated lift nets - portable hand lift nets - shore operated stationary lift nets	Lift nets are horizontal netting panels or bag shaped like a parallelepiped, pyramid or cone with the opening facing upwards which are submerged at a certain depth, left for a while, the time necessary for light or bait to attract fish over the opening, then lifted out of the water.	
Falling Gear	- cover pots - cast nets	These are gears that are clapped down on the prey to be captured.	

Types of gears (Source: FAO & UN Atlas of the Oceans).

Gear Type	Sub-category	Definition	Demonstration
Gill Nets and Entangling Nets	- set gillnets - drifting gillnets - encircling gillnets - trammel nets - fixed gillnets - combined gillnets-trammel nets	Gillnets and entangling nets are strings of single, double or triple netting walls, vertical, near by the surface, in midwater on on the bottom, in which fish will gill, entangle or enmesh.	
Traps	- pots - stow or bag nets - fixed traps	Traps, large stationary nets or barrages or pots, are gears in which the fish are retained or enter voluntarily and will be hampered from escaping.	 Traps
Grappling and Wounding	- harpoons - clamps - rakes - tongs - spears - wrenching gears	As in hunting, man has extended the range of his arm by using long-handled implements, which can be pushed, thrown or shot for killing, wounding or grappling fish or molluscs.	 Grappling and Wounding
Harvesting Machines			 Harvesting Machine

APPENDIX 7

GESAMP's report for the action against marine environmental damage (Source: Huber et.al., 2003).

CONCLUSION	ACTION
Human impact on the oceans is most severely felt in coastal areas, including the coastal terrestrial strip and the adjacent waters.	• manage seas and coasts as an integral part of the development process, taking full account of their net benefit to society; • integrate the management of coastal areas and associated watersheds, thereby recognizing the interdependence of freshwater (including groundwater), coastal and marine systems; and • focus management effort on physical alteration, sewage, nutrients (especially nitrogen) and sediment mobilization in relation to land-based activities.
The open ocean is much less affected than coastal areas, although it is contaminated with substances that are widely dispersed by atmospheric transport, such as nitrogen, lead, mercury and persistent volatile organic substances.	• reduce activities resulting in the atmospheric transport of pollutants to the ocean; • keep a watch on the exploitation of deep-sea non-living resources, oceanic responses to climate change and the delivery of nitrogen into the open ocean, and take appropriate action; • assess the consequences of interventions likely to result in large-scale effects, such as fertilization of oceanic surface waters and sequestration of carbon dioxide in the deep ocean, before they are implemented; • recognize that global approaches are required to address problems in the open ocean.
Many fisheries have free and open access, encouraging overcapitalization and overexploitation.	• adopt and enforce measures to equate fishing capacity and effort with optimum sustainable yields of stocks; • address artisanal over-fishing through appropriate measures including creating opportunities for alternative employment; and • reduce by-catch and discards through, inter alia, more selective fishing methods and better enforcement of restrictions.
Coastal habitats have already been severely impaired and are threatened with further damage.	• minimize habitat destruction and the loss of biodiversity by the development and/or enforcement of legal, administrative and economic measures appropriate to local circumstances; • establish protected areas for habitats, sites of exceptional scenic beauty and cultural value; and • where the degradation of habitats has already occurred, or cannot be prevented, and natural recovery is unlikely, initiate restoration where it is likely to be successful.
Risks to public health from exposures to contaminated seafood and coastal waters are more significant than previously recognized. Existing quality standards for bathing waters and seafood do not provide adequate protection.	• re-evaluate coastal bathing water and seafood quality standards in the light of recent evidence of risks associated with exposures; • invest in appropriate technologies and procedures to prevent or reduce human exposures to contaminated seafood and bathing waters; and • invest in costly treatment technologies and impose stringent quality standards only where they are needed to meet environmental and public health objectives and are appropriate to local circumstances.

APPENDIX 7 (Cont.)

GESAMP's report for the action against marine environmental damage (CONTINUED).

CONCLUSION	ACTION
Integrated coastal management (ICM)—encompassing associated freshwater catchments—is increasingly recognized as an effective approach to managing and protecting the marine and coastal environment. It merits wider application both in resolving existing problems and in dealing effectively with new ones.	• promote coordinated, cross-sectoral, and holistic approaches to managing environmental resources and amenities taking full account of environmental, public health, economic, social and political considerations; • make environmental impact assessment (EIA), risk management, and cost-benefit analysis integral elements of the decision making process and incorporate the value of ecosystem services wherever possible; • seek the active involvement and participation of all major stakeholders (local authorities, the private sector and particularly the interested public) in the design and implementation of ICM; • regularly review management systems and their implementation and adjust priorities, targets and methods as necessary; and • strengthen institutional capacities through training and retraining programs.
If existing global and regional environmental agreements had been implemented as intended, coastal areas would not be in the deplorable state they are today. National legislative frameworks to achieve national goals and implement multilateral agreements are weak in many countries and are often inadequately enforced.	• governments should adapt national legal instruments so that they conform with the provisions of internationally endorsed agreements; • national and international attention should be focused on compliance with existing international agreements rather than on the development of new ones unless there is compelling justification for them; • governments need to adopt a consistent and coordinated approach to their dealings with different international organizations and agreements; • international bodies responsible for the implementation of global environmental agreements should improve the coordination of their secretariats and governing bodies to this end; and • further attention should be devoted at the regional level to harmonizing national approaches and measures, and to collaborating cost-effectively; the full potential of voluntary commitments and targets, including those by the private sector, should be explored as well as further legally binding instruments.
There is a need to improve the balance of attention devoted to different environmental sectors (ocean, land, atmosphere) and to ensure that full account is taken of the overall consequences of interventions designed to prevent or correct problems in individual sectors.	• do not foreclose options for ocean disposal without due consideration of the impact on other sectors of environment and overall net benefits; and • refrain from an unwarranted preoccupation with issues of relatively minor consequence for the marine environment (e.g. ocean disposal of oil production platforms, authorized discharges of radioactive wastes) and focus attention on issues of substantive concern (e.g. physical alterations, coastal development and habitat loss).

APPENDIX 7 (Cont.)

GESAMP's report for the action against marine environmental damage (CONTINUED).

CONCLUSION	ACTION
The economic value of goods, services and amenities provided by the environment is poorly appreciated and grossly underestimated by managers and policy-makers. This value is only rarely taken into account in developmental plans and activities.	• take account of the economic value of environmental goods and services wherever possible; • insist that the costs of environmental degradation should be borne by those who cause it; and • broaden user fees to include hitherto "untaxed", cost-free uses of the environment and its resources.
Public information and education on environmental problems in the ocean is inadequate; furthermore, the media and special interest groups frequently direct unwarranted attention to peripheral and trivial issues, thus diverting attention from issues of substance.	• the media, governments, special interest groups and scientific organizations should fulfill their responsibilities to provide reliable public information and education about marine (and other) environmental issues to enable the public to assess the relative significance of problems and threats.
Every human activity involves a certain degree of risk. Risk is unavoidable: there is no "zero risk" option.	• strive to minimize risk and, whenever in doubt, apply a precautionary approach; and • involve natural and social scientists in the assessment of relative risk and weigh options on the basis of their net benefits.
The public sector often has difficulty in mobilizing funds for investment in environmental protection, and the private sector is playing an increasingly visible and important role.	• stimulate private sector involvement and investment by using appropriate economic incentives and creating legal and administrative frameworks to promote and protect such investments.
National capabilities to cope with the problems of the marine and coastal environment are inadequate in most developing countries.	• governments, aided by the international community should strengthen the capabilities of national institutions to manage the marine and coastal environment effectively; and • governments should provide national institutions with the authority and resources (both human and financial) needed to carry out their tasks.
International cooperation and assistance, including the transfer of knowledge, experience, technology and financial resources, benefits both the industrialized and less developed countries and is essential in boosting capabilities of developing countries to protect the environment.	• the international community should improve the flow and quality of official development assistance to less developed countries and devote a larger part of this aid to protecting oceans and coastal areas through genuine partnerships between "donor" and "recipient" countries.

APPENDIX 8

International Legal Protection of Wild Fauna and Flora (Adopted from Heijnsbergen, 1997)

(Protection of ¹ species, ² genetic diversity, ³ ecosystems, ⁴ habitats)

DATE	NAME OF TREATY
1900	(London) Convention Designed to Ensure the Conservation of Various Species of Wild Animals in Africa which are Useful to Man or Inoffensive ^{1,4}
1916-1936	Migratory Birds Convention ¹
1931	Convention for the Regulation of Whaling ¹
1933	(London) Convention relative to the Preservation of Fauna and Flora in their Natural State ^{1,4}
1940	Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere ^{1,4}
1946	International Convention for the Regulation of Whaling ¹
1950	International Convention for the Protection of Birds ¹
1964	Agreed Measures for the Conservation of Antarctic Fauna and Flora ^{1,3,4}
1968	(African) Convention on the Conservation of Nature and Natural Resources ^{1,3,4}
1971	Program on the Man and the Biosphere (MAB) ⁴
1971	Convention on Wetlands of International Importance Especially as Waterfowl Habitat (RAMSAR) ⁴
1972	Convention concerning the Protection of the World Cultural and Natural Heritage ^{3,4}
1972	Convention for the Conservation of Antarctic Seals ³
1972	Stockholm Declaration ^{2,3,4}
1972...1984	Bilateral Treaties ¹
1973	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) ¹
1973	Agreement on the Conservation of Polar Bears ^{1,3,4}
1976	Convention on the Conservation of Nature in the South Pacific ^{3,4}
1979	ECC Council Directive on the Conservation of Wild Birds ^{1,4}
1979	(Bonn) Convention on the Conservation of Migratory Species of Wild Animals ^{1,4}
1979	(Bern) Convention on the Conservation of European Wildlife and Natural Habitats ^{1,4}
1980	Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) ³
1982	UN Convention on the Law of the Sea (UNCLOS) ¹
1982	Protocol concerning Mediterranean Specially Protected Areas ⁴

APPENDIX 8 (Cont.)

