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Economic Analysis of Ayvalık Adaları Nature Park

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Strengthening the System of Marine and Coastal Protected Areas of Turkey Project

2013

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Foreword

Turkey is a country surrounded by the sea on three sides. Turkey's nature and climatic conditions adorn it with a significant biodiversity in its coastal areas. However, there are also problems that touch these regions and that become more imminent everyday. Urbanization, industrialization, tourism, other residential areas and activities alike that leads to irregular and unplanned development that have severe impacts on coastal and marine areas.

Developments, especially in the economy also increase marine transportation and dependency on the use of marine and coastal areas for development, housing, commerce, recreational activities and basic needs. Furthermore, the pressure of fast urbanization and settlement activities on coastal areas leads to many problems including loss of dunes, salt beds and marshes; marine and coastal pollution, deterioration and loss of coastal ecosystems. Biodiversity and fertility of coastal and marine areas are faced with this increasing pressure, leading to damages that cannot be undone.

These coastal and marine areas are one of the most precious assets we have and we must protect them. In order to alleviate these pressures and overcome these challenges, relevant structures and infrastructures for effective implementation and surveillance to ensure that these areas are sustainably managed, preserved and protected without being deteriorated and with a balanced approach between use and protection. In this regard, all related agencies and institutions have to go under a capacity building process to meet the demands of the required structures and infrastructures; cooperation and coordination between all parties have to be improved and an effective and efficiently operating work program and a model for financial resources have to be developed.

In its responsibility area covering a coastline that extends over some 8,592 km, General Directorate for the Protection of Natural Assets carries out research activities for the protection and study of threatened and endangered species and habitats that are duly specified in the national legislation as well as in international conventions that Turkey is a party; carries out research activities on the biodiversity of marine and coastal environments; determines the marine surface vessel capacity of important bays

and harbors; establishes procedures and principles for use of protection and use of such areas; carries out other integral coastal management activities and strives to minimize risks that threaten such assets.

Protection of marine and coastal resources being a global priority, Marine Protected Areas are fast developing and expanding as a concept. Turkey is no exception to this rule where considerable awareness raising efforts are being carried out.

Through the large scale GEF Project entitled 'Strengthening Turkey's Marine and Coastal Protected Areas' covering the term between 2009-2013 and with the UNDP as the implementing partner, the General Directorate has taken a very first step for devising a long term solution for the protection of marine biodiversity in Turkish coastal waters; for the restructuring of marine and coastal protected areas database and to guarantee effectiveness and sustainability of ecological service functions.

A series of technical reports that are prepared as a part of the project on economic analysis, socio-economy of fisheries in coastal areas, together with other efforts on the identification of marine sensitive areas, integration of economic principles to planning processes, ensuring financial sustainability, mitigation of pollutants from marine vessels and determination of alternative livelihood resources are expected to yield the following project outcomes:

- Responsible institutions have the capacities and internal structure needed for prioritizing the establishment of new MCPAs and for more effectively managing existing MCPAs.
- MCPA financial planning and management systems are facilitating effective business planning, adequate levels of revenue generation and cost-effective management.
- Inter-agency coordination mechanisms in place to regulate and manage economic activities within multiple use areas of the MCPAs.

Documents covering the three main outcomes of the Project so far mentioned are submitted to your perusal.

Osman İYİMAYA
General Director

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Exchange rates

1 TL = US\$ 0.528

1 TL = € 0.4

1€ = US\$1.30

Acronyms

ESA	Ecosystem Service Approach
EU	The European Union
IUCN	International Union for Conservation of Nature
GEF	Global Environment Facility
GDPNA	General Directorate for Protection of Natural Assets
GDNCNP	General Directorate of Nature Conservation and National Parks
GDP	Gross Domestic Product
MoFWA	Ministry of Forestry and Water Affairs
MCPA	Marine and Coastal Protected Area
REDD	Reduced Emissions from Deforestation and Degradation
SEPA	Special Environmental Protection Area
SIT	Areas of Natural or Cultural/ Archeological Conservation Concern
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme

Yönetici Özeti

Ayvalık Adaları Tabiat Parkı 1995 yılında koruma alanı ilan edilmiştir ve T.C. Orman ve Su İşleri Bakanlığı, Doğa Koruma ve Milli Parklar Genel Müdürlüğü (DKMPGM) tarafından yönetilmektedir. 179,5 km² lik alanı kaplayan Tabiat Parkı toplam 19 adadan oluşmaktadır.

Çalışmanın Amacı ve Yaklaşım

Bu çalışmanın amacı Ayvalık Adaları Tabiat Parkı'nın ekonomik analizini gerçekleştirerek;

- Alanın temin ettiği denizel hizmet ve ürünler yelpazesi hakkında farkındalık yaratmak,
- Kilit ekosistem hizmetlerinin devamını tehdit eden baskılara ve bunların ekonomik sonuçlarına işaret ederek, alanın sürdürülebilir yönetimine katkıda bulunmak,
- Denizel hizmetlerin ekonomik değerini ortaya koyarak ve potansiyel gelir getirici faaliyet ve mekanizmaların altını çizerek alan için hazırlanacak olan İş Planına bilgi tabanı sağlamaktır.

TVKGM-GEF-UNDP projesi kapsamında hazırlanan bu raporla, Ayvalık Adaları Tabiat Parkı için alternatif gelir kaynakları seçeneklerinin tespit edilmesi ve bir iş planının geliştirilmesi öngörülmüştür. Rapor alandaki ekosistem hizmetlerinin ve değerlerinin tespit edilmesine odaklanmış, potansiyel finansal mekanizmalar hakkında sadece genel bir değerlendirme yapılmıştır. Ayvalık Adaları Tabiat Parkı ekonomik analizi, alan hakkında mevcut veri ve literatür taramasına ve Eylül 2010, Ocak 2011 tarihlerinde kilit paydaşlarla yapılan görüşmelerden elde edilen verilere dayanmaktadır. Ayrıca, muhtemel yarar transfer değerlerini temin edebilmek, alan için belirlenen değerleri karşılaştırmak ve değerlendirme yaklaşımlarına dair farklı anlayışları görebilmek için, bölgedeki deniz ve kıyı alanlarında yapılmış ekonomik değerlendirme çalışmalarını kapsayan bir literatür taraması da yürütülmüştür.

Bu çalışma için, "Ekosistem Hizmetleri Yaklaşımı (Ecosystem Service Approach - ESA)" ve "Milenyum Ekosistem Değerlendirmesi"nin temin, düzenleme, kültürel ve destek hizmetleri sınıflandırmasına (2005) dayanarak, deniz ve kıyı ekosistemleri hizmetlerine yönelik bir tipoloji geliştirilmiştir. Ekosistem Hizmetleri Yaklaşımı, denizel ortamlardaki ekosistemlerin ve bunların barındırdığı biyolojik

çeşitliliğin bireysel ve sosyal refaha katkıda bulunduğunu açıkça onaylamaktadır. Bu yaklaşım yapılan katkının, balık gibi doğrudan tüketilen ürünlerin elde edilmesinin çok daha ötesine gittiğini, denizel ekosistemlerin karbon tutma gibi kritik düzenleme fonksiyonları olduğunu da açıklamaktadır. Dolayısıyla, "Ekosistem Hizmetleri Yaklaşımı" karar alma süreçlerinde ekosistemlerin bir bütün olarak ele alınmasını sağlamış ve ekosistemin verdiği hizmetlere değer biçilmesinin önünü açmıştır.

Temel Bulgular

Ayvalık Adaları Tabiat Parkı ekosistem hizmetlerinin bir yıllık ekonomik değeri yaklaşık 43 milyon ABD doları olarak hesaplanmıştır. Bu, alanın başlangıç aşamasındaki değerini yansıtmaktadır ve daha detaylı çalışmalarla geliştirilmelidir. Alan için ortaya çıkarılan toplam değer olarak, tedarik hizmetlerini balık; düzenleme hizmetlerini karbon tutma, erozyon kontrolü ve su arıtımı; kültür hizmetlerini turizm ve rekreasyon kapsamaktadır. Bunlar brüt değerlerdir (yani masraflar düşülmemiştir) ve karbon tutmayla ilişkilendirilmiş faydalar gibi bazı potansiyel değerler henüz elde edilememiştir ("yakalanmamaktadır"). Buna rağmen, bu değerler olması gerekenin altında değerler olarak düşünülebilir. Mesela turizm için tahmini değerler kullanılmıştır ve bazı potansiyel önemli hizmetler hesaplara dahil edilememiştir. Alanda potansiyel olarak var olduğu düşünülen fakat bilimsel bilgi ve veri noksanlığından incelenemeyen ekosistem hizmetleri bulunmaktadır. Doğal ilaçlar gibi hammaddeler, genetik kaynaklar ve dekoratif ürünler, denizel ortamın mikro-iklim düzenlemesinde, sel, fırtınadan korumadaki rolü, alanın eğitim, peyzaj ve miras değerleri gibi henüz üzerinde çalışılmamış hizmetleri sayabiliriz.

Alana dair toplam değer yaklaşık %88'ini turizm ve rekreasyon teşkil etmektedir. Bu ekosistem hizmetine dair değerlerin tespit edilmesinde yarar transferi yöntemi kullanıldığı göz önüne alındığında, alandaki yıllık yaklaşık 38 milyon ABD dolarlık turizm değeri iyileştirilebilir. Tabiat Parkına özel bir turizm taşıma kapasitesi çalışmasına ve hem ziyaretçi harcamalarını hem de sayılarını daha iyi yansıtan araştırmalara ihtiyaç duyulmaktadır (bu çalışmada günübirlik ziyaretçiler dahil edilmemiştir).

Çalışma alanındaki *Posidonia oceanica* çayırları kapladıkları alan nedeniyle düzenleme hizmetlerinde yılda 658.000 ABD \$ a karşılık gelen karbon bağlama ve erozyon kontrolü hizmeti sağlamaktadır. Aynı zamanda, Ayvalık Adaları kıyıları yılda 3,5 milyon ABD \$ değerinde atıksu doğal filtrasyonuna (arıtım) katkıda bulunmaktadır.

Tüm ekonomik, kültürel ve ekolojik önemine rağmen Ayvalık Adaları Tabiat Parkı'nda ekosistem hizmetleri; deniz kirliliği, altyapı eksikliği ve aşırı konut projeleri ile yasadışı balıkçılık gibi gün geçtikçe artan sorunlarla karşı karşıyadır.