International Legal Protection of Wild Fauna and Flora (continued).

(Protection of ¹ species, ² genetic diversity, ³ ecosystems, ⁴ habitats)

DATE	NAME OF TREATY
1985	(Nairobi) Protocol concerning Protected Areas of Wild Fauna and Flora ^{1, 2, 3, 4}
1985	(ASEAN) Agreement on the Conservation of Nature and Natural Resources ^{1, 2, 3, 4}
1986-1987	Convention for the Protection of the Natural Resources and the Environment of the South Pacific Region ⁴⁻¹
1990	(Kingston) Protocol concerning Specially Protected Areas ^{1, 3, 4}
1992	ECE Code of Practice for the Conservation of Threatened Animals and Plants and Other Species of International Significance ^{1, 2, 3, 4}
1992	EEC Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora ^{1, 3, 4}
1992	Convention on Biological Diversity (CBD) ^{1, 2, 3, 4}
1994	Protocol for the Implementation of the Alpine Convention in the Field of Nature Protection and Landscape Conservation ^{1, 4}

APPENDIX 9

Rolston's Principles for Balancing Values

(Source: Rolston, 1994)

Balancing Natural and Cultural Values

- Emphasize nonrival cultural and natural values.
- Be careful about compromises.
- Protect minority values.
- Complement economic frameworks with ecological analyses.
- Enough is enough.
- Identify all affected parties.
- Insist on sustainability.
- Avoid irreversible change.
- Recognize a shifting burden of proof.
- Make latent value judgments explicit.

Balancing Biodiversity and Cultural Values

- Protect biodiversity ecosystemically.
- Protect keystone species.
- Protect speciating in process.
- Protect charismatic species.
- Protect naturally rare species.
- Protect species over individuals.
- Keep biodiversity in the commons.
- Do not jeopardize biodiversity to postpone solutions to social injustice.
- Protect the most fundamental values, whether natural or cultural.
- Protect biodiversity with triage.

Balancing Integrity and Health Values

- Land health and human health are nonrival values.
- Human integrity is enriched by environmental integrity.
- Do not jeopardize land integrity and health to postpone solutions to social problems.
- A toxic threat is trumps.
- Community overrides consumption.
- Preserve processes more than products.
- Restore in order to conserve.
- Respect systemic historical change, more than episodic, contingent change.
- The more fragile a landscape, the lighter it ought to be treated.

Balancing Global Natural and Human Cultural Values

- Conserving natural value is a fundamental principle of international law.
- Emphasize global nonrival cultural and environmental values.
- Foreign affairs are domestic affairs in a global Earth ethics.
- Common natural resources are more fundamental than national and private resources.
- Ecological sustainability is more fundamental than economic sustainability.
- Do not jeopardize global natural values to avoid solving social problems.
- Avoid global irreversible change.
- Plan for seven generations.
- Think globally, act locally.
- Earth is more important than people.

APPENDIX 10

Key Biodiversity Issues for Protected Areas (Source: CBD Technical Series No. 15, 2004)

- Article 8 of **the Convention on Biological Diversity** (*In-situ* conservation) calls for the establishment of a system of protected areas or areas where special measures need to be taken to conserve biological diversity.
- Protected areas carry out **numerous functions** that are beneficial to humans, and even essential to human welfare.
- The **value of protected areas** is poorly understood and greatly under-valued by markets, politicians and the general public.
- There are **more than 100,000 protected area sites worldwide** covering almost 12 percent of the Earth's land surface. However, they do not adequately cover all important ecosystems, habitats and species. Less than one per cent of the world's marine ecosystems is protected and other biomes, including major freshwater systems and grasslands are poorly represented in the existing protected area systems.
- Recent studies have shown that there are **large gaps** in the existing systems of protected areas in almost all regions.
- The **global gap analysis** is considered to be an effective conservation planning tool that combines data on the global distribution of terrestrial vertebrates and protected areas to assess the effectiveness of the global protected area network in representing species, and to provide recommendations for the future expansion of this network.
- **Marine and coastal protected areas** (MCPAs) provide an effective and flexible tool for implementing the three objectives of the Convention.
- The diverse **inland water ecosystems** are probably the most threatened of all ecosystem types because of habitat degradation and unsustainable exploitation.
- Regarding **forest biodiversity**, although more than 10 % of the world's forests are included in protected areas, not all forest types are well represented.
- **Dry and sub-humid land ecosystems** are often believed to contain relatively low levels of biological diversity, particularly if measured by species richness. However, it is especially in such ecosystems that people depend the most on biodiversity (including ecosystem functions and ecosystem services) for their livelihoods.
- While planning, establishing and managing protected areas, there is a need to have in mind **corridors, connectivity and ecological networks**.
- **Trans-boundary protected areas** are those, which straddle two or more countries. They present unique challenges for management, in particular, as a result of differences in legal systems, human, technical and financial resources, infrastructure and policies between relevant countries.
- There is a critical need to better support the **role of protected area personnel** in biodiversity conservation.

APPENDIX 10 (Cont.)

- The conventional model of protected areas needs a substantial paradigm shift towards more **participatory forms of management**, for effective and sustainable conservation, and social justice.
- Management of protected areas has often been based on models that exclude the **local resident populations** and perceive their concerns as incompatible with conservation.
- **Indigenous and local communities** are owners and co-managers of considerable areas of land designated as protected areas. They often suffer direct economic losses when their access to biological resources is cut off by establishment of a protected area.
- The **Global Environment Facility** (GEF) considers protected areas linked to their surroundings as the most important tool to achieve biodiversity conservation and ecological integrity.
- Important progress has been made in the last few decades in expanding and consolidating protected areas. However, much still needs to be done to ensure their **effectiveness in the long-term**.
- Many protected areas are being seriously degraded, and many are in danger of losing the very values for which they were originally established. **Assessment of management effectiveness** has so far been undertaken in only a small percentage of the world's protected areas.
- Bearing in mind the role that protected areas can play to meet the global biodiversity target of significantly reducing by 2010 the rate of biodiversity loss as a contribution to poverty alleviation and to the benefit of all life on earth, the **protected area coverage indicator** is a possible means of assessing progress towards this target.
- **Mining and biodiversity conservation** have traditionally been viewed as mutually exclusive activities. There is considerable scope for the industry to help alleviate pressure on protected areas due to poverty as well as to contribute directly to biodiversity conservation, while minimizing environmental impacts.
- Tourism has become a major economic activity. The apparent conflict between **tourism activities and biodiversity conservation** is often solved when a protected area is not considered only as a wilderness area set aside for conservation purposes, but as series of ecosystems composed of several interacting elements and actors which have to live in harmony.
- A number of **bioprospecting innovations** have been derived from protected areas and they provide a background to the role of ABS (Access and Benefit Sharing) in protected areas management, including the need for nationally adapted guidelines, policies and legislation.
- The **role of youth** in the current and future planning and management of protected areas has been particularly emphasized in recent years.

APPENDIX 11

IUCN Protected Area Management Categories (IUCN, 1994).

IUCN CATEGORY AND DEFINITION	OBJECTIVES OF MANAGEMENT	GUIDANCE FOR SELECTION
CATEGORY Ia Strict Nature Reserve Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.	- to preserve habitats, ecosystems and species in as undisturbed a state as possible; - to maintain genetic resources in a dynamic and evolutionary state; - to maintain established ecological processes; - to safeguard structural landscape features or rock exposures; - to secure examples of the natural environment for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded; - to minimize disturbance by careful planning and execution of research and other approved activities; and - to limit public access.	- The area should be large enough to ensure the integrity of its ecosystems and to accomplish the management objectives for which it is protected. - The area should be significantly free of direct human intervention and capable of remaining so. - The conservation of the area's biodiversity should be achievable through protection and not require substantial active management or habitat manipulation (c.f. Category IV).
CATEGORY Ib Wilderness Area Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.	- to ensure that future generations have the opportunity to experience understanding and enjoyment of areas that have been largely undisturbed by human action over a long period of time; - to maintain the essential natural attributes and qualities of the environment over the long term; - to provide for public access at levels and of a type which will serve best the physical and spiritual wellbeing of visitors and maintain the wilderness qualities of the area for present and future generations; and - to enable indigenous human communities living at low density and in balance with the available resources to maintain their life style.	- The area should possess high natural quality, be governed primarily by the forces of nature, with human disturbance substantially absent and be likely to continue to display those attributes if managed as proposed. - The area should contain significant ecological, geological, physiogeographic, or other features of scientific, educational, scenic or historic value. - The area should offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet, non-polluting and non-intrusive means of travel (i.e. non-motorized). - The area should be of sufficient size to make practical such preservation and use.

IUCN Protected Area Management Categories (Continued).

IUCN CATEGORY AND DEFINITION	OBJECTIVES OF MANAGEMENT	GUIDANCE FOR SELECTION
CATEGORY II National Park Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.	- to protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes; - to perpetual, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources, and species, to provide ecological stability and diversity; - to manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will maintain the area in a natural or near natural state; - to eliminate and thereafter prevent exploitation or occupation inimical to the purposes of designation; - to maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation; and - to take into account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other objectives of management.	- The area should contain a representative sample of major natural regions, features or scenery, where plant and animal species, habitats and geomorphological sites are of special spiritual, scientific, educational, recreational and tourist significance. - The area should be large enough to contain one or more entire ecosystems not materially altered by current human occupation or exploitation.
CATEGORY III Natural Monument Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.	- to protect or preserve in perpetuity specific outstanding natural features because of their natural significance, unique or representational quality, and/or spiritual connotations; - to an extent consistent with the foregoing objective, to provide opportunities for research, education, interpretation and public appreciation; - to eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation; and - to deliver to any resident population such benefits as are consistent with the other objectives of management.	- The area should contain one or more features of outstanding significance (appropriate natural features include spectacular waterfalls, caves, craters, fossil beds, sand dunes and marine features, along with unique or representative fauna and flora; associated cultural features might include cave dwellings, cliff-top forts, archaeological sites, or natural sites which have heritage significance to indigenous peoples). - The area should be large enough to protect the integrity of the feature and its immediately related surroundings.