Öneriler

Çalışma sonucunda, değerlendirme yöntemlerinin iyileştirilmesi ve denizel ekosistem hizmetlerinin daha etkin ve sürdürülebilir yönetilmesi için öneriler geliştirilmiştir.

- Tabiat Parkı'nın henüz onaylanmış bir *yönetim planı* bulunmamakta, bu nedenle izleme gibi temel yönetim faaliyetleri yürütülmektedir. Bu da alanın denizel ve karasal doğal varlıklarının uzun vadede korunmasını etkilemektedir. Yasal dayanağı olan ve uygulanan bir yönetim planının geliştirilmesi öncelikle ele alınacak konular arasındadır.

- Balıkçılık için yapılan değerlendirme ve *balıkçılık yönetimi*, sürdürülebilir av oranının (miktar) net faydayla (gelirler eksi masraflar) çarpılmasına dayandırılmalıdır. Sürdürülebilir av oranlarının tespit edilebilmesi için alandaki balık stoklarının düzenli bilimsel araştırmalarla incelenmesi yararlı olacaktır.
- Alana özel *düzenleme hizmetlerine* odaklı bilimsel çalışmalar bu hizmetleri daha iyi anlamak ve değerlendirmeye ışık tutmak açısından önemlidir. Karbon bağlama, erozyon kontrolü, sel ve fırtınadan korunma ve atıkların özümsemesi bu hizmetler kapsamındadır.
- Öncelikli araştırma alanı olarak alandaki *Posidonia oceanica* çayırlarının sağladığı hizmetler incelenmelidir. Ayvalık Adaları Tabiat Parkı'na özel olarak yürütülecek çalışmalarla çayırların sağladığı karbon bağlama ve depolama oranları Türkiye'yi yeni gelişen Mavi Karbon piyasasında avantajlı bir konuma taşıyabilir.
- Turizm, bölgenin deniz koruma alanı statüsünü bütünleyici bir şekilde gelişmeli ve yönetilmelidir. 2006 yılında Ayvalık için yapılan Turizm Master Planı, yapılacak turizm taşıma kapasitesi çalışmasıyla tamamlanmalı, bölgede turizm gelişimi yönlendirilmelidir. Turizm Master Planı'nda belirlenen, doğal kaynakların korunması ve doğa yürüyüşleri, kuş gözlemi, dalış ve yelkencilik gibi alternatif turizm faaliyetlerinin geliştirilmesi ve pazarlanmasına yönelik hedefler dikkate alınarak, turizm sezonunun uzatılması sağlanmalıdır .

Tablo . Ayvalık Adaları Tabiat Parkı değerlendirme sonuçları özeti

Ekosistem Hizmeti	Değer/ yıl ABD\$	Değerleme yöntemi	Not
Balık	216.546	Piyasa değerleri	Bu değer sürdürülebilir av oranına göre hesaplanmamıştır (alan için bilinmiyor). Brüt değerlerdir – masraflar düşülmemiştir. Değer sadece Ayvalık balık pazarında kaydı tutulan yansıtılmaktadır; doğrudan lokantalara ve tüketiciye satılan balığı, rekreasyonel balıkçılığı kapsamamaktadır. Ayrıca resmi kayda geçen balık avı olduğundan daha az gösteriliyor olabilir.
Deniz börülcesi (Salicornia)	142.560	Piyasa değerleri	6 TL/kg piyasa değeri ve bölgedeki balık lokantalarının yüksek sezonda 900 kg deniz börülcesi talebi olduğu varsayılmıştır. Ayvalık dışına satılan börülce kapsama alınmadığı için muhtemelen düşük bir değerdir. Brüt değerlerdir – masraflar düşülmemiştir.
Karbon bağlama	658.022	Piyasa değerleri	Mavi Karbon kredileri pazarının orman karbon pazarı gibi gelişeceği öngörülmüştür. Bu nedenle, henüz böyle bir ekonomik değer pazarda mevcut değildir. Hesaplamalar güncel karbon pazar fiyatı olan 11,2 ABD \$/t CO ₂ eşdeğeri ile yapılmıştır.
Erozyon kontrolü	339.460	Fayda transferi	Mangos ve diğerleri (2010)'nin çalışmasına göre, tehdit altında olan 1 m'lik kıyının hizmeti 160.000 Avro olarak, Ayvalık Adaları Tabiat Parkı'nda 40,8 km kıyı şeridinde denk gelen <i>Posidonia oceanica</i> çayırları ve alanın %4'ünün erozyon riski altında olduğu dikkate alınmıştır.
Atık su doğal filtrasyonu (Arıtım)	3.575.000	Fayda transferi	Mangos ve diğerleri (2010)'nin çalışmasına göre, Türkiye kıyıları atık su doğal filtrasyonu 229 milyon Avro olarak hesaplanmış ve çalışma alanının kıyı şeridi uzunluğuna göre (100 km) taksim edilmiştir.
Turizm / Rekreasyon	37.934.220 ¹	Piyasa değerleri	Proje kapsamında diğer ÖÇKB'lerde yapılan ortalama turist harcamalarına, parktaki rekreasyonel harcamalara ve bölgeye gelen ziyaretçi sayıları (yılda yaklaşık 250.000 geceleyen ziyaretçi) tahminlerine dayanmaktadır.
TOPLAM	42.856.808		

¹ Bu değer yıllık geceleyen ziyaretçi harcamalarını içeren tahminden (35.109.000 ABD doları) ve Tabiat Parkında yapılan denizel rekreasyon harcamalarından oluşmaktadır (2.825.220 ABD doları).

Executive summary

Objectives of study & approach

Ayvalık Adaları Nature Park was established in 1995 and is managed by the General Directorate of Nature Conservation and National Parks (GDNCNP) of the Turkish Ministry of Forestry and Water Affairs (MoFWA). It covers an area of 179.5 km² and includes 19 islands.

The objective of this study was to undertake an economic analysis of Ayvalık Adaları Nature Park in order to:

- Raise awareness of the range of marine goods and services provided by the site;
- Contribute to the sustainable management of the site by highlighting pressures threatening the viability of key ecosystem services and the economic implications of this; and,
- Inform the business plan to be developed for the site by demonstrating the economic value of marine services and highlighting potential revenue generating activities and mechanisms.

It should be noted that other components of the GDPNA-GEF-UNDP project under which this study sits are focused on the identification of feasible income generating options and the development of a business plan for Ayvalık Adaları Nature Park. Therefore this report is focused on the identification and valuation of ecosystem services and only provides a high level discussion of potential financing mechanisms.

The economic assessment of Ayvalık Adaları is based on a review of the available data and literature on the site, interviews with key stakeholders and data gathered through site visits in September 2010 and January 2011. A literature review of economic valuation studies of marine and coastal areas from the region was also undertaken to provide potential transfer values, benchmarks against which to assess values derived for the site and insights on valuation approaches.

A typology of marine and coastal ecosystem services has been developed for this study following the ecosystem service approach (ESA), which is based on the Millennium Ecosystem Assessment (2005) classification of ecosystem services into provisioning, regulating, cultural and supporting services. The ESA explicitly recognizes that ecosystems such as marine environments and the

biological diversity contained within them contribute to individual and social wellbeing. Importantly it recognizes that this contribution extends beyond the provision of goods such as fish to the natural regulating functions of marine ecosystems such as carbon sequestration. The ESA therefore provides a framework for considering whole ecosystems in decision making and for valuing the services they provide.

Key Findings

The total annual value of the ecosystem services in Ayvalık is estimated to be around US\$ 43 million per year. This provides an initial value of the site, which needs to be refined through further study. This value incorporates provisioning services - fish and salicornia, regulating services - carbon sequestration, erosion protection and waste treatment, and cultural services - tourism and recreation. It is considered to be an underestimate in that conservative estimates have been used for example for tourism and a number of potentially important services are not included in this total. Ecosystems services thought to be present (or potentially present) at the site which cannot be estimated due to a lack of scientific information and/or data are - raw materials such as natural medicines, genetic resources and ornamental resources, which have yet to be studied at the site; the role the marine environment plays in micro-climate regulation, the role of the marine environment in flood and storm protection, the sites heritage value and educational value and the sites landscape and amenity value.

A significant proportion of this total value (88%) is related to tourism and recreational benefits. Given that the value-transfer method has been used for determining the tourism value of the site, the estimate for the value of tourism of US\$ 36.5 million per year clearly could be refined. A tourism carrying capacity for the site is required along with site specific evidence of tourist expenditures and an understanding of the number of day visitors (who are not included in the estimate provided).

Due mainly to the presence of *Posidonia oceanica* meadows in the study area, the value of the area's provisioning services is also significant. The seagrass communities provide a carbon sequestration benefit worth US\$ 658,000 per year as well as tempering the

coastal erosion risks present in the area. The coasts in Ayvalık Nature Park also help assimilate waste, a service estimated at US\$3.5 million annually.

Despite their economic, cultural and economic importance the quality and quantity of Ayvalık Adaları Nature Park's ecosystem services are threatened by a range of pressures including marine pollution, infrastructure and housing development and illegal fishing activities.

Recommendations

The study has identified a range of recommendations aimed at the refinement of the valuation estimates and improvement in the management of the marine ecosystem services. Key recommendations include:

The Nature Park currently lacks a **management plan** and as a result key management activities such as monitoring are not being conducted making the long term conservation of the site's marine and terrestrial natural assets uncertain. The development of a legally endorsed and implemented management plan is therefore a priority.

- In terms of **fishery valuation and management** the valuation should be based on a sustainable harvest rate (quantity) multiplied by revenues,

minus costs. Scientific studies of fish stocks are therefore required to determine sustainable harvesting rates.

- Site specific scientific studies of the regulating services are required to better understand these services and inform the valuation. This includes the following regulating services – carbon sequestration, erosion control, flood and storm protection and waste assimilation.
- A priority area of research is considered to be studies of the services offered by the site's Posidonia meadows. In particular, site specific studies of the carbon sequestration and storage rates of Ayvalık's Posidonia meadows would position Turkey to potentially benefit from the emerging market in Blue Carbon.
- Tourism needs to be developed and managed in a way that complements the area's status as a marine protected area, and maximizes the revenues from a sustainable tourism sector. The tourism master plan developed for Ayvalık in 2006 should be complemented by a study of the area's tourism carrying capacity to understand the limits to tourism development in the area. The Master Plan's objectives to conserve natural resources and to further develop and market alternative tourism activities such as hiking, birdwatching, scuba diving and yachting, in order to extend the tourism, season should be prioritized.

Table . Summary of valuation results for Ayvalık Adaları Nature Park

Service	Value/ year US\$	Valuation approach	Comment
Fish	216,546	Market price	This is not based on a sustainable harvest rate, which is unknown. Only includes fish registered at the Ayvalık fish market. It excludes fish sold directly to restaurants and individual customers and recreational fishing and may also be based on an under-reporting of fish catch. This is a gross value – costs have not been deducted
Salicornia	142,560	Market price	Based on a market price of 6 TL/kg and the assumption that all of the fish restaurants in the area demand 900 kg per season. Considered to be an underestimate as excludes salicornia exported outside of the area This is a gross value – costs have not been deducted
Carbon sequestration	658,022	Market price (avoided cost approach)	Assumes development of market in blue carbon credits analogous to the forest carbon market. This value is therefore not currently 'captured'. Based on market price of carbon of US\$ 11.2 / t CO ₂ eq
Erosion protection	339,460	Benefits transfer	Mangos <i>et al.</i> (2010). Based on 160,000 Euro per meter of coastline, 40.8 km of <i>Posidonia</i> beds in Ayvalık Adaları Nature Park and 4% of the area at risk.
Waste treatment	3,575,000	Benefits transfer	Based on Mangos <i>et al.</i> (2010) estimate for Turkey of 229 million Euros apportioned to the study site based on length of its coastline (100 km).
Tourism / Recreation	37,934,220 ²	Market price	Based on a conservative estimate of tourist numbers (about 250,000 overnight visitors per year) and average tourism expenditures (based on other Turkish MCPAs in Bann & Başak 2011a & 2011b) and the annual revenue estimates of the marine recreational activities conducted in the nature park
TOTAL	42,856,808		

² This total is comprised of an estimate of the expenditure by overnight visitors of US\$35,109,000 plus an expenditure on recreational activities of US\$2,825,220.

Introduction



This study is an activity under the General Directorate for the Protection of Natural Assets - Global Environment Facility - United Nations Development Programme (GDPNA-GEF-UNDP) project 'Strengthening the Protected Area Network of Turkey: Catalyzing Sustainability of Marine and Coastal Protected Areas'.

The proposed long-term solution for marine biodiversity conservation in Turkey's territorial sea is a reconfigured Marine and Coastal Protected Area (MCPA) network designed to protect biodiversity while optimizing its ecological service functions. The success of this long-term solution is seen to rest on three main pillars: (i) the existence of key agencies capable of identifying and managing sensitive and biologically significant MCPAs; (ii) *the application of economic analysis to inform the planning and management of MCPAs and the integration of sustainable financing mechanisms*; and (iii) inter-sectoral co-operation that builds on the relevant strengths of various management agencies and branches of Government and civil society to solve marine biodiversity conservation challenges. This study relates to the development of the second pillar.

1.1. Objective

The objective of this study was to undertake an economic analysis of Ayvalık Adaları Nature Park in order to:

- Raise awareness of the range of marine goods and services provided by the site;
- Contribute to the sustainable management of the site by highlighting pressures threatening the viability of key ecosystem services and the economic implications of this; and,
- Inform the business plan to be developed for the site by demonstrating the economic value of marine services and highlighting potential revenue generating activities and mechanisms.

It should be noted that other components of the GDPNA-GEF-UNDP project under which this study sits are focused on the identification of feasible income generating options and the development of a business plan for Ayvalık Adaları Nature Park. Therefore this report is focused on the identification and evaluation of ecosystem services and only provides a high level discussion of potential financing mechanisms.

1.2. Approach

The economic assessment of Ayvalık Adaları Nature Park is based on a review of the available data and literature on the site, interviews with key stakeholders and data gathered through site visits undertaken 13-17 September 2010 and 3-4 January 2011. A list of people consulted is provided in Annex 1. A literature review of economic valuation studies of marine and coastal areas from the region was also undertaken to provide potential transfer values, benchmarks against which to assess values derived for the site and insights on valuation approaches. The study should be viewed as a *high level initial economic analysis* of the area, which identifies key ecosystem services provided by the site and prioritizes areas for future research and the refinement of the economic estimates presented.

This assessment is mainly based on Egeplan (2001), but also draws on Özbay (2008) and Aykır (2004). The General Directorate for Nature Conservation and Natural Parks (GDNCNP) under the Ministry of Forestry and Water Affairs (MoFWA) commissioned an analytical study of the area in 2000-2001 (Egeplan 2001). This study researched the ecology, natural ecosystems and biological diversity of the Nature Park along with the socio-economic and demographic structure of the site. Data pertaining to the terrestrial biodiversity in this report relies on Egeplan's research, which is now over 10 years old and therefore may no longer accurately reflect the biodiversity status of the area due to the possible impacts of the developments that have occurred at the site over the past decade (see Section 2.2). For instance, according to Atasay Tannrisever (the park's manager), since the Egeplan assessment a forest fire has taken place in the southern section of the protected area, which may have impacted the

terrestrial biodiversity of the site. However, settlement and construction pressures have been kept under control (ibid). This study will be carried out in 2012 & 2013 by the GDPNA-GEF-UNDP project.

An Ecosystem Service Valuation Framework was developed for the assessment, which provides a comprehensive list of marine and coastal services provided at the site (see Section 3). This framework provides the basis for understanding the range of benefits provided by the marine ecosystem and the pressures that they face. The scope of the valuation is limited to the services provided by the marine environment. It does *not* include other services that may be provided by other (terrestrial) ecosystems within or closely related to the Nature Park, although a discussion of these related services is provided where relevant.

1.3. Layout of report

The rest of this report is set out as follows: Section 2 provides an overview of the site and the pressures that it faces plus available information on the socio-economic characteristics of the area; Section 3 presents the marine ecosystem services typology and a qualitative assessment of the services provided by the site; Section 4 presents the valuation of individual ecosystem services where the required bio-physical and monetary data is available; Section 5 discusses potential financing mechanisms; and, section 6 concludes. Annex 1 lists the people interviewed during field visits in September 2010 and January 2011. Annex 2 presents the 'Decisions of the Long Term Development Plan for Ayvalık Adaları Nature Park' developed in 2004, which were not formally approved.

Background on site



3

Ayvalık Adaları Nature Park covers an area of 179,5 km² (Keskin *et al.* 2011). It is situated at the intersection of the Marmara and Aegean geographic regions, around Ayvalık district of Balıkesir Province in Northeastern Turkey (it is the southernmost district of the province). Ayvalık archipelago consists of 22 islands, 19 of which fall within the protected area, namely: Cunda (Alibey), Pınar (Mosko, Kılavuz), Çıplak, Yellice (Poyraz), Güneş, Maden (Pirgos), Kız, Yumurta, Balık, Kara, Hasır, Küçükmaden, Güvercin, Maden, Taşlı (pileyit), Yelken (Ayiy alo), Yalnız (Petago), Kara, Yuvarlak, Göz Adası (Kalamapulo) and Yumurta Islands (GDNCNP, 2011). Cunda Island, now a peninsula accessible by road, is the largest island within the archipelago (23 km²) and the only island that is inhabited (Engelliler, 2011).

On the 21st April 1995 Ayvalık Adaları was declared a “Nature Park” by the Decree of the Cabinet of Ministers number 22265 (*ibid*). Under Turkey’s National Parks Law dated 1983 and numbered 2873, Nature Parks are defined as “natural areas of important vegetation and fauna characteristics that are suitable for human recreation within the integrity of the natural landscape” (Hukuki Net, 2011). A total of 20 Nature Parks covering some 72,912 ha exist in Turkey, 4 of which have a marine component covering 14,200 ha of marine area (UNDP, 2009). Nature Parks are managed by the GDNCNP, under the Ministry of Environment and Water Affairs (Özbay, 2008;UNDP, 2009).

Of note is the fact that Ayvalık Adaları Nature Park is the only pilot MCPA within the GDPNA-GEF-UNDP project under which this study sits that does not have a Special Environmental Protection Area (SEPA) status³. The site is therefore not managed by the GDPNA but rather by the MoFWA and is subject to its financial regime.

Ayvalık town is of significant cultural and historical heritage and is protected under various SIT protection levels as designated by the Ministry of Culture and Tourism⁴. The most remarkable archi-

³ The other pilot areas of the GDPNA-GEF-UNDP project are Foça, Gökova, Datça, Köyceğiz-Dalyan and Fethiye-Göcek SEPAs.

⁴ The Ministry of Culture and Tourism, General Directorate of Conservation of Cultural and Natural Assets assigns conservation status of varying degrees in Turkey based on the “The Law of Conservation of Cultural and Natural Properties” (dated 21.07.1983; No: 2863; amended by law no: 3386 and 5226). “First degree natural sites” are sites of exceptional natural characteristics that should be conserved and only used for scientific purposes. “Second degree natural sites” are conserved areas where some tourism-oriented construction can be allowed.

tectural characteristic of Ayvalık and Cunda island is the presence of over 2,100 registered Neo-Classical Greek building stock that is unique in Turkey (personal communication with Fırat Aykaç).

Figure 1. Map showing the boundaries of Ayvalık Adaları Nature Park (source: GDNCNP)



In 2004, based on MoFWA’s legislation numbered 2873 concerning National Parks and other protected areas, the “Long Term Development Plan” (called “Uzun Devreli Gelişim Planı” in Turkish), which is the equivalent of a management plan, for Ayvalık Adaları Nature Park was prepared. The purpose of the plan was to preserve the park’s natural and cultural values and to specify allowable activities within the nature park (Özbay, 2008). The 2004 development plan (see Annex 2) included principles for the MCPA’s conservation and defined three main protection zones reflecting different levels of protection: strictly conserved zones, restricted use zones and controlled use zones (ibid).

Within the controlled use zones terrestrial entrance points to the park, recreational routes for boats and hiking/trekking paths as well as daily use beaches were defined⁵. These decisions were reflected in the Nature Park’s physical plan prepared at 1/25,000 scale. The Long Term Development Plan never became operational. It was seen as “too re-

⁵ Ayvalık Adaları Nature Park management held a twenty-day training programme in 2008 for more than 30 local field guides. These field guides were trained with the intention of implementing a monitoring scheme for daily boats and the eventual deployment as nature guides in the terrestrial sections of the park. However, this field guide system has never been properly implemented in the park due to bureaucratic challenges.

strictive” by the local authorities and some local residents leading to a legal process aimed at its annulment (Özbay, 2008). Eventually in 2009 the plan was revised by GDNCNP resulting in controversial changes to the previously defined protection levels (personal communication with Ayvalık Environment Platform). A lawsuit was filed against the revised plan which to date remains unresolved and hence the Nature Park has no development plan in operation.