IUCN Protected Area Management Categories (Continued).

IUCN CATEGORY AND DEFINITION	OBJECTIVES OF MANAGEMENT	GUIDANCE FOR SELECTION
CATEGORY IV Habitat/Species Management Area Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.	- to secure and maintain the habitat conditions necessary to protect significant species, groups of species, biotic communities or physical features of the environment where these require specific human manipulation for optimum management; - to facilitate scientific research and environmental monitoring as primary activities associated with sustainable resource management; - to develop limited areas for public education and appreciation of the characteristics of the habitats concerned and of the work of wildlife management; - to eliminate and thereafter prevent exploitation or occupation inimical to the purposes of designation; and - to deliver such benefits to people living within the designated area as are consistent with the other objectives of management.	- The area should play an important role in the protection of nature and the survival of species, (incorporating, as appropriate, breeding areas, wetlands, coral reefs, estuaries, grasslands, forests or spawning areas, including marine feeding beds). - The area should be one where the protection of the habitat is essential to the well-being of nationally or locally-important flora, or to resident or migratory fauna. - Conservation of these habitats and species should depend upon active intervention by the management authority, if necessary through habitat manipulation (c.f. Category Ia). - The size of the area should depend on the habitat requirements of the species to be protected and may range from relatively small to very extensive.
CATEGORY V Protected Landscape/Seascape Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.	- to maintain the harmonious interaction of nature and culture through the protection of landscape and/or seascape and the continuation of traditional land uses, building practices and social and cultural manifestations; - to support lifestyles and economic activities which are in harmony with nature and the preservation of the social and cultural fabric of the communities concerned; - to maintain the diversity of landscape and habitat, and of associated species and ecosystems; - to eliminate where necessary, and thereafter prevent, land uses and activities which are inappropriate in scale and/or character; - to provide opportunities for public enjoyment through recreation and tourism appropriate in type and scale to the essential qualities of the areas; - to encourage scientific and educational activities which will contribute to the long term well-being of resident populations and to the development of public support for the environmental protection of such areas; and - to bring benefits to, and to contribute to the welfare of, the local community through the provision of natural products (such as forest and fisheries products) and services (such as clean water or income derived from sustainable forms of tourism).	- The area should possess a landscape and/or coastal and island seascape of high scenic quality, with diverse associated habitats, flora and fauna along with manifestations of unique or traditional land-use patterns and social organizations as evidenced in human settlements and local customs, livelihoods, and beliefs. - The area should provide opportunities for public enjoyment through recreation and tourism within its normal lifestyle and economic activities.

IUCN Protected Area Management Categories (Continued).

IUCN CATEGORY AND DEFINITION	OBJECTIVES OF MANAGEMENT	GUIDANCE FOR SELECTION
CATEGORY VI Managed Resource Protected Area Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.	- to protect and maintain the biological diversity and other natural values of the area in the long term; - to promote sound management practices for sustainable production purposes; - to protect the natural resource base from being alienated for other land-use purposes that would be detrimental to the area's biological diversity; and - to contribute to regional and national development.	- The area should be at least two-thirds in a natural condition, although it may also contain limited areas of modified ecosystems; large commercial plantations would <i>not</i> be appropriate for inclusion, - The area should be large enough to absorb sustainable resource uses without detriment to its overall long-term natural values.

APPENDIX 12

Red List Categories and Definitions (IUCN, 2006)

CATEGORY	DEFINITION
EXTINCT (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EXTINCT IN THE WILD (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CRITICALLY ENDANGERED (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
VULNERABLE (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DATA DEFICIENT (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
NOT EVALUATED (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

APPENDIX 13

The definitions of the terms used in the Red List Categories and Criteria.

1. Population and Population Size (Criteria A, C and D): The term 'population' is used in a specific sense in the Red List Criteria that is different to its common biological usage. Population is here defined as the total number of individuals of the taxon. For functional reasons, primarily owing to differences between life forms, population size is measured as numbers of mature individuals only. In the case of taxa obligately dependent on other taxa for all or part of their life cycles, biologically appropriate values for the host taxon should be used.

2. Subpopulations (Criteria B and C): Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less).

3. Mature individuals (Criteria A, B, C and D): The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction. When estimating this quantity, the following points should be borne in mind:

- Mature individuals that will never produce new recruits should not be counted (e.g. densities are too low for fertilization).
- In the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals, which take this into account.
- Where the population size fluctuates, use a lower estimate. In most cases this will be much less than the mean.
- Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g. corals).
- In the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.
- Re-introduced individuals must have produced viable offspring before they are counted as mature individuals.

4. Generation (Criteria A, C and E): Generation length is the average age of parents of the current cohort (i.e. newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once. Where generation length varies under threat, the more natural, i.e. pre-disturbance, generation length should be used.

5. Reduction (Criterion A): A reduction is a decline in the number of mature individuals of at least the amount (%) stated under the criterion over the time period (years) specified, although the decline need not be continuing. A reduction should not be interpreted as part of a fluctuation unless there is good evidence for this. The downward phase of a fluctuation will not normally count as a reduction.

6. Continuing decline (Criteria B and C): A continuing decline is a recent, current or projected future decline (which may be smooth, irregular or sporadic) which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines, but an observed decline should not be considered as a fluctuation unless there is evidence for this.

7. Extreme fluctuations (Criteria B and C): Extreme fluctuations can be said to occur in a number of taxa when population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e. a tenfold increase or decrease).

APPENDIX 13 (Cont.)

8. Severely fragmented (Criterion B) The phrase 'severely fragmented' refers to the situation in which increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonization.

9. Extent of occurrence (Criteria A and B): Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy (see Figure 2). This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g. large areas of obviously unsuitable habitat) (but see 'area of occupancy', point 10 below). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

10. Area of occupancy (Criteria A, B and D): Area of occupancy is defined as the area within its 'extent of occurrence' (see point 9 above) which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data (see point 7 in the Preamble). To avoid inconsistencies and bias in assessments caused by estimating area of occupancy at different scales, it may be necessary to standardize estimates by applying a scale-correction factor. It is difficult to give strict guidance on how standardization should be done because different types of taxa have different scale-area relationships.

11. Location (Criteria B and D): The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat.

12. Quantitative analysis (Criterion E): A quantitative analysis is defined here as any form of analysis which estimates the extinction probability of a taxon based on known life history, habitat requirements, threats and any specified management options. Population viability analysis (PVA) is one such technique. Quantitative analyses should make full use of all relevant available data. In a situation in which there is limited information, such data as are available can be used to provide an estimate of extinction risk (for instance, estimating the impact of stochastic events on habitat). In presenting the results of quantitative analyses, the assumptions (which must be appropriate and defensible), the data used and the uncertainty in the data or quantitative model must be documented.

APPENDIX 14

CRITICALLY ENDANGERED-CR (Source: IUCN Red List of Threatened Species, 2006)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 90\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

- (a) direct observation
- (b) an index of abundance appropriate to the taxon
- (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
- (d) actual or potential levels of exploitation
- (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 80\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 80\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 80\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km², and estimates indicating at least two of a-c:

- a. Severely fragmented or known to exist at only a single location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) area, extent and/or quality of habitat
 - (iv) number of locations or subpopulations
 - (v) number of mature individuals.
- c. Extreme fluctuations in any of the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 10 km², and estimates indicating at least two of a-c:

- a. Severely fragmented or known to exist at only a single location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (i) extent of occurrence
 - (ii) area of occupancy

APPENDIX 14 (Cont.)

- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.
- c. Extreme fluctuations in any of the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
 - (a) Population structure in the form of one of the following:
 - (i) no subpopulation estimated to contain more than 50 mature individuals, OR
 - (ii) at least 90% of mature individuals in one subpopulation.
 - (b) Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

APPENDIX 15

Turkey profile (Source: Kaboğlu, Güçlüsoy & Bizsel, 2005; based on data from Turkey's Environmental Atlas, GEF-SGP Turkish National Strategy, World Resources Institute, A Global System of Marine Protected Areas, Turkey's National Biodiversity Strategy Action Plan)

Type of data	Master data	Detailed data
Population	67,803,927 (2000)	
Geography	Location: 35°51' - 42°06' N 26° - 45° E Land area: 777,971 km ²	Area of Anatolian Peninsula: 97% of the total Area of Terrace Peninsula: 3% of the total Lowest elevation: 0 m. (the Mediterranean) Highest elevation: 5,166 m. (Mount Ararat)
Climate	Subtropical	Annual mean precipitation: 652.5 mm. Annual mean temperatures: South coasts: 18-20°C East coasts: 14-15°C Inlands: 4-18°C
Coastal data	Length of coastline: 8333 km. Mediterranean coast: 1577 km. Aegean coast: 2805 km. Black Sea coast: 1659 km. Marmara Sea coast: 663 km.	Area of continental shelf: 53,292 km ² Area of territorial sea: 81,006 km ² Area of claimed Exclusive Economic Zone: 176,643 km ² Percent of population within 100 km. of the coast: 58% (2000)
Marine data	Area of the Mediterranean Sea: 2,966,000 km ² Area of the Aegean Sea: 214,000 km ² Area of the Black Sea: 586,000 km ² Area of the Marmara Sea: 11,500 km ²	Salinity: Mediterranean Sea: 0.038 Aegean Sea: 0.032 Marmara Sea: 0.23 Black Sea: 0.018
Freshwater data	Total area of freshwater systems: 10,000 km ² Number of river basins: 26 Number of natural lakes: 200 Total internal renewable water resources: 227 km ³	Total known marine species: 3000 Area of natural lakes: 906,000 ha. Area of artificial lakes (dams): 380,000 ha. Annual river flows from other countries: 8 km ³ Annual river flows to other countries: 60 km ³
Ecosystem data	Ecosystem types: Forests, steppes, wetlands (freshwater systems), coastal and marine	Area of forests: 15,496,000 ha. Area of steppes: 28,000,000 ha. Area of wetlands: 1,280,000 ha.
Species data	Number of known (and endemic) species: Higher plants: 8,947 (2762) Mammals: 155 (1), Fish: 472 (3) Birds: 454, Reptiles: 93 (2) Amphibians: 20 (1) Invertebrates: 120,000	Number of threatened species: Plants: 104, Mammals: 17 Birds: 14, Reptiles: 12 Amphibians: 3, Fish: 50 Number of freshwater fish species: 192