2.1. Biodiversity Overview

The habitat in Ayvalık Nature Park provides a diverse range of vegetation types that typify the Mediterranean phytogeographic zone⁶ (maquis, phrygana, meadows, forests, coastal sanddunes and swamps). Forests cover about 2,847 ha of the Nature Park and are dominated by *Pinus brutia*. Due to the marine enclosure of the protected area, these natural vegetation types form closed clusters consisting of local populations that could be sensitive to man-made interventions (ibid). The islands are generally covered by maquis, phrygana and pine vegetation and only Çıplakada is dominated by meadows and arable lands. The marshland found in the Badavut section of the MCPA is a semi-salty wetland which seasonally receives wild avifauna (ibid).

Ayvalık Adaları Nature Park host 615 plant taxa, 596 species, 10 subspecies and 9 varieties (Egeplan, 2001). Two endemic plant species to the area have been identified: *Centaurea acicularis* Sm. var. *urvillei* Boiss. and *Campanula lyrata* Lam. ssp. *lyrata*. In addition, four species classified under varying threat categories by the International Union for Conservation of Nature (IUCN) were encountered at the Nature Park: *Pancratium maritimum* L. (Endangered (EN) *Parietaria cretica* L. (Vulnerable (VU), *Limonium graecum* (Poiret) Rech. fil. var. *Graecum* (VU), and *Centaurea acicularis* Sm. var. *urvillei* Boiss. (VU). The scientific analysis revealed that over 60 plant species have either medicinal or economic uses (ibid).

About 20% of bird fauna seen in Turkey (86 species) was encountered in the Nature Park (ibid). The avifauna survey was limited to 3 months and did not capture the park’s wintering birds. Identified

⁶ Ayvalık district is generally characterized by a rainy Mediterranean climate (Egeplan, 2001).

avifauna species found in the Nature Park of conservation concern include: *Falco eleonora*, *Phalacrocorax aristotelis*, *Ciconia nigra*, *Phoenicopiterus ruber* and *Falco peregrinus*.

The same scientific study identified seven amphibian species in the nature park. Two of these are salamanders: *Triturus vulgaris vulgaris* and *Triturus karelini*; the rest are frog species. Among the thirty eight reptile species identified at the site, *Vipera xanthina* is a venomous and rare snake species protected under the Bern Convention; *Vipera ammodytes meridionalis* is also a protected species.

The marine ecosystems of Ayvalık Adaları Nature Park are ecologically some of the most important of the protected area (Gürkan, 2005). Ayvalık Adaları' marine conservation importance is especially due to the presence of red corals (*Corallium rubrum*) that are otherwise only encountered in Portofino, Italy within the Mediterranean (Gökdeniz *et al.*, 2010). The species has been identified in thirty four distinct spots of the Nature Park (Ayvalık İlçe Turizm Müdürlüğü, 2007) with the main concentrations found in Ezerbey, Deli Mehmet, Kerbela and Tokmaklar diving points at 35-45m depths (İlker, 2012). The fish fauna in the Nature Park amounts to 142 species half of which are reported to have economic value (GDNCNP, 2001).

2.2. Pressures

Although Ayvalık Adaları Nature Park itself is not heavily inhabited and is a relatively well preserved MCPA, there are a number of pressures that compromise the ecological integrity of the site. These pressures are mainly concentrated around Ayvalık district center and Küçükköy (Sarımsaklı) to the South where developments have been increasing over the years and infrastructure is inadequate. Table 1 provides an overview of the pressures facing the site, the sectors responsible for the pressures and the main policy drivers.

2.3. Socio-economic characteristics of site

Within Ayvalık Adaları Nature Park's boundaries there are no permanent settlements but a number of secondary homes or housing complexes exist such as the Parliamentarians' housing estate, Doğakent secondary homes, Ortunç touristic complex falling within Ayvalık Municipality and Ceylan, and

Cemkon and Karaca secondary housing complexes that fall within Küçükköy Municipality (Egeplan, 2001 and personal communication with Atasay Tanrıseven). The population inside the MCPA boundaries is estimated to be around 5,000 people (personal communication with Atasay Tanrıseven). However, the Municipality centers of Ayvalık and Küçükköy interact closely with the MCPA and therefore their socio-economic characteristics are also of importance to the management of the area.

According to the 2010 census, Ayvalık district center has a population of 36,718 while its surrounding villages have a population of 26,909, amounting to a total of 63,627 people (TUIK, 2011a). Around 50.5% of the population is female (ibid). The district center, which is in close proximity to the MCPA, has seen an average population increase of 5% per year since 2007 (ibid). Furthermore, the town's population doubles during the summer period as a result of tourists and secondary home-owners being in residence. The town center's population is projected to reach 52,204 by 2020 (a 40% increase) while that of Küçükköy settlement, which is also partially in the Nature Park, is projected to reach 37,614 (Egeplan, 2001). This growth implies a significant increase in the usage of the coastal and marine areas and of other natural resources in the area.

According to 2010 data, 568,000 people are employed in the Northern Aegean region (including both Balıkesir and Çanakkale provinces). Around 40% of the population is employed in the agrarian sector, followed by 13.5% in crafts, 11.3% in services and sales and 11.3% in elementary occupations (TUIK, 2011b). Based on 2009 data, the employment rate in Balıkesir and Çanakkale Provinces is 48% and unemployment is around 8.5% (Güney Marmara Kalkınma Ajansı, 2010). The rest consists of age groups less than 15 years old, retired and unregistered workers (e.g. housewives and farmers etc).

According to the Turkish Ministry of Development's (the former State Planning Organization) district level socio-economic ranking (2004), Ayvalık is ranked 64th out of 872 districts in the country based on a range of development indicators such as income, employment, demography, education, health, industry, agriculture and other financial indicators (Güney Marmara Kalkınma Ajansı, 2010).

Table 1. Overview of Pressures (sources: GDNCNP, 2001; Gürkan, 2005; and field interviews)

Pressure	Description	Context / Policy Driver	Sector Responsible
Inner Sea Pollution	Inner Ayvalık Gulf has become a closed water body since the construction of the road linking the mainland to Alibeyadası (Cunda island) cutting off the sea's natural circulation. The two outlets to the open sea are too narrow (Dalyan straight and Dolap island straight) for the marine environment's regeneration in the inner gulf given the amount of wastewater entering the system and the presence of the Ayvalık port and the private marina. The town's population increases two folds in the summer intensifying this pressure.	<ul style="list-style-type: none"> - Inadequate infrastructure (Ayvalık does not have a water treatment plant and only 40% of the town is connected to an impermeable septic system); - Inadequate implementation/ monitoring of existing regulations - Poor compliance with waste disposal rules for commercial boats and houses - The carrying capacity of the Inner Gulf (harbour and ports) has not been studied. 	Housing developments and tourism
Infrastructure and housing development	<p>In 2009, top-down revisions to the Long Term Development Plan were made softening the conservation status of certain sections within the park. This gave way to new roads, construction and other developments. This pressure is especially important on the relatively well preserved Cunda Island and Tuzla wetlands.</p> <p>The park boundaries exclude inhabited zones. However, increasing demands for recreation, permanent housing, and agriculture/grazing lands increase the pressure on wildlife and habitats. The Küçükköy section of the park, including the Sarımsaklı beaches, has seen fast non aesthetic housing developments.</p> <p>Such pressures are resulting in terrestrial habitat destruction and fragmentation</p>	<ul style="list-style-type: none"> - Park patrols are inadequate and therefore unable to enforce the conservation regulations. - A carrying capacity study for terrestrial usage has not been carried out. - Entrance points to the park were identified in the park's original management plan but have not been set up - Lack of transparency and participation with regards to public policy; - Lack of political will for sound conservation 	Housing, agriculture, tourism, households and government
Illegal commercial fishing	A number of trawlers exploit the open seas outside the MCPA. These boats not only overfish using illegal methods but also damage the habitats and populations of non-targeted species. This in turn impacts the fish populations within the MCPA.	<ul style="list-style-type: none"> - Local authorities responsible for monitoring fishing activity work during the day while the trawlers operate mainly at night. - Local authorities lack the necessary human and financial resources to patrol regularly. - Even for economic species, quotas have not been defined by the Ministry of Food, Agriculture and Husbandary. 	Fishing
Illegal diving and spear-fishing	Diving is prohibited in certain zones of the park. Nevertheless, boats manage to bring people to scuba dive and spearfish (especially at night) within these zones. This affects fish populations.	As above	Tourism
Noise and solid waste pollution	In the high tourist season between June-September, daily boat excursions depart from Ayvalık to the islands. The loud music disturbs the wildlife and solid waste is deposited around the coastline and in the sea.	<ul style="list-style-type: none"> - A carrying capacity study for commercial boats within the MCPA has not been carried out. - Solid waste disposal facilities in the MCPA do not exist. - Monitoring schemes, with the help of guides, have not been implemented due to bureaucratic hurdles, even though local field guides have been trained. 	Tourism
Ghost nets	Ghost nets (nets abandoned on the sea bottom or that get tangled on rocky reefs) affect Ayvalık's marine biota (especially its corals).	<ul style="list-style-type: none"> - Clean-up efforts by the local diving clubs are insufficient. - Marine biodiversity assessment and monitoring is currently not being carried out at the park. 	Fishing

In Ayvalık, according to 2000 data, 8,400 people are employed - 6% in agriculture, 30% in small-scale industries such as food, machinery, construction, energy sectors and 64% in commerce, tourism and communication (Ayvalık Turizm Master Planı, 2007). The literacy rate is 95% for the district with 47% of the town residents having graduated from primary school, 20% from high school and 9% from university (*ibid*).

Agriculture is prominent in the region with olives dominating the agricultural landscape. Within the administrative borders of the district there are about 16,200 ha of olive groves, forming 77% of the overall agricultural practice (Ayvalık İlçe Tarım Müdürlüğü, 2010). Ayvalık has an inseparable association with olive oil and the region recently gained an “appellation,” a geographic sign assuring consumers that produce originates from the area (Keskin *et al.*, 2011). Around 26,250 tons of olive oil are produced annually. Following olives, the main agricultural crops are wheat and horticultural products (*ibid*). Ayvalık Adaları Nature Park’s terrestrial areas are not widely used for agriculture. Olive groves and small scale crop gardens are mainly encountered at the Cunda and Çıplak Islands within the nature park (Egeplan 2001).