APPENDIX 16

Fisheries data of Turkey (Source: FAO: 2006)

Commodity balance (1999)	Production	Import	Export	Total supply	Per caput supply
	'000 ton liveweight				kg/year
Fish for direct human consumption	638.1	40.294	51.784	591.542	9.0
Fish for animal feed and other purposes	35.065				

Estimated employment (1999):	
Primary sector:	68 000
Secondary sector:	190 000
Gross value of fisheries output (1999):	US\$ 902.5 million
Trade (2000):	
Value of imports:	US\$ 51.9 million
Value of exports:	US\$ 90.9 million

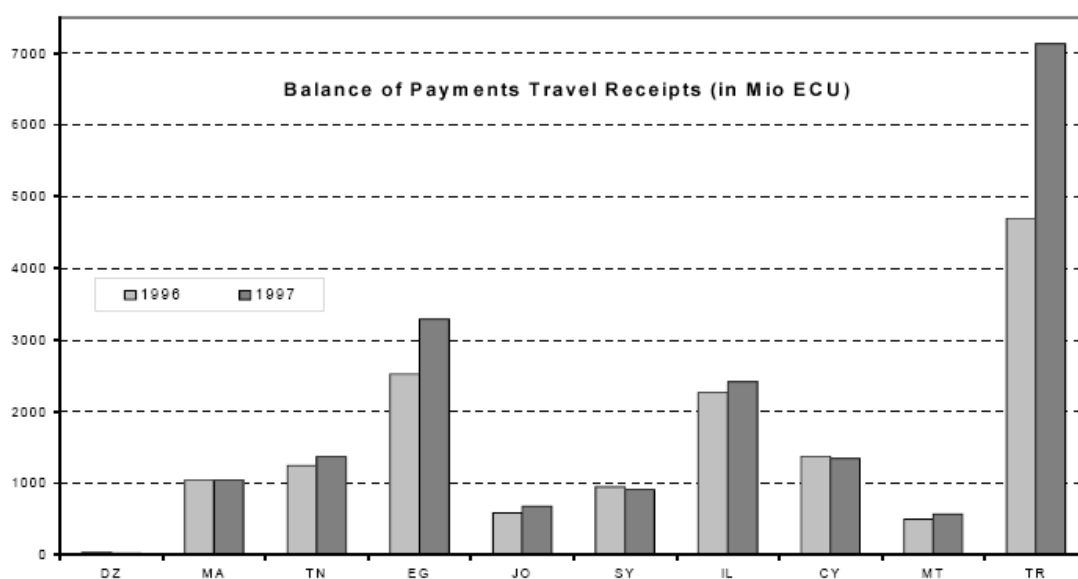
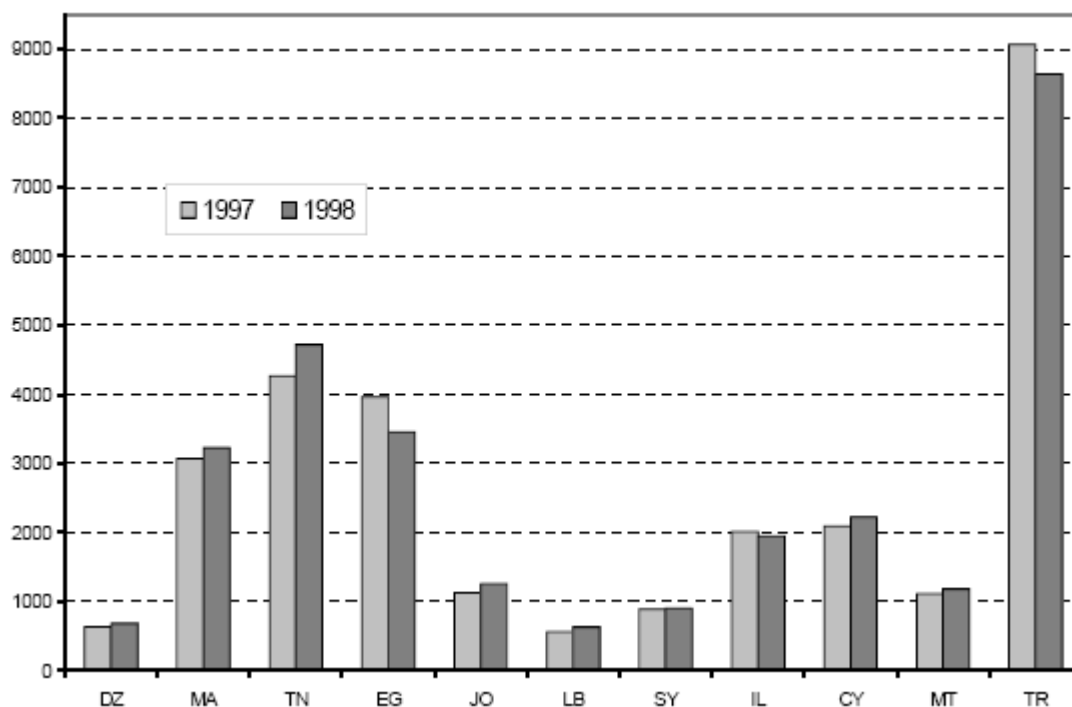
Fishing vessel types, 1990-1995 (numbers)						
Boat type	1990	1991	1992	1993	1994	1995
Trawler	483	481	532	531	408	359
Purse Seiner	457	426	621	615	544	509
Carrier vessel	613	225	253	214	136	140
Other	7 196	7 514	6 390	6 941	7 758	8 702
Total	8 749	8 646	7 796	8 301	8 846	9 710

The Turkish fishing fleet, 1990-1995 (numbers)								
Region	1990	1991	1992	1993	1994	1995	1996	1997
Black Sea	3 205	3 133	2 942	3 495	3 682	4 255	4 133	4 043
Sea of Marmara	3 089	2 944	2 333	1 639	1 877	1 901	1 877	1 799
Aegean Sea	1 243	1 359	1 424	2 047	2 080	2 329	2 309	2 331
Mediterranean Sea	1 212	1 210	1 097	1 120	1 207	1 225	1 271	1 567
Total	8 749	8 646	7 796	8 301	8 846	9 710	9 590	9 740

APPENDIX 17

Tourism data of Turkey (Source: UNWTO, 2006)

Tourist arrivals at the borders (in 000's)



DZ: Algeria, MA: Morocco, TN: Tunisia, EG: Egypt, JO: Jordan, LB: Lebanon

SY: Syria, IL: Israel, CY: Cyprus, MT: Malta, TR: Turkey

APPENDIX 17 (Cont.)

International Tourist Arrivals (million)					
Rank	Series ¹	Million		Change (%)	
		2004	2005*	04/03	05*/04
1 France	TF	75.1	76.0	0.1	1.2
2 Spain	TF	52.4	55.6	3.1	6.0
3 United States	TF	46.1	49.4	11.8	7.2
4 China	TF	41.8	46.8	26.7	12.1
5 Italy	TF	37.1	36.5	-6.4	-1.5
6 United Kingdom	VF	27.8	30.0	12.3	8.0
7 Mexico	TF	20.6	21.9	10.5	6.3
8 Germany	TCE	20.1	21.5	9.4	6.8
9 Turkey	TF	16.8	20.3	26.1	20.5
10 Austria	TCE	19.4	20.0	1.5	3.0

International Tourism Receipts (US\$ billion)							
Rank		US\$				Local currencies	
		Billion		Change (%)		Change (%)	
		2004	2005*	04/03	05*/04	04/03	05*/04
1	United States	74.5	81.7	15.8	9.6	15.8	9.6
2	Spain	45.2	47.9	14.1	5.8	3.8	5.8
3	France	40.8	42.3	11.6	3.5	1.5	3.5
4	Italy	35.7	35.4	14.1	-0.7	3.8	-0.7
5	United Kingdom	28.2	30.7	24.6	8.7	11.1	9.5
6	China	25.7	29.3	47.9	13.8	47.9	12.7
7	Germany	27.7	29.2	19.7	5.6	8.9	5.5
8	Turkey	15.9	18.2	20.3	14.2	14.7	7.8
9	Austria	15.3	15.5	9.9	0.9	-0.1	0.9
10	Australia	13.6	15.0	21.7	9.6	7.7	5.8

APPENDIX 18

Proposals for the conservation of biodiversity (Source: National Report on Sustainable Development, 2002).

POLICY FORMULATION

- Conservation and sustainable use of biodiversity should be integrated into all national sectoral plans and programs.
- Traditional utilization methods that contribute to the conservation of biodiversity should be supported and improved.
- National policies should be developed regarding genetically modified organisms (GMOs) and alien species as factors threatening biodiversity.
- Eco-tourism should be promoted.
- Clean technologies should be promoted in the industrial sector and incentives should be provided for the industry to adopt measures for environmental protection.
- Fields of cooperation with the NGOs should be expanded and developed.
- Conservation policies should be developed.
- All decisions about the use of all ecosystems should be free of political influence.

LEGAL / INSTITUTIONAL ARRANGEMENTS

- Legislation should be developed for the conservation of biodiversity in areas remaining outside the protected areas.
- The Soil Law should be put into effect and implemented.
- The Biosafety Law should be put into effect and a National Biosafety Committee should be established.
- A Nature Protection Law should be prepared.
- Landscape conservation areas should be included in relevant legislation as a separate category.
- The Law on National Deforestation and the Control of Soil Erosion should be implemented.
- The 2b-practice should be stopped in forest areas.
- The articles of Tourism Incentives Law concerning the use of coastal and forest areas that are irrespective of the sustainability of ecosystems should be amended in line with the principles of sustainable development and conservation of biodiversity.
- National legislation should be adapted to the following EU directives: Council Directive 90/220/EEC on the Deliberate Release into the Environment of Genetically Modified Organisms; Council Directive 90/219/EEC on the Contained Use of Genetically Modified Microorganisms; Regulation (EC) No. 97/258 of the European Parliament and of the Council concerning Novel Foods and Novel Food Ingredients.
- The EIA process should prioritize the prevention of loss of biodiversity; the required legal arrangements should be made for the transition into the strategic EIA process.
- Powers and responsibilities of public institutions and organizations should be clearly defined to prevent overlaps and conflicts, and inter-organizational cooperation and coordination should be effectuated.
- Protected areas should be locally managed using a participatory approach.
- Dissuasive measures should be taken to prevent illegal entry and exit of species specified in national legislation and international conventions to which Turkey is a party.
- Organic farming practices should be expanded, protected, and supported.
- Studies concerning the economic use of gene resources should be speeded up.
- Studies concerning the economic utilization of biodiversity should be prioritized.

APPENDIX 18 (Cont.)

Proposals for the conservation of biodiversity

IMPLEMENTATION MECHANISMS (PROTECTED AREAS, MANAGEMENT PLANNING, INVENTORY, INDICATORS, MONITORING PROGRAMS, FINANCIAL MECHANISMS)

- The numbers of protected areas should be increased to cover at least 5% of the land area of the country and they should be more effectively managed.
- Financial resources allotted to the conservation of biodiversity should be increased.
- Research institutes should expand their projects geared towards solving the problems of implementation and these efforts should be supported.
- The areas which are of significance and require priority action in terms of biodiversity (areas where rare, endemic, and endangered species are found) should be identified and designated for in-situ conservation.
- Biodiversity and sustainable development indicators should be developed.
- Action should be taken to accelerate the completion of inventories.
- The communities living in protected areas should be supported with the introduction of alternate means for their livelihoods.
- Protected areas should be managed at the local level using a participatory approach.
- Fund-raising, planning and project implementation activities should be undertaken to revive the damaged/degraded ecosystems.
- Action should be taken for the improvement and a more expanded use of native species.
- Land-use should be decided on at the level of each basin according to management plans.
- Clean technologies should be promoted for the industrial sector, and incentives should be provided for the industry to take environmental protection measures.
- Dominant or indicator species in ecosystems should be identified at the level of each basin and monitored.
- Steppe ecosystems should be protected.
- Sustainable and alternative methods/approaches should be developed for the species gathered from nature, and traditional information and experiences should be compiled and protected.
- Action should be taken to protect the genetic diversity of cultivated species, to tightly control access to these species, and to retain the information, benefits and new results emerging from their use within the country.
- Action should be taken to make situation assessments, establish a data bank, and improve data management models.
- An information exchange mechanism should be established.
- Funds allocated for investments in the conservation of biodiversity should be increased.
- Adequately sized areas, which are significant in terms of biodiversity, should be reserved for the conservation of each ecosystem.
- Land-use plans should be prepared at the national scale.
- Organic farming practices should be expanded, protected, and supported.
- Studies concerning the economic use of gene resources should be speeded up.
- Studies concerning the economic utilization of biodiversity should be prioritized.
- A natural history museum should be established.

CAPACITY BUILDING

- The infrastructure of customs offices should be improved and adequate numbers of customs specialists should be trained and employed.
- In a restructuring process, institutional organization and capacities should be enhanced with human resources development, infrastructure, technical assistance, etc. for the purposes of conservation of biodiversity.
- The capacities of NGOs should be enhanced with the support of international programs.

APPENDIX 18 (Cont.)

Proposals for the conservation of biodiversity

AWARENESS BUILDING / EDUCATION

- Means of communication should be more effectively used for awareness raising.
- In-service training programs should be conducted for the training of personnel at all institutions/organizations who have responsibilities and powers concerning biodiversity and its sustainable management.
- Awareness building programs should be implemented for different target groups, particularly geared towards people living in protected areas and those who use these areas.
- Education programs on biodiversity should be prepared for primary and higher education.

APPENDIX 19

40 YEARS OF MONK SEAL CONSERVATION IN TURKEY (Source: Kırac, Savaş & Güçlüsoy, 2004)

Strengths and Achievements

I. Research and acquiring scientific data

- The first scientific study authored by Mursaloğlu in 1964 confirmed the occurrence of the endangered Mediterranean monk seal along Turkish coasts; it formed an important basis for later research and conservation efforts.
- During the second generation period of Turkish monk seal history, significant and wide-ranging scientific data were collected by various researchers, covering distribution and abundance, habitat requirements, breeding and feeding. Such information proved indispensable in determining conservation priorities for the species in Turkey (Berkes et al. 1979, Berkes 1976, 1978, Mursaloğlu 1984a, 1986, 1991).
- Third generation scientific studies played an important role in acquiring more precise and up-to-date data on the distribution and status of the species, and have also furthered knowledge on ecology and biology of the species (Öztürk et al. 1991, Öztürk 1992, Güçlüsoy et al. 1999, Kompanje et al. 2000, Kırac et al. 1998a, 2002, Salman et al. 2001, Güçlüsoy & Savaş 2003b, Karamanlidis & Johnson 2002).
- In this, the third generation period, the current status of the species and its habitat are monitored more effectively. A case in point is SAD-AFAG's "FokData" monk seal data base, launched in 1990, which stores individual sighting records originating from throughout the coastal areas of Turkey (Kırac et al. 1998a).

II. Sustainable management of aquatic resources

- Largely because of lobbying efforts by SAD-AFAG, METU-IMS, IU-FAP and others, some fisheries decisions of relevance to the monk seal have subsequently been taken in close cooperation with local fisheries cooperatives, particularly those at Foça and Aydıncık on the west Mersin coasts.
- A regulation banning entry into monk seal caves under any circumstances was incorporated into the government's 1991 Aqua Products Circular, following a proposal by SAD-AFAG during the first NMSC meeting in Ankara and subsequent adoption by the MoA.
- Banning beach-seines and coastal trawlers in the Foça SPA in 1992, following a proposal by the local fishermen of Foça, the Foça Municipality and SAD-AFAG.
- Banning beach-seines and other coastal trawler fishing techniques on all Turkish coasts (except for Ayvalık and vicinity), proposed by SAD-AFAG based on the study reports of the Fisheries Faculty of Aegean University and the experience gained from the FPP in 1999; approved by the Ministry of Agriculture in 2001.
- Banning harpoon fishing of dusky grouper (*Ephinephelus guaza*) and dog tooth grouper (*E. caninus*) in Turkey, proposed by SAD-AFAG in 2002 and approved by the Ministry of Agriculture (MoA) in 2002, to the benefit of the species and artisanal fishermen.
- "No fishing zones" established in Kızılliman and Melleç in Mersin, and Mordoğan in İzmir, in order to keep fishing away from important monk seal breeding caves. The proposals provided by SAD-AFAG and METU-IMS, in joint action and in consensus with artisanal fishermen, were subsequently adopted by the MoA.
- The establishment of marine guarding systems in two protected areas, Foça (donated by MoE) and Aydıncık (by AFAG), with the use of patrol boats operated by local government and stakeholders, including fishing cooperatives and municipalities.
- Involvement of artisanal fishermen in conservation, through actions such as the "Artisanal Fisheries Symposium" held by SAD-AFAG and Dokuz Eylül University in 1999, and the strengthening of artisanal fishing cooperatives in Foça, Karaburun and Aydıncık via financial and equipment support by SAD-AFAG in 2002 and 2003.

APPENDIX 19 (Cont.)

III. Conservation: protected areas and sustainable management plans

Concrete steps and achievements made during the third generation conservation period (since 1987) include:

- A coastal zone and adjacent marine area zonation plan for the “Foça Monk Seal and Sea Protection Area” (Aslan cape to Deveboynu cape), prepared and submitted to the MoE by SAD-AFAG in 2003.
- The declaration of five coastal areas as 1st degree protected areas (SIT) along the west Mersin coast, totaling some 70 km. Proposed by METU-IMS in 1998 and adopted by the Ministry of Culture (MoC) [see Regional News, TMG 1 (2): December 1998].
- The declaration of Kūdūr Peninsula (near Bodrum) as a 1st degree protected area (SIT), proposed by SAD-AFAG in 1999, and subsequently adopted by the MoE and Ministry of Culture (MoC) [see Mediterranean News, TMG 2 (1): May 1999].
- Regulating navigation around the Ayvalık islands, Foça islands and Bodrum Peninsula and adjacent islands. Ships greater than 300 GT and ships with all tonnages carrying hazardous cargo will no longer be permitted to navigate between the mainland and adjacent islands so as to ensure safety of navigation, life and environment. The SAD-AFAG proposal was adopted in 2001 by the Undersecretariat for Maritime Affairs and implemented by the Department of Oceanography and Navigation.
- SAD-AFAG supported the MoC in providing habitat data for a court case against an investor attempting to construct a hotel in Gökgemile bay near Fethiye — a 1st degree protected area (SIT) and also an important monk seal site. The MoC won the court case in 1999. Similarly, various illegal coastal zone developments have been investigated by SAD-AFAG.
- As a result of research studies by SAD-AFAG, METU-IMS and IU-FAP, 12 Important Monk Seal Sites in Turkey were identified and subsequently proposed to the NMSC as protected areas in 1998 [see Endgame: the fight for marine protected areas in Turkey, TMG 5 (1): May 2002].
- In May 2004, the Turkish government publicly pledged to establish permanent protection status for 5 Important Monk Seal Sites of the 12 originally recommended [see Turkish government pledges 5 new protected areas for the Monk Seal, TMG 7 (1): June 2004].
- In 2000, during a study considering revisions to the extensive “no diving zones” under MoC regulations, SAD-AFAG proposed continuation of diving restrictions in seal-critical areas. Persuaded by SAD-AFAG’s case, the MoC subsequently agreed to announce further new “no diving zones” on certain coasts.