Meadows are limited in the district and as a result animal husbandry is also practiced in the forested

zones. There are an estimated 5,200 cattle and 2,000 sheep and goats in the district (*ibid*). Animal husbandry is, in principle, not allowed within the MCPA. However, about two or three sheep herds amounting to 500 animals graze within the park including Çıplak island where one herd is taken for grazing during the summer (personal communication with Nurullah Özdemir). In Ayvalık district, around 18,708 tons of milk were produced in 2010 (Ayvalık İlçe Tarım Müdürlüğü, 2010).

Bee-keeping is a widespread activity within the park supported by the variety of plants and trees conducive to apiculture found there. However, it remains a secondary or ‘on the side’ income generating activity. There are eighty people formally registered as bee-keepers in the district and around seven thousand hives within the MCPA (personal communication with Nurullah Özdemir). Bee-hives are often moved from one habitat to another according to the season. The majority of registered and non-registered bee-keepers are said to come from outside of Ayvalık.

The labour force, which is primarily located outside of the Nature Park, is concentrated on coastal tourism and fishing (Gürkan 2005). These two key activities are explored in greater detail in Chapters 3 and 4 along with an assessment of the ecosystem services and values of the Ayvalık Adaları Nature Park.

Qualitative Assessment of Ecosystem Services



3.1. Marine Ecosystem Services Typology

A typology of marine and coastal ecosystem services has been developed for this study following the ecosystem service approach (ESA), which is based on the Millennium Ecosystem Assessment (2005) classification of ecosystem services into the following four categories:

- **Provisioning services** relate to the tangible products, such as fish and pharmaceuticals, provided by marine ecosystems;
- **Regulating services** refer to the marine environment's natural processes such as waste assimilation and carbon sequestration that contribute to social wellbeing;
- **Cultural services** may be associated with both use and non-use values and relate to the non-material benefits obtained from ecosystems, for example, through tourism and educational use of the marine environments; and,
- **Supporting services** are necessary for the production of all other ecosystem services (e.g. soil formation or nutrient cycling). They differ from the other services in that their impacts on people are either indirect (via provisioning, regulating or cultural services) or occur over a very long time.

The ESA explicitly recognizes that ecosystems such as marine environments and the biological diversity contained within them contribute to individual and social wellbeing. Importantly it recognizes that this contribution extends beyond the provision of goods such as fish to the natural regulating functions of marine ecosystems such as carbon sequestration. The ESA therefore provides a framework for considering whole ecosystems in decision making and for valuing the services they provide.

It is important to note that economic valuation is focussed on the 'final benefits' or 'outcomes' realised by society from the services marine ecosystems provide, not the services and functions that contribute to those outcomes. This is to avoid double counting. The benefits generated by supporting services, while fundamental to the provision of final benefits, are not valued independently as they are intermediate benefits which contribute to the provision of a range of final benefits. Their value is captured in the valuation of the final outcomes associated with the services they support. Supporting

services include soil formation and retention, primary production and habitat provision⁷.

Health is also not explicitly listed as an ecosystem service as health benefits are considered to be provided by a range of services such as fish, flood protection benefits and a clean environment for recreation. The health cost associated with a deterioration in these services may be used to measure the benefits provided by the marine ecosystem. **Biodiversity** is also considered to be cross cutting, the final benefits of which could be associated with a range of services. An exception is biodiversity non-use which is listed as a separate service.

Table 2 provides a typology of marine ecosystem services and a qualitative assessment of the marine ecosystem services provided at Ayvalık Adaları Nature Park. Each ecosystem services is been rated as follows: ‘***’ means that the service is important, ‘**’ means that the service is provided, ‘-’ means the service is not relevant at the site, and ‘?’ means that there isn’t enough information to determine whether the services is present or not, so its provision is uncertain. Table 2 also identifies the sectors that are supported by (or benefits from) the provision of each ecosystem service and the sectors that can influence the quality and quantity of that service.

The typology presented in Table 2 does not include marine sub-habitat types, which can include hard beds, rocks, muds, sands, gravels, seagrass meadows and caves. The extent of services provided will depend on the specific sub-habitat type. The available data at Ayvalık Adaları Nature Park did not warrant this level of detail, with the exception of the *Posidonia* meadows (seagrasses) which form an important input into the economic valuation. In support of this approach Austen *et al.* (2010) states that In the case of the marine environment the spatial data are less essential, as most marine environments deliver most marine ecosystem services, albeit to differing amounts.

⁷ Many marine organisms provide living habitat through their normal growth, for example, reef forming invertebrates and meadow forming sea grass beds. ‘These ‘natural’ marine habitats can provide an essential breeding and nursery space for plants and animals, which can be particularly important for the continued recruitment of commercial and/or subsistence species. Such habitat can provide a refuge for plants and animals including surfaces for feeding and hiding places from predators. Living habitat plays a critical role in species interactions and regulation of population dynamics, and is a pre-requisite for the provision of many goods and services’ (Beaumont *et al.*, 2007).

3.2. Provisioning services

3.2.1. Food

The two main food products provided by Ayvalık Adaları Nature Park are fish and *salicornia*.

3.2.2. Raw materials

These products relate to the extraction of marine organisms for all purposes other than human consumption. Marine raw materials include seaweed for industry and fertilizer, fishmeal for aquaculture and farming, pharmaceuticals and ornamental goods such as shells. The provision of genetic resources, natural medicines and ornamental products at the site is unknown.

3.3 Regulating services

3.3.1. Regulation of GHGs

A key service provided by marine ecosystems is their capacity to sequester carbon dioxide. The ocean is estimated to hold about one third of all anthropogenic CO₂ emissions and has two interconnected CO₂ absorption circuits: the biological pump and its physico-chemical counterpart. At the global level, the latter has been responsible for most of the capture of CO₂ of human origin, while the biological pump is consider still be working as it did before the dawn of the industrial age (Nellemann *et al.*, 2009). The sequestration of CO₂ emitted by human activities by the physico-chemical pump (through a process of solubility), shows little dependence on ecosystem quality. However, it leads to the gradual acidification of the oceans, which will have a considerable effect on marine ecosystems and the living resources produced, particularly in the Mediterranean (CIESM, 2008; Gambaiani *et al.*, 2009). This issue, about which little is yet known, is the subject of many initiatives currently underway (Orr, 2009) and a European research programme including the socio-economic consequences is set to be launched in the near future.

At the local level, the flow of carbon from the surface towards the sediment depends on biological processes, which in turn depend on ecosystem quality (and does not lead to the acidification of the environment).

Table 2. Qualitative assessment of marine ecosystem services and benefits at the Ayvalık Adaları Nature Park

ES Type	Service	Benefit / outcome	Rating	Sectors supported by ecosystem service	Sectors impacting / influencing the provision of ecosystem service	
Provisioning Services	Food	Commercial and subsistence fish and wildlife	**	Households, Fishery, Tourism	Households, Fishery, Agriculture, Industry	
	Fibre/ materials	Fibre and construction products, e.g., reeds, and aggregates	?	Households, Industry (construction materials)	Households, Industry	
	Water	Public water supply, water for industrial and agricultural usage	-	Agriculture, Industry, Tourism	Agriculture, Industry, Tourism	
	Natural medicines	Natural medicines	*	Household	Households, Fishery, Agriculture, Industry	
	Biochemicals	Biochemicals and genetics	?	Agriculture	Agriculture, Industry, Tourism	
	Ornamental resources	Ornamental resources	?	Industry	Agriculture, Industry, Tourism	
	Source of energy	Energy provision e.g., hydropower	-	Energy	Agriculture, Industry, Tourism	
	Transport	Commercial use of waterways	*	Industry	Agriculture, Industry, Tourism	
	Regulating Services	Regulation of GHGs	Carbon sequestration	*	Potentially all	
		Micro-climate stabilization	Air quality	*	Potentially all	
Water regulation (storage and retention)		Flood protection	*	Tourism, Industry, Households/ Urban Settlement, agriculture	Potentially all	
Waste processing		Detoxification of water and sediment / waste	*			
Nutrient retention		Improved water quality	?	Fisheries, Agriculture		
Cultural Services	Spiritual, religious, cultural heritage	Archaeological ruins (historical not recreational value)	**	Tourism, Households		
	Educational		*	Households		
	Recreation and ecotourism	Recreational fishing and hunting, birdwatching, hiking, diving, sailing, canoeing, Holiday destination (aesthetic views) , archaeological ruins (historical not recreational value)	**	Tourism	Tourism, Infrastructure, agriculture, Industry	
	Landscape and amenity	Views	**	Tourism		
	Biodiversity non-use		**	All	All	

Code: ** service important, * service provided, - service not relevant, ? uncertain of provision

About 35-50% of the carbon production of the coastal ocean is estimated to be a result of the photosynthesis by marine macrophytes including seagrasses (Duarte&Cebrian 1996). These marine plants have a global average biomass of about 180 g C/m² and an average net production of about 400 g C/m² yr, ranking amongst the most productive ecosystems in the biosphere (The Encyclopedia of Earth, 2011).

In the Mediterranean the matte (sheaths and rhizomes) produced by the *Posidonia* meadows store a carbon flow, which has been estimated at 1.2 million tonnes of carbon per year (Pergent, 1997). Thus the preservation or restoration of these coastal ecosystems contributes to the sustainability of this ecosystem service. The Mediterranean *Posidonia* accumulates in its subsurface large quantities of organic material derived from its roots, rhizomes and leaf sheaths embedded in often sandy sediments (Lo Iacono *et al.*, 2008). These organic deposits can reach up to several meters as they accumulate over thousands of years forming what is known as matte, whose high content in organic carbon plays a crucial role in the global carbon cycle (ibid). *Posidonia oceanica* is considered to be one of the most extensive coastal reservoirs of CO₂ because of the preservation of this matte along the Mediterranean coasts over time (Duarte *et al.*, 2005). This in-situ accumulation of large quantities of biogenic materials over millennia is an important ecological phenomenon and occurs only in few ecosystems other than seagrass meadows such as peats, coral reefs and mangroves (Mateo *et al.*, 1997).

Despite their global importance, there is growing evidence that seagrasses are experiencing an unprecedented level of damage and deterioration (Orth *et al.*, 2006). It is estimated that seagrass meadows are being lost due to anthropogenic ecosystem impacts at a rate of up to two football fields per hour, roughly similar to tropical rainforest conversion (Unsworth & Unsworth, 2010).

The distribution of *Posidonia oceanica* (*L. Delile*) communities in Ayvalık Adaları Nature Park was studied by the Middle Eastern Technical University's Subaqua Society (the ecology sub-group) in 2008. The study examined the shoot density, leaf length and conditions of the *Posidonia* communities between the depths of 5-20 m in Cunda island's Western coast as well as the Çıplak, Güneş, Kara, Pınar, Yalnız islands in the MCPA (ODTÜ Sualtı Topluluğu Ekoloji Grubu, 2011). The total area

of *Posidonia oceanica* was calculated to be 10.8 km². Around 4.1 km² of these *Posidonia* meadows is classified as dense/very dense, 2.6 km² of medium density and 4.1 km² of low density. The distribution of the species, as outlined in this study, is limited to a 20 m depth contour of the sea bottom.

Posidonia can provide a range of regulating services, in addition to carbon sequestration, as discussed in Box 1.

Box 1. Seagrass meadows (*Posidonia oceanica*)

Posidonia oceanica are a type of land-based flowering plant, which returned to the marine environment some 120 to 100 million years ago. They form vast underwater meadows (also known as beds) at a depth of between 0 and 50 metres in the open seas and in the brackish and saltwater coastal lagoons. *Posidonia oceanica* is endemic to the Mediterranean and a highly productive system supporting high levels of biomass (Lo Iacono *et al.*, 2008). Despite being endemic its distribution is restricted due to anthropogenic disturbances; their total surface area within the Mediterranean is about 38,000 km² (Mangos *et al.*, 2010).

Posidonia seagrass communities provide a wide range of Ecosystem Services:

The *Posidonia* meadows are the leading Mediterranean ecosystem in terms of biodiversity provision, supporting a quarter of its recorded marine species over an area estimated to cover almost 1.5% of the seabed.

They serve as spawning grounds and nurseries for many commercial species and the source of major primary production, thereby supporting the fishing industry.

They protect beaches against erosion (by reducing hydrodynamism and by trapping sediment in the matte). The dead leaves of *Posidonia oceanica* found on shores act as a natural barrier reducing the energy of the waves and minimizing erosion. They also play an important role in beach and dune systems.

They encourage water transparency, thereby supporting tourism and providing an effective tool for monitoring the quality of coastal waters.

They trap and absorb man-made CO₂. According to a recent report seagrasses are the most effective species in terms of long-term carbon storage (Laffoley & Grimsditch, 2009).

They produce oxygen and are known as the "lungs of the sea" with +/- 14 lt O₂/m²/day capacity on average

They cycle nutrients through their plant growth.

They operate as coastal water filters. Subsurface rhizomes and roots stabilize the plant while erect rhizomes and leaves reduce silt accumulation.

Source: Based on Mangos *et al.* 2010

3.3.2. Micro-climate stabilization

Oceans play a role in regulating the atmosphere and modulating weather. While it is thought that this ecosystem services is provided by Ayvalık Adaları Nature Park, there are no scientific studies defining this service.

3.3.3. Disturbance Regulation

Flood and storm protection: Marine flora and fauna can help defend coastal regions by dampening and preventing the impact of tidal surges, storms and floods. This disturbance alleviation service is provided by a diverse range of species, such as salt marshes, mangrove forests and sea grass beds, which bind and stabilize sediments and create natural sea defences (Huxley, 1992; Davison & Hughes, 1998 as reported in Beaumont *et al.*, 2007). These natural sea defence systems protect infrastructure and investments in vulnerable coastal areas, and would need to be replaced by man-made alternatives if damaged or lost. This service is important in Turkey given the concentration of socio-economic activities on Turkey's coasts; 27 of Turkey's provinces border the sea and 30 million people live by the coast (UNDP, 2010). It is also considered important in Ayvalık Adaları Nature Park, given the communities that live along the coastline and the importance of tourism infrastructure.

Coastal erosion is a natural phenomenon widely observed in the Mediterranean, particularly in coastal zones with soft substrate. According to the European Environment Agency (EEA, 2006) 20% of European coasts are threatened by erosion (i.e. around 20,000 km).

The Mediterranean's Posidonia meadows provide protection against erosion through three main functions. Firstly, its foliage which limits hydrodynamics by 10 to 75% (Gacia *et al.* 1999). Secondly, the banquettes formed by its dead leaves and rhizomes on beaches - that can reach a height of between 1 and 2 metres - builds a structure that protects the coastline against erosion (Guala *et al.*, 2006; Boudouresque *et al.*, 2006). Thirdly, the Posidonia mat traps sediment (Dauby *et al.* 1995, Gacia & Duarte 2001), thus contributing to their stability. Jeudy de Grissac, 1984 estimated that the degradation of a one meters thickness of Posidonia duff could lead to the coastline retreating by twenty meters.

Akgün (2007) conducted erosion and landslide susceptibility assessment of an area of about 424 km² in and around Ayvalık using Geographical Information Systems (GIS) and remote sensing techniques. The results indicate that the following areas are highly/very highly susceptible to erosion: areas where rocks showed high to very high weathering grades; hill slopes with moderate to high slope gradients; NW facing hill slopes with relatively high precipitation; sparse vegetated areas; and, areas with high drainage density. While this study is not specific to the Nature Park, it is reasonable to infer that the same erosion risk probabilities apply to the park. Personal communications with the author of this study confirms that coastal erosion has been observed in Cunda Island and Northern shores of Ayvalık.

3.3.4. Waste remediation

A significant amount of human waste, both organic and inorganic, is deposited in the marine environment. This waste would require additional treatment if it were to be taken up by terrestrial systems, and therefore would entail increased treatment costs. Marine living organisms store, bury and transform many waste materials through assimilation and chemical de and re-composition (Beaumont *et al.*, 2007). The capacity of marine ecosystems to absorb, detoxify, process and sequester waste shows a wide variation. Some toxic pollutants, such as heavy metals, cannot be converted into harmless substances, whereas some organic waste can even encourage ecosystem development through its biomass and benefit ecosystems. Marine ecosystems provide an ecosystem service for the quantity of waste below the threshold at which it becomes harmful to them (Mangos *et al.*, 2010).

While this service is thought to be provided by Ayvalık Adaları Nature Park, there are no site specific studies defining or quantifying this service for the area.

3.4. Cultural Services

3.4.1. Spiritual, religious and cultural heritage

The marine environment may be linked to the cultural identity of a community, or associated with religion, folklore, painting, cultural and spiritual traditions. Communities that live by and are dependent on the sea for their livelihood often attach

special importance to marine ecosystems that play a significant role in the economic or cultural definition of the community (Beaumont *et al.*, 2007).

Ayvalık's identity is strongly linked to the marine environment. The town's slogan is "rakı, balık, Ayvalık" ('rakı, fish, Ayvalık' in English) emphasizing the culinary importance of the sea. Ayvalık and Cunda Island's culinary resources and tradition, fish and locally produced olive oil, are nationally recognized. This sea-based culinary heritage has been shaped by the migrants of the town from Crete, Lesbos and Bosnia.



Figure 2.

Historically, Ayvalık has been an important town whose prosperity peaked in the 18th and 19th centuries. Previously known as Kidonia, it was a Greek town which maintained its economic independence for part of the late 18th century Ottoman period (Ayvalık Ticaret Odası, 2010). This led to the development of the olive oil business, along with houses, churches and schools with Neo-classical Greek characteristics often made by the local "sarımsak" stone. As a whole, these structures constitute some of the richest civil architectural examples in Turkey (*ibid.*).

Economic activities, such as olive oil production, and their related products have historically been concentrated in the town's sea front so as to be close to the maritime routes of commerce (*ibid.*). These sea routes have also shaped the town's population as the Greek and Turkish populations have historically been subject to constant exchange between the Lesbos and Crete Islands in Greece and the mainland. This commercial exchange continues to this day, especially with Lesbos.

Box 2. "Şeytan Sofrası" – The Devil's Dinner Table

The Devil's Dinner Table is the geological imprint of what is believed to be the "devil's footprint" and is located in the recreational zone of the southern Küçükköy section of the Nature Park. It offers a panoramic view point among the pine trees from which all of the Ayvalık Adaları as well as Lesbos can be observed. People who visit the "footprint" throw coins and make wishes at what is considered to be a holy site within the nature park. The area is managed by Ayvalık Municipality and is especially popular at sunset when spectacular views of the Ayvalık Adaları and bays can be experienced.

There are eight Greek Orthodox monasteries in remote zones inside the Nature Park (Egeplan, 2001). The majority of these spiritual centers are located on small islands or near the sea shores (*ibid.*). One of these monasteries, Agia Paraskevi, is situated in the Tımarhane point in Çamlık Bay and housed psychologically disturbed people during the Greek settlement of Ayvalık (tımarhane meaning asylum in Turkish). It was believed that the steady marine winds helped the healing process (Turkey Arena, 2011).

3.4.2. Education and research

Marine living organisms provide stimulus for education and research. Beaumont *et al.* (2007) cites a number of uses of marine information including: the study of microbes in marine sediments to develop economical electricity in remote places; the inhibition of cancerous tumour cells; the use of Aprodite sp. spines in the field of photonic engineering, with potential implications for communication technologies and medical applications; the development of tougher, wear resistant ceramics for biomedical and structural engineering applications by studying the bivalve shell. In addition, marine biodiversity can provide a long term environmental record of environmental resilience and stress.

There have been over fifty Masters and Doctoral theses on Ayvalık region since the late 1980's according to the Turkish Council of Higher Education (YÖK, 2011). Around 18 of these studies are on the architecture and city planning aspects of Ayvalık district, while 9 study olive production in the region. At least ten of the research studies relate to different scientific aspects of the Nature Park (fisheries, biology and tourism) but the majority consists of geological or hydrogeological studies concerning the formation of the Ayvalık archipelago

as well as the geomorphology of the southern section of the park.

Currently no education or interpretation activities are being conducted at the MCPA; however, the site has a remarkable potential for being used as a live laboratory.

3.4.3. Recreation and Tourism

Marine ecosystems provide the basis for a wide range of tourism and recreational activities, resulting in significant employment opportunities for coastal communities and contributions to Gross Domestic Product (GDP). Tourism is one of the most important economic activities within Ayvalık Adaları Nature Park and is closely linked to the marine environment. A range of marine based recreational activities are currently offered including scuba diving, boat tours and sailing.

3.4.4. Landscape and amenity

Landscape and amenity services provided by marine ecosystems attract tourists and generally make the area an attractive place to visit and live. This benefit can be captured through property price premiums in the area and the returns to coastal businesses (restaurants and hotels) relative to non-coastal businesses.

3.4.5. Biodiversity non-use

Biodiversity non-use relates to the benefits people derive from marine organisms unrelated to their use. Such benefits can be motivated by bequest values (the value placed on ensuring the availability of marine ecosystems for future generations), and existence value (a benefit derived from simply knowing that the marine ecosystem biodiversity exists).