IV. Public awareness and lobbying activities

- During the third generation period, decision makers, universities and academics, the press and media, and the general public have been widely informed about the monk seal in Turkey, the threats facing it, and measures necessary to prevent its extinction.
- On the formal education level, SAD-AFAG, METU-IMS and IU-FAP have undertaken education programmes in selected high schools, primary schools and universities nationwide.
- Threat factors against the species and its habitats have been clearly identified and published (Savaş 1999, Güçlüsoy & Savaş 2003a, Kırac et al. 1998b) and reported to relevant ministries, local governors and mayors for corrective actions to be taken.

V. Others

- At Çavuş Island near Bodrum, an oil spill clean-up operation was launched and successfully completed by SAD-AFAG in 1997 to save monk seal habitats. The operation, aided by local people, collected 137 tons of oil waste [see Oil Spill At Çavuş Island, TMG 1 (1): May 1998].

*APPENDIX 19 (Cont.)***WEAKNESSES**

- Lack of coastal zone management planning in protected areas, especially within the 5 top-priority Important Monk Seal Sites of Turkey — this in spite of the considerable knowledge already available on abundance and distribution of the species, and the threats facing it, within these areas.
- Lack of any adequate protection within the remainder of the 12 Important Monk Seal Sites in Turkey, identified and subsequently recommended to the NMSC as protected areas in 1998.
- Insufficient coordination, cooperation and consensus within the NMSC under the control of MoE. Lack of effective collaboration and cooperation between GOs and NGOs.
- Inadequate patrolling and inspection of coastal National Parks, Specially Protected Areas and SIT areas, as well as Important Monk Seal Sites. Illegal activities continue to undermine the quality of these habitats and disturb the species. A lack of qualified personnel compounds the problem.
- The extinction of the monk seal in the Black Sea, while the authorities stood by, witnessing this inexorable process without taking any meaningful action to halt it.
- Difficulty in achieving effective collaboration among conservationists and universities; the tendency to act as individual organizations rather than as a coordinated unit or coalition.
- Local Monk Seal Committees have shown little sign of functioning adequately on their own, with the exception of the Foça LMSC.
- Funding remains erratic and in chronically short-supply, hampering monk seal research and conservation efforts and hindering longer-term planning.

APPENDIX 20

The Turkish National Action Plan for the Conservation of the Mediterranean Monk Seal in the Aegean and Mediterranean Sea (Source: TUDAV)

1. Strengthening the legal implementation and creating new regulations for the conservation of habitats

Targets: To prevent habitat destruction, to ban fishing activities, tourism, construction and diving in important seal habitats, to mitigate marine pollution.

Description:

- A) New regulations for reducing the impacts of tourism to the seal habitats, such as speed boat traffic, diving activities (scuba and snorkeling), sports fishing, near monk seal habitats will be elaborated. The existing laws regarding fishing activities and coastal construction will be reviewed.
- B) Yearly clean up of the important seal habitats by collecting plastics and other floating artificial debris will be made in remote areas away from human activities as well as on beaches.
- C) Patrolling important seal habitats against illegal and harmful fishing activities, diving and other operations.
- D) Establishing an oil spill response plan and equipment.

Priority: Urgent

Responsibility: Ministry of Environment (MoE), Ministry of Agriculture and Rural Affairs (MoARA), Ministry of Tourism (MoT), and Ministry of Justice (MoJ)

Stakeholders: MoE, MoARA, coastguards, artisanal fishermen, local NGO's.

Prerequisites for implementation: Recent data on important seal habitats, a preliminary field study on above mentioned areas should be made.

Expected problems for implementation: Coordination of the relevant ministries (MoE, MoARA) can be difficult. More effective cooperation of the relevant organizations within the framework of the national strategy for the conservation of the Mediterranean monk seal is expected.

Monitoring: This action can be monitored by Coast Guard, MoE, and NGO's with regular patrolling in the seal habitats.

2. Establishment of new special protected areas

Targets: To preserve the monk seal habitats, especially the breeding sites as well as the spawning and nursery grounds for fish to enable fish to reproduce and recruit sufficiently. To reduce mortality of and disturbance for the monk seal with newly trained staff.

Description: In these special protected areas all kinds of human activities such as fishing, tourism, diving and construction must be forbidden. These areas will be continuously patrolled by paid staff. Educational materials, such as posters, brochures, and billboards, will be prepared and distributed. It should work in close contact with Coast Guard and local authorities. The following four areas have been already designated as potential special protected areas, namely Gökçeada, Karaburun Peninsula, Bodrum Peninsula (these three are in the Aegean Sea) and Cilician Basin (in the Mediterranean Sea).

Priority: Urgent

Responsibility: Ministry of Environment (MoE). A single governmental authority should be responsible for the allocation and management of marine protected areas with the cooperation of scientific communities and local NGO's.

Stakeholders: Ministry of Agriculture and Rural Affairs (MoARA), Ministry of Tourism (MoT), Universities, NGOs, Coast Guard, artisanal fishermen, municipalities.

Prerequisites for implementation: Revision of the existing national laws and the unification of responsibilities and authorizations dispersed among various governmental bodies in relation to coastal habitat protection and fishery management.

Expected problems for implementation: Funding for research and infrastructure such as patrol boats and facilities as well as for hiring enough personnel.

Monitoring: This action should be monitored by MoE and NGOs specialized in the management of protected areas and monk seal protection with interim and final reports.

APPENDIX 20 (Cont.)

3. Reduction of mortality

Targets: To retract fishermen from deliberate killing by education and by showing alternative methods to deter seals. To establish a database and a stranding network for stranded or deliberately killed monk seals in the Turkish coasts. To update information for dead seals, such as possible reason of death, place of animal found biological data of dead animals.

Priority: High

Description:

A) Establishment of a national stranding network to monitor monk seal mortality. This network will also serve for the evaluation of the colonies.

B) Producing public educational materials against deliberate killing.

C) Studying seal-detering mechanism on fishing nets to avoid net damages made by seals.

Responsibility: Ministry of Agriculture and Rural Affairs (MoARA), Ministry of Environment (MoE)

Stakeholders: MoARA, MoE, fisheries cooperatives, artisanal fishermen, owners of fish farms, local NGOs, Coast Guard.

Prerequisites for implementation: Cooperation with local fishermen and fish farmers.

Expected problems for implementation: Fishermen and owners of fish farms may not be cooperative.

Monitoring: MoE should monitor fisheries cooperatives for the awareness campaigns. Databank should be monitored by NGOs with collaboration of MoE.

4. Public awareness program

Target: To raise public awareness on the protection of the Mediterranean monk seal so that the implementation of various protection activities can be effective as they receive support from wide range of people.

Priority: High

Description: Education mostly for fishermen, local people, harbor authorities, coast guards, school teachers, students, and tourists about the Mediterranean monk seal in term of protection. This action is to provide them with up-to-date information from the scientific community and states authorities, with the help of a special documentary film, conservation guide books, stickers, booklets, and other educational materials.

Responsibility: Ministry of Environment (MoE)

Stakeholders: MoE, Ministry of Agriculture and Rural Affairs, Fisheries Cooperatives, Ministry of Education, Ministry of Tourism, NGOs and other local organizations, schools, tour operators, divers.

Prerequisites for implementation: Financial sources

Expected problems for implementation: Although there will be some focused areas for this action, it is favorable that this action can cover all over the nation, which needs large fund.

Monitoring: This action will be monitored by progress reports.

5. Research and monitoring of the Mediterranean monk seal population

Targets: To better understand number of individuals and population parameters, such as sex, size and age, of the Mediterranean monk seals in the Aegean and Mediterranean coast of Turkey and to monitor their habitats as well.

Priority: High

Description: Observations in all monk seal habitats that already known will be made from both sea and land to determine actual population size and structure. At the same time, those habitats will be monitored for any changes. The sighting information will also be collected from yachtsmen, divers, fishermen, and so on.

Responsibility: Ministry of Environment

Stakeholders: Universities, yachtsmen, divers, local people, local authorities and small scale fishermen, NGOs.

Prerequisites for implementation: Local people, including NGOs should be cooperated.

Expected problems for implementation: None

Monitoring: This action can be monitored by international or national authorities with the interim and final reports.

APPENDIX 21

1. QUESTIONNAIRE FOR THE FISHERMEN

TARİH:/...../.....

KİŞİSEL BİLGİLER

İsim	
Yaş	
Ailede Fert Sayısı	
Adres	
Telefon	

	Yok	İlkokul	Ortaokul	Lise	Yüksek okul, üniversite
Eğitim Durumu					

	Yok	Var	Açıklama
Ek Gelir			

	≤ 500 milyon	500 milyon - 1 milyar	1 milyar - 1.5 milyar	≥ 1.5 milyar
Aylık Ortalama Gelir				
Açıklama				

	Yok	SSK	Bağkur	Emekli Sandığı	Diğer	Açıklama
Sosyal Güvence						

MESLEKİ BİLGİLER

	0-5	5-10	10-15	15-20	20 <	Açıklama
Kaç yıldır balıkçılık yapıyor						

	0-5	5-10	10-15	15-20	20 <	Açıklama
FOÇA – KARABURUN ‘ da kaç yıldır balıkçılık yapıyor?						