3.4.6. Option value

Option value relates to currently unknown potential future uses of marine biodiversity and reflects the importance of more uses being discovered in the future. The biodiversity may never actually be exploited, but there is benefit associated with retaining the option of exploitation.

Valuation of Ecosystem Services



In 2008, a World Bank study put the total annual figure for all marine ecosystem services at more than US\$ 20 trillion. This estimate only accounted for the marine ecosystem goods and services for which a market already exists and is therefore considered to be an underestimate.

This section presents, where possible, monetary estimates for the ecosystem services identified in Table 2 as being present at Ayvalık Adaları Nature Park. The monetary estimates have been derived using market pricing or value transfer valuation approaches. Market price approaches include the use of market prices to value traded ecosystem services and also the so called cost based approaches. The use of **market prices** for marine ecosystem services that are traded reflect a lower bound estimate of its value, as they do not capture the consumer surplus⁸ element of value. They are therefore only proxies of welfare value. However, such estimates are still very informative and relatively straight forward to derive. **Cost based approaches** take the cost of replacing a service or averting a damaging impact on a marine resource as a proxy for the value of the benefits provided by the marine environment. They suffer from the same complications as market prices and risk the under-valuation of non-market goods

Value transfer (also called benefits transfer) involves the application of values from an existing study (often called the 'study site') to a new study (often referred to as the 'policy site') where conditions are similar and a similar policy context is being investigated. Value transfer is a practical means of demonstrating the monetary value of marine benefits. It is cheap and quick relative to primary research, but there are a number of factors which influence the reliability of the transfer exercise. The quality of the original study is obviously a key consideration for value transfer applications. In order to minimize errors / uncertainty, the primary research study should be based on adequate data and a theoretically sound approach. The degree of similarity between the study site and the policy site is also a major factor. Value transfer will be more reliable if the policy site is located within the same region / country as the study site, and displays similar site characteristic (e.g. size, services and availability of and distance to substitutes). Other factors affecting

⁸ Consumer surplus is the amount an individual is willing to pay above the market price. The price reflects the cost of obtaining a good, not the actual benefit derived from its 'consumption', which is equal to the market price plus consumer surplus.

the reliability of the value transfer exercise include: the reference condition (i.e., how closely the baseline at the study site matches the baseline at the policy site); the proposed change in the provision of the service (i.e., the magnitude of the change and whether the valuation is of a change in the quantity or the quality of an attribute); and the range/ scale of the commodity being valued (e.g., one site or many sites valued and physical area).

As well as providing *welfare measures* an attempt has been made to illustrate the importance of these ecosystem services in terms of the jobs they create and their contribution to local livelihoods.

The marine ecosystem services valued are – fish, salicornia, carbon sequestration, protection against coastal erosion, waste treatment and tourism and recreation. Where relevant, background is provided on these services – i.e., physical (quantitative) data, management structure, pressures and opportunities for development. For the regulating services (carbon sequestration, protection against coastal erosion, waste treatment) a review of relevant valuation evidence for the region is also presented.

4.1. Provisioning Services

4.1.1. Fish

4.1.1.1. Background

The Gulf of Edremit is the most important fishing zone in the Northern Aegean on account of the fact that the structure of its sea bottom is suitable for trawl fishing and it is enriched by the nutrient rich



Figure 3. The traditional Northern Aegean trata boat, banned since 2008 for the damages it causes to the sea bottom (source: Esra Başak)

water flowing in from the Black Sea (Kocataş & Bilecik 2002). Edremit Gulf is mainly dominated by traditional coastal fisheries but bigger scale trawlers and purse-seiners are also encountered (Ceyhan *et al.*, 2006).

There are two fishing cooperatives in Ayvalık district: one in the town center and the other on Cunda island (personal communication with Mehmet Kırağ). The fishing cooperative on Cunda Island was established 15 years ago and represents 150 small-scale fishermen. Traditionally, fishing practices in Ayvalık involved 7-8 m boats using haul nets known locally as “*trata*”, but since these boats were extracting and impacting the sea bottom close to the littoral, this practice was banned in 2008 – much to the discontent of the local cooperatives (Keskin *et al.*, 2011). Since the catch of “*papalina*,” a juvenile sardine popular in Ayvalık has been banned along with the *trata* boats, fishermen have switched to catching “*çaça*” or European sprat (personal communication with Sema Özdemir).

Currently, in Cunda and Ayvalık, there are three-hundred and fifty small-scale fishing boats (less than 12 m) registered with the district agricultural authorities (personal communication with Sema Özdemir). These artisanal boats fish between Baba point and East of Eğribucak point and target the following species: red mullet, surmullet, Gilt-head seabream, Red porgy, Two-banded seabream, bogue and squids.

Another distinctive marine activity in the MCPA concerns the extraction of certain mollusk species (predominantly *Tapes aureus* but also *Venus verrucosa* and *Ostrea edulis*). This activity is conducted by 4-5 families living in Cunda island. The export of sea-shells from the MCPA in 2010 amounted to 217 tons (*ibid*)⁹. However, since August 2011 the capture of mollusks and sea-shells has been banned to protect the remaining low stock in the region (*ibid*). They are therefore not included in the economic valuation.

Large-scale fishing has been practiced in Ayvalık for the past ten to fifteen years often by people coming from elsewhere such as the Black Sea and İzmir region. There are three trawlers of more than 12 m in length and seven purse-seiners 40-50 m

⁹ There is one company based in Cunda Island, Artur Balıkçılık, that exports veneridae and clams to Europe (especially to Italy and France). Since the species’ harvest has been banned in the summer of 2011, the company imports their products from İzmir.

long, with sonar and light equipment whose nets of 600 m diameter that can reach depths of 50-70 m (personal communication with İsmail Güran). The trawlers are allowed to fish at a distance of 1,5 nautical miles from the coast (which fall outside the MCPA) and purse-seiners have a depth limitation of about 18m (SURKOP 2012).

The targeted species for these purse-seiners are pilchard, anchovy and horse mackerel. Some of the fishing operators have processing and exporting units outside of Ayvalık town and their catch is mainly targeted at İzmir's wholesale market. The fishing season is between the 1st of September and the 15th of May as dictated by the Turkish fishing regulations; however, there are no quotas limiting the quantity of fish taken by these industrial boats. A good day's catch is reportedly 250-300 crates of fish with each crate selling at between 10-30 TL (personal communication with Ömer Akman).

Field interviews revealed that recreational fishing is practiced in Ayvalık Adaları Nature Park but its extent is not known as no formal studies of amateur fishing have been conducted in the MCPA. However, the study by Ceylan *et al.* (2006) identify this activity as one of the main problems facing the fisheries sector in the Gulf of Edremit as amateur fishermen are reported to fish quantities comparable to commercial fishermen highlighting insufficient monitoring and enforcement within the area.

4.1.1.2. Valuation

1,129 tons of fish and 186 tons of other sea products such as octopus, shrimps and mussels was recorded for the Northern Aegean section of the province in 2009 (Balıkesir Food, Agriculture and Animal Husbandry Directorate 2011). In Ayvalık, data provided by the district agricultural authorities shows that a total of 52,320 kg fish were marketed in 2010 valued at 410,125 TL (US\$ 216,546) (Ayvalık İlçe Tarım Müdürlüğü, 2010) as listed in Table 3. The top three species by value are Pilchard, Squid and Bogue.

This data reflects only the fish registered at the Ayvalık fishmarket for both the small-scale fishermen and industrial boats; however, it is very likely to be an underestimate as fish is also being sold directly to restaurants in Ayvalık and Cunda as well as to individual customers. Furthermore, interviews with the agricultural authorities point to an annual

fish catch of 90,000-91,000 kg volume in Ayvalık, almost double the amount recorded in Table 3.

4.1.2. Salicornia

Salicornia is a salt tolerant plant that grows in salt marshes and on coastal zones. Boiled and served with olive oil and garlic it is a favourite starter in fish restaurants in Ayvalık. There are estimated to be 10 people collecting salicornia during the season April–September from Sarımsaklı salt lake and Hakkibey Island in the MCPA (personal communication with Deniz Restaurant representative in Cunda). A restaurant is estimated to buy 5 kg per day during the season (or 900 kg/restaurant/season). There are an estimated 40 fish restaurants operating in Cunda Island and 10 in Ayvalık center. The market price of salicornia ranges between 5-7 TL/kg. Taking the average price of 6TL/kg, the total value of salicornia is estimated at 270,000 TL/year (US\$ 142,560). This only accounts for salicornia consumed in the local restaurants and therefore excludes salicornia that is being exported to other districts.

4.2.Regulating services

4.2.1. Carbon sequestration

The total distribution of *Posidonia oceanica* meadows in Ayvalık Adaları Nature Park has been assessed as 10,800 ha (ODTÜ Sualtı Topluluğu Ekoloji Grubu, 2011).

A number of global and regional studies have measured the carbon storage of *Posidonia* species both in its biomass (including aboveground and belowground vegetation) and its soil organic carbon. For instance, the estimates available of soil organic pools under *Posidonia oceanica* beds have been published based on samples of the vertical mat walls of the meadows at seven heavily vegetated Mediterranean sites (Mateo *et al.* 1997). This estimated a mat/sediment storage capacity of 2.1 t CO₂/ha/yr. Duarte *et al.* (2010) carried out a meta-analysis for the net community production of different seagrass species globally and estimated the aboveground carbon sequestration rate to be in the range of 32.5 t CO₂/ha/yr, assuming an average dry weight of 672 g/m² (average depth of 5 m).

For the purposes of this study global averages defined both for the living biomass and the soil

Table 3. Quantity and Value of Fish and Other Sea Products Marketed in Ayvalık Fish Market in 2010 (Source: Ayvalık District Food, Agriculture and Animal Husbandry Directorate).