	Evet	Hayır
Kooperatife üyelik var mı?		

Aylar	1	2	3	4	5	6	7	8	9	10	11	12
Ortalama ava çıkılan gün sayısı												

	Harita Grid No.	Avlanma Şekli	Açıklama
Avlanma Yeri			

APPENDIX 21 (Cont.)

1. QUESTIONNAIRE FOR THE FISHERMEN (CONTINUED)

BALIK AVLAMA ORTALAMALARI

	Mevsim (Ay)	Miktar (ağ)	Miktar (tutulan balık)
Trol			
Gırgır			
Dönek			
Paragat (ince-Kalın)			
Yüksek ağ (pelajikler)			
Voli ağı			
Dil ağı			
Barbun			

	(Sahibi Hariç)	Açıklama
Tayfa Sayısı		

MESLEĞİNİ GERÇEKLEŞTİRİRKEN KARŞILAŞTIĞI BAŞLICA GÜÇLÜKLER VE SORUNLAR

		Açıklama
Yasal		
Ekonomik		
Sosyal		
Finansman		
Foklar		
Koruma alanı		
Tur tekneleri		
Plajlar		
Amatör balıkçılar		
Balıkçılar		
Deniz Sporları		
Diğer		

TEKNE BİLGİLERİ

Kayıtlı olduğu liman	Adı	Tipi
Ruhsat No.	Tekne tonajı (groston)	Mürettebat (Kapasite)
Tekne Tam Boyu (m)	Motor gücü ve tipi	Yakıt deposu hacmi

APPENDIX 21 (Cont.)

2. QUESTIONNAIRE FOR TOUR BOATS

TARİH:/...../.....

KİŞİSEL BİLGİLER

İsim	
Yaş	
Ailede Fert Sayısı	
Adres	
Telefon	

	Yok	İlkokul	Ortaokul	Lise	Yüksek okul, üniversite
Eğitim Durumu					

	Yok	Var	Açıklama
Ek Gelir			

	≤ 500 milyon	500 milyon - 1 milyar	1 milyar - 1.5 milyar	≥ 1.5 milyar
Aylık Ortalama Gelir				
Açıklama				

	Yok	SSK	Bağkur	Emekli Sandığı	Diğer	Açıklama
Sosyal Güvence						

MESLEKİ BİLGİLER

	0-5	5-10	10-15	15-20	20 <	Açıklama
Kaç yıldır turculuk yapıyor						

	0-5	5-10	10-15	15-20	20 <	Açıklama
FOÇA – KARABURUN ‘ da kaç yıldır turculuk yapıyor?						

Aylar	1	2	3	4	5	6	7	8	9	10	11	12
Yılın hangi aylarında çalışıyor												

	Harita Grid No.	Açıklama
Tur rotası ve gezilen yerler		

APPENDIX 21 (Cont.)

2. QUESTIONNAIRE FOR TOUR BOATS (CONTINUED)**TURİST DAĞILIMI**

	Oran (%)	Açıklama
Yerli		
Yabancı		
Avrupa		
Uzak Doğu		
Orta Doğu		
Asya		
Amerika		
Avustralya		
Afrika		

	(Sahibi Hariç)	Açıklama
Tayfa Sayısı		

MESLEĞİNİ GERÇEKLEŞTİRİRKEN KARŞILAŞTIĞI BAŞLICA GÜÇLÜKLER VE SORUNLAR

		Açıklama
Yasal		
Ekonomik		
Sosyal		
Finansman		
Foklar		
Koruma alanı		
Tur tekneleri		
Plajlar		
Amatör balıkçılar		
Balıkçılar		
Deniz Sporları		
Diğer		

TEKNE BİLGİLERİ

Kayıtlı olduğu liman	Adı	Tipi
Tekne tonajı (groston)	Tekne Tam Boyu (m)	Mürettebat (Kapasite)
Yolcu Kapasitesi	Motor gücü ve tipi	Yakıt deposu hacmi
Ruhsat No.		

APPENDIX 21 (Cont.)

3. QUESTIONNAIRE FOR TOURISM

TARİH:/...../.....

KURUMSAL BİLGİLER

Kurumun adı	
Anket yapılan kişinin adı	
Adres	
Telefon	

	Belediye	Turizm Bakanlığı	Diğer (Açıklayınız)
Kurumun ruhsatı			

	Kurumun Tipi	Sınıfı	Açıklama
Otel			
Tatil Köyü			
Pansiyon			
Kamping Alanı			
Plaj			
Restoran			
Disko			
Bar			
Havuz			
Diğer			

	0-5	5-10	10-15	15-20	20 <	Açıklama
Faaliyette bulunma süresi						

Oda - Müşteri Kapasitesi	Yatak - Hizmet Kapasitesi	Çalışan Personel Sayısı

Aylar	1	2	3	4	5	6	7	8	9	10	11	12	Tüm yıl
Faaliyette olduğu aylar													
Doluluk Oranı (%)													

	Harita Grid No.	Açıklama	Tesis Alanı (m ²)
Tesisin konumu ve kullanım alanı			

APPENDIX 21 (Cont.)

QUESTIONNAIRE FOR TOURISM (CONTINUED)

	Hayır	Evet	Açıklama	Kullanım Alanı (harita grid no.)
Su sporları var mı?				

	Hayır	Evet
Arıtma tesisi var mı?		

TURİST DAĞILIMI

	Oran (%)	Açıklama
Yerli		
Yabancı		
Avrupa		
Uzak Doğu		
Orta Doğu		
Asya		
Amerika		
Avustralya		
Afrika		

	Hayır	Evet	Balık Türü		
			Çiftlik	Deniz	Günlük ortalama (kg)
Balık talebi var mı?					

TURİZM AÇISINDAN BAŞLICA GÜÇLÜKLER VE SORUNLAR

	Açıklama
Yasal	
Ekonomik	
Sosyal	
Finansman	
Foklar	
Koruma alanı	
Tur tekneleri	
Plajlar	
Amatör balıkçılar	
Balıkçılar	
Deniz Sporları	
Diğer	

APPENDIX 22

The vector work

(P: polygon, L: line, S: point, PB: polygon border, T: transparent, LW: line weight, BLW: border line weight, SS: symbol size)

Layer	Dataset	Original feature type	Digitized in	Transformation (Transformed in)	New feature type	Point, line or polygon style	Point, line or polygon color	Line or polygon border weight or symbol size
Grid	-	Polygon	MapInfo (Gridmaker tool)	-	-	PB: Continuous P: Not filled (T)	PB: Cyan	BLW: 1
Shoreline	-	Line	AutodeskMap	Combine (MapInfo)	Polyline	L: Continuous (1)	L: Black	LW: 2
Land objects	-	Line	AutodeskMap	Enclose (MapInfo)	Polygon	P: Filled PB: None	P: Grey	
SPA	Present regulations	Polygon	MapInfo	-	-	PB: Continuous P: Not filled (T)	PB: Pink	BLW: 2
SIT areas	Present regulations	Line	AutodeskMap	Enclose (MapInfo)	Polygon	L: Continuous (1) PB: None P: Filled	L: Red PB: None P: Various	LW: 1
Core zone	Present regulations	Line	AutodeskMap	Enclose (MapInfo)	Polygon	L: Continuous (1) PB: Continuous P: Not filled (T)	L: Brown PB: Red	LW: 1 BLW: 5
Fisheries regulation zone	Present regulations	Buffer polygon	MapInfo (Buffering from shoreline)	Border Drawing (AutodeskMap)	Line	L: Continuous (1) PB: Continuous P: Not filled (T)	L: Blue PB: Purple	LW: 6 BLW: 1

APPENDIX 22 (Cont.)

The vector work (continued).

(P: polygon, L: line, S: point, PB: border, T: transparent, LW: line weight, BLW: border line weight, SS: symbol size)

Layer	Dataset	Original feature type	Digitized in	Transformation (Transformed in)	New feature type	Point, line or polygon style	Point, line or polygon color	Line or polygon border weight or symbol size
İncir Island recreation zone	Present regulations	Line	AutodeskMap	Enclose (MapInfo)	Polygon	L: Continuous (1) PB: None P: Filled	L: Green PB: None P: Patterned	LW: 1
Navigation regulation zone	Present regulations	Line	MapInfo	Combine	Polyline	L: Continuous (1)	L: Orange	LW: 6
Military zone	Present regulations	Line	MapInfo	Combine	Polyline	L: Continuous (1)	L: Green	LW: 4
Velocity limitation zone	Present regulations	Buffer polygon	MapInfo (Buffering from shoreline)	Border Drawing (AutodeskMap)	Line	L: Continuous (1) PB: Continuous P: Not filled (T)	L: Purple PB: Purple	LW: 4 BLW: 1
Mediterranean Monk Seal caves	Mediterranean Monk Seal	Point	MapInfo	-	-	S: Flagged	S: Purple	SS: 14
Observation points	Mediterranean Monk Seal	Point	MapInfo	-	-	S: Flagged	S: Dark orange	SS: 18
Seal Grid	Mediterranean Monk Seal	Polygon	MapInfo (Gridmaker tool)	-	-	PB: Continuous P: Not filled (T)	PB: Cyan	BLW: 1

APPENDIX 22 (Cont.)

The vector work (continued).

(P: polygon, L: line, S: point, PB: border, T: transparent, LW: line weight, BLW: border line weight, SS: symbol size)

Layer	Dataset	Original feature type	Digitized in	Transformation (Transformed in)	New feature type	Point, line or polygon style	Point, line or polygon color	Line or polygon border weight or symbol size
Land use objects	Human activities	Line	AutodeskMap	Enclose (MapInfo)	Polygon	L: Continuous (1) PB: None P: Filled	L: Yellow PB: None P: Brown	LW: 1
Land use grid	Human activities	Polygon	MapInfo (Gridmaker tool)	-	-	PB: Continuous P: Not filled (T)	B: Cyan	BLW: 1
Tour boat objects	Human activities	Line Point	AutodeskMap MapInfo	Combine -	Polyline -	L: Continuous arrowed S: Anchorage	L: Light purple S: Dark purple	LW: 2 SS: 18
Tour boat grid	Human activities	Polygon	MapInfo (Gridmaker tool)	-	-	PB: Continuous P: Not filled (T)	PB: Cyan	BLW: 1
Fishing objects	Human activities	Line Point	AutodeskMap MapInfo	Combine -	Polyline -	L: Continuous arrowed S: Fish	L: Light green S: Pink	LW: 1 SS: 12
Fishing grid	Human activities	Polygon	MapInfo (Gridmaker tool)	-	-	PB: Continuous P: Not filled (T)	PB: Cyan	BLW: 1
Tourism objects	Human activities	Line Point	AutodeskMap MapInfo	Combine -	Polygon -	L: Continuous (1) PB: None P: Filled S: Building	L: Red PB: None P: Dark purple S: Dark yellow	LW: 1 SS: 14
Tourism grid	Human activities	Polygon	MapInfo (Gridmaker tool)	-	-	PB: Continuous P: Not filled (T)	PB: Cyan	BLW: 1
Human activities grid	Human activities	Polygon	MapInfo (Gridmaker tool)	-	-	B: Continuous P: Not filled (T)	PB: Cyan	BLW: 1

APPENDIX 23

Catalogue of the monk seals in the Foça pilot monk seal conservation area, Turkey, from 1993 to 1999 (Source: Güçlüsoy & Savaş, 2004).

Code and name of the monk seal	Sex	Phenotype (after Samaranch & Gonzales 2000)	Estimated length (cm)	Weight (kg) (at necropsy)	Date of first observation	Date of last observation	Total number of observations
S1 Duygu	Female	Large & medium grey seal	210 – 240		27.04.1994	20.06.1997	13
S2 Dişi Korsan dead	Female	Large & medium grey seal	210	152	07.01.1995	04.04.1998	44
S4 Sühendan	Female	Large & medium grey seal	220-250		18.10.1994	05.10.1995	5
S5 İlksen	Female	Large & medium grey seal	200-230		31.05.1995	13.09.1996	6
S6 Marianne	Female	Large & medium grey seal	210-240		26.04.1996	05.10.1997	9
S7 Bahtiye dead	Male	Juvenile	157	39	18.10.1996	10.02.1997	35
S8 Emine	Female	Large & medium grey seal	210-240		05.10.1995	26.09.1998	62
S9 Derya	Female	Juvenile	150-180		13.10.1995	22.01.1998	51
S10 Fatma	Female	Juvenile	150-180		31.07.1998	10.10.1998	9

APPENDIX 24

Observation points of SAD-AFAG

ID	NAME	GRID ID	lat (y)	long (x)
1	RAMAZAN BURNU	-	38°45.084'	26°48.930'
2	BALIK CIFTLIGI	AB3	38°44.386'	26°46.802'
3	ASLAN BURNU	S3	38°44.389'	26°44.698'
4	KARTDERE I	R6	38°43.760'	26°44.017'
5	KARTDERE I-II	Q6	38°43.670'	26°43.949'
6	KARTDERE II	Q6	38°43.626'	26°43.837'
7	FIRKATA	P7	38°43.534'	26°43.715'
8	CENNET KOYU	P8	38°43.353'	26°43.748'
9	KOSOVA BURNU	P8	38°43.294'	26°43.644'
10	AYANI II	P9	38°42.908'	26°43.743'
11	AYANI I	P10	38°42.758'	26°43.743'
12	HANEDAN	P14	38°41.692'	26°43.748'
13	KUMBURNU	Q15	38°41.444'	26°43.900'
14	INGILIZ VII	R18	38°40.718'	26°44.270'
15	INGILIZ VI	R18	38°40.687'	26°44.176'
16	INGILIZ IV	R19	38°40.599'	26°44.098'
17	INGILIZ III	R19	38°40.568'	26°44.035'
18	INGILIZ V	Q19	38°40.512'	26°44.014'
19	INGILIZ I	R19	38°40.522'	26°44.098'
20	INGILIZ II	R19	38°40.558'	26°44.155'
21	INGILIZ VIII	S18	38°40.713'	26°44.463'
22	FENER BURNU	T21	38°40.084'	26°44.630'
23	FOCA TERSANE	S21	38°39.955'	26°44.473'
24	HAYIRSIZ II	L9	38°42.877'	26°42.528'
25	HAYIRSIZ I-II	K10	38°42.800'	26°42.492'
26	HAYIRSIZ I	K10	38°42.712'	26°42.481'
27	ORAK	M14	38°41.686'	26°42.898'
28	ORAK, INCE BURNU	L13	38°42.073'	26°42.554'
29	SIRENLER IV	K13	38°42.042'	26°42.497'
30	SIRENLER III	K13	38°41.877'	26°42.465'
31	SIRENLER II-III-III	K14	38°41.836'	26°42.523'
32	SIRENLER II-III	K14	38°41.790'	26°42.492'
33	SIRENLER II	K14	38°41.717'	26°42.512'
34	SIRENLER I-II	L14	38°41.661'	26°42.528'
35	SIRENLER I	L15	38°41.573'	26°42.559'
36	PITE I	P15	38°41.443'	26°43.614'
37	PITE II	P15	38°41.404'	26°43.656'
38	FENER I	M18	38°40.642'	26°42.975'
39	FENER II	M19	38°40.564'	26°42.808'
40	FENER III	M19	38°40.482'	26°42.881'
41	INCIR 0	P19	38°40.451'	26°43.586'
42	INCIR II	P19	38°40.410'	26°43.705'
43	INCIR III	P19	38°40.523'	26°43.617'
44	INCIR IV	O19	38°40.534'	26°43.460'
45	INCIR I	O19	38°40.451'	26°43.492'
46	INCIR VII	P20	38°40.328'	26°43.591'
47	INCIR VI	P20	38°40.353'	26°43.690'

ACRONYMS

ASEAN	Association of Southeast Asian Nations
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
CAD	Computer Aided Design
CBD	Convention on Biological Diversity
CCA	Carrying Capacity Assessment
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CGIS	Canadian Geographic Information System
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CODASYL	Conference on Data System Languages
CZM	Coastal Zone Management
DBMS	Database Management Systems
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DIAS	Digital Image Analysis System
DSS	Decision Support System
DXF	Drawing Exchange File
ECE	Economic Commission for Europe
ECC	European Community Commission
ECEF	Earth Centered, Earth Fixed
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EFZ	Exclusive Fishery Zone
EIA	Environmental Impact Assessment
ESRI	Environmental Systems Research Institute, Inc.
FAO	Food and Agriculture Organization
GB	Gigabyte
GDP	Gross Domestic Product

ACRONYMS (Cont.)

GEOTIFF	Geographic Tagged Image File Format
GHz	Gigahertz
GIS	Geographic Information Systems
GPS	Global Positioning System
GRT	Gross ton
GUA	Gesellschaft für umfassende Analysen
IBM	International Business Machines Corporation
ICAM	Integrated Coastal Area Management
ICZM	Integrated Coastal Zone Management
IMF	International Monetary Fund
IT	Information Technology
İTO	İzmir Chamber of Commerce
IUCN	World Conservation Union
JPEG	Joint Photographic Experts Group
MAB	Program on the Man and the Biosphere
MB	Megabyte
MPA	Marine Protected Area
NASA	National Aeronautics and Space Administration
NAVSTAR	Navigation Signal Timing and Ranging Global Positioning System
NF	Normal Form
NGO	Non-governmental Organization
nm	Nautical mile
PA	Protected Area
RAM	Random Access Memory
RSI	Research Systems, Inc.
SAD-AFAG	Underwater Research Society-Mediterranean Seal Research Group
SDTS	Australian Spatial Data Transfer Standard
SEA	Strategic Environmental Assessment

ACRONYMS (Cont.)

SHODB	Seyir, Hidrografi ve Oşinografi Dairesi Başkanlığı
SPA	Specially Protected Area
SPOT HRV	Satellite Probatoire d'Observation de la Terre High Resolution Visible Imaging System
SQL	Structured Query Language
SWIR	Short Wave Infrared
TIFF	Tagged Image File Format
TIR	Thermal Infrared
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Conference on the Law of the Sea
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNWTO	(United Nations) World Tourism Organization
UTM	Universal Transverse Mercator
VNIR	Visible and Near Infrared
VPF	Vector Product Format Data
WCPA	World Commission of Protected Areas
WGS	World Geodetic System
WHC	World Heritage Convention
WSSD	World Summit on Sustainable Development
XLS	Microsoft Excel Spreadsheet Format
XML	Extensible Markup Language

ABBREVIATIONS (Specific to the thesis methodology)

B	Buffer
BA	Buffer Area
C	Core
C_t	Total Capacity
CA	Core Area
Cap	Capacity
D_{ave}	Average Number of Working Days in a Year
F	Fisheries
f_{ave}	Average Fullness Percentage of Tourism Facilities
GA	Grid Area
GF	Grid Factor
GI	Annual Grid Cell Income
I_F	Annual Income of Fisheries
I_T	Annual Income of Tourism
I_{TB}	Annual Income of Tour Boats
I_z	Annual Income of Used Grid Cells in Zone
IA	Area of Intersection
LU	Land Use
MS	Monk Seal
N_q	Number of persons asked to be questioned
N_R	Number of Respondents
N_T	Number of Target Groups
P	Unit Price of Each Fish Species
P_{ave}	Average Unit Price per Customer
R, r	Buffer Radius
T	Tourism
TB	Tour Boat
UA	Area of Union
V	Vacancy
W	Amount of fish landed