Common Name (Turkish)	Common Name (English)	Latin Name	Quantity (kg)	Price range (TL)	Value (TL)	% of Value
Kalamar	Squid	<i>Loligo vulgaris</i>	2,440	15-20	41,770	10.2
Ahtapot	Octopus	<i>Octopus vulgaris</i>	2,160	8-9	18,170	4.4
Sardalya	Pilchard	<i>Sardina pilchardus</i>	16,090	3-5	66,770	16.3
Kupes	Bogue	<i>Boops boops</i>	7,400	5-6	37,900	9.2
İzmarit	Blotched picarel	<i>Spicara maena</i>	2,740	5	13,700	3.3
Barbun	Surmullet	<i>Mullus surmuletus</i>	170	35-40	6,700	1.6
Tekir	Red mullet	<i>Mullus barbatus</i>	3,090	5-10	28,500	6.9
Şona	Seabream sps	<i>Diplodus sps</i>	55	15	825	0.2
Karagöz	Two-banded seabream	<i>Diplodus vulgaris</i>	870	7-15	8,170	2
Kefal	Grey mullet	<i>Chelon labrosus</i>	3,550	5-8	22,440	5.5
İskorpit	Red scorpionfish	<i>Scorpaena scrofa</i>	370	5	1,850	0.5
Hamsi	Anchovy	<i>Engraulis encrasicolus</i>	65	3	195	0
Sarpa	Salema	<i>Sarpa salpa</i>	3,920	5-10	21,020	5.1
Levrek	Seabass	<i>Dicentrarchus labrax</i>	1,240	20-45	35,300	8.6
Melanur	Saddled seabream	<i>Oblada melanura</i>	1,235	7-25	13,820	3.4
Çipura	Gilthead seabream	<i>Sparus aurata</i>	615	15-45	20,375	5
Sargoz	White bream	<i>Diplodus sargus</i>	335	5-20	6,175	1.5
Mırmır	Sand steenbras	<i>Lithognathus mormyrus</i>	780	7-20	13,700	3.3
Hanos	Comber	<i>Serranus cabrilla</i>	20	5	100	0
İstavrit	Horse mackerel	<i>Trachurus sp</i>	2,010	7	14,070	3.4
Palamut	Bonito	<i>Sarda sadra</i>	310	10-20	4,900	1.2
Uskumru	Mackerel	<i>Scomber scombrus</i>	2,170	10	21,700	5.3
Bakalaruz	Whiting sps	<i>Merlangius merlangos</i>	40	20	800	0.2
Melina	Picarel sps		150	5	750	0.2
Mercan	Red porgy	<i>Pagrus pagrus</i>	365	15-20	7,275	1.8
Fangri	Porgy sps	<i>Pagrus sps</i>	80	30	2,400	0.6
İskarta	Other species	-	50	15	750	0.2
TOTAL			52,320	-	410,125	100

organic carbon by the Nicholas Institute for Environmental Policy Solutions at the Duke University (Murray *et al.*, 2010) have been adopted (Table 4). This study demonstrates that the biggest carbon pool for *Posidonia oceanica* lies in the soil organic pools, with a global average of 500 t CO₂/ha.

Table 4. Global averages and standard deviations of the carbon sequestration rates and global ranges for the carbon pools by habitat type

Habitat Type	Annual Carbon Sequestration Rate (t CO ₂ eq/ha/yr)	Living biomass (t CO ₂ eq/ha)	Soil organic carbon (t CO ₂ eq/ha)
Seagrass	4.4 +/- 0.95	0.4 –18.3	66–1,467
Tidal Marsh	7.97 +/- 8.52	12–60	330–4,436
Estuarine Mangroves	6.32 +/- 4.8	237–563	1,060
Oceanic Mangroves	6.32 +/- 4.8	237–563	1,690–2,020

Source: Murray *et al.* 2010

While carbon credit markets do not yet cover projects related to the marine environment it is highly likely that markets for ‘Blue’ Carbon will emerge in the future. This is discussed in more detail in Section 6. An estimate of creditable carbon can be derived for seagrasses associated with their avoided loss.

Removal of seagrass results in the release of previously stored CO₂ from both biomass and soil and an end to the annual carbon sequestration function. The total creditable carbon is therefore equal to the release of stored carbon over a relevant timeframe plus the annual carbon sequestration rate.

By using the market price of carbon, it is possible to calculate the value of creditable carbon, associated with their avoided loss. A lower bound of US\$ 11.2/t CO₂ eq was adopted based on the average price of traded carbon on the voluntary markets

in Turkey in 2010 (Peters-Stanley *et al.* 2011) and an upper bound of US\$ 20/t CO₂ eq (based on EU Emission Trading System (ETS)).

Table 5 presents the results of the analysis. The carbon value of Ayvalık Adaları Nature Park’s *Posidonia* meadows is estimated at US\$ 658,022 – 1,175,040 a year (US\$ 609-1,088 / ha), with a present value of US\$ 4,701,285 – US\$ 8,395,152. This assumes that soil carbon is released at 50 t CO₂ eq/ha/yr, over a period of 10 years, and is based on a 10% discount rate. The monetary value of this service will fluctuate depending on the price of carbon, and the discount rate used in the analysis. It should be stressed that these values are based on a market existing for ‘blue’ carbon, the site being able to generate verifiable site specific estimates of current carbon storage and sequestration functions, and ensuring the site’s long term protection and maintenance.

4.2.2. Protection against coastal erosion

4.2.2.1. Existing estimates

Mangos *et al.* (2010) estimated the benefits of coastal erosion protection provided by marine ecosystems using the expenditure avoided approach. The following three steps were undertaken:

- **Determining the length of built-up coastline that could benefit from protection:** Since the density of coastal urbanization was not available for all Mediterranean countries, a 20% erosion figure established for the European coasts was used along with an estimate urbanization coefficient of 80%. On this basis it emerges that coastal erosion is affecting 16% of the Mediterranean coasts, i.e. 7,360 km.
- **Assessing the presence of effective *Posidonia* meadows** along the built-up and eroded coastline identified in step 1. Pasqualini *et al.* (1998) estimated that the *Posidonia* meadows covered

Table 5. Potential carbon sequestration value of *Posidonia* meadows at Ayvalık Adaları Nature Park

Posidonia surface (ha)	Carbon sequestration† (tCO ₂ eq/ha/yr)	Soil carbon released†** (tCO ₂ eq/ha/yr)	TOTAL Annual carbon loss per site (tCO ₂ eq)	Value (US\$ 11.2 / tCO ₂ eq)			Value (US\$ 20 / tCO ₂ eq)		
				Annual value US\$/ha	Annual Value / US\$	PV (10 years, 10%), US\$	Annual value US\$/ha	Annual Value / US\$	PV (10 years, 10%), US\$
1,080	4.4	50	58,752	609	658,022	4,701,285	1,088	1,175,040	8,395,152

† Based on Duarte *et al.* 2010 & Murray *et al.* 2010

** Assuming a 10 year release period of soil carbon after habitat destruction

some 35,000 km² in the Mediterranean. Given the size of the 0-50 m bathymetric section in which this plant can thrive, it would thus cover some 40% of the benthic area corresponding to 0-50 m depth. As *Posidonia* tends to be abundant in areas with soft substrate (which represent about 50% of the coast), and given the geographical dispersal of *Posidonia*, it is estimated that 90% of the *Posidonia* meadows are established in coastal zones threatened by erosion. The provision of an effective protection service against erosion depends on various characteristics such as the size of the meadow, its maturity and the intensity of the erosion affecting the coast. Using the estimate that over 10% of the European coasts demonstrate the existence of protection mechanisms against erosion (EEA, 2006) and assuming that 50% of the *Posidonia* meadows provide an effective protection against erosion at the regional level it is estimated that 3,312 km of *Posidonia* meadows provide an effective protection service against coastal erosion.

- **Monetary assessment of the value of the protection provided:** It is assumed that the economic value of these benefits is equivalent to the expenditure avoided (investment and maintenance costs)¹⁰. In 2001, expenditure on coastal erosion defence observed along European coastlines amounted to 3.2 billion Euros. It can thus be estimated that European spending on erosion defence amounts to about 160,000 € per km of coastline.

At the regional level, the valuation shows that the *Posidonia* meadows allow the riparian countries to avoid annual spending of about 530 billion €/yr, covering investment and other costs (i.e. maintenance costs). For Turkey the value is estimated at 60 million euro per annum. This is a crude estimate based on the length of the coastline and a default unit value of 160,000 € per km of coastline. It does not reflect the risk of erosion or the site specific expenditure that would be needed to protect areas at risk.

4.2.2.2. Valuation of erosion control at Ayvalık Adaları Nature Park

There are no site specific studies of the risks faced by Ayvalık Adaları Nature Park coastline or the role *Posidonia* meadows play in defending the coastline against erosion or estimates of expenditure on protection activities or infrastructure.

¹⁰ This expenditure breaks down as 53% for new investment, 38% for maintenance and 9% for the purchase by the public authorities of property threatened by coastal erosion (EC, 2004).

Box 3. Main Tourism Attractions of Ayvalık

Historical Ayvalık Town Center: Ayvalık takes its name from the abundance of “ayva” (quince) trees and has been an important settlement since Hellenistic times (anciently known as Kidonia). The town is characterised by its Neo-Classical Greek architectural including the Taksiyarhis Church now used as a mosque.

Sarımsaklı Beach & Küçükköy: Located about 7 km South of Ayvalık center, Sarımsaklı beach stretches to about 8 kms and is heavily populated with tourist resorts and secondary homes. Küçükköy (“small village” in Turkish) is an historical settlement where an Ottoman janissary brigade was based in order to pacify an uprising in Lesbos Island. Later on the village received migrants from Greece and the former Yugoslavia, a fact that is reflected in its 19th century architectural heritage.

Cunda (or Alibey Island): Now connected to the mainland and the town center via a causeway, the island is located 8 km from Ayvalık. The island is not only attractive for its quaint beaches but also the historical promenade of Cunda offers the specialised culinary tradition of Ayvalık at its best with over 40 fish restaurants located there. Some of the historical monasteries such as Moonlight Monastery, Pangia, and Agia Ianni Churches are found in Cunda. During the summer, there are boat services leaving from Ayvalık port to the island and back.

Şeytan Sofrası: This is a panoramic viewpoint in the Southern part of the park where the stretch of bays and islands offer a popular sunset point (see Box 2). The number of visitors to the viewpoint is not known.

Source: Ayvalık Chamber of Commerce 2010

The total length of coastline with *Posidonia* beds (without making any distinction regarding the density of the meadows) is estimated to be 40.8 km (19.5 km along the terrestrial coasts and 31.3 km along the islands of the park) (ODTÜ Sualtı Toplu- luğu Ekoloji Grubu, 2011). Using a transfer value of 160,000 € per km of coastline (Mangos *et al.*, 2010) the value of protection against coastal erosion is 160,000 € per km of coastline × 40.8 km = 6.53 million € per year. Around 4% of the coastal areas in Ayvalık Adaları Nature Park (4 km of the 100 km coastline) is estimated to be occupied by man-made structures such as human settlements, hotels, coastal facilities such as piers, docks and roads (personal communication with Atasay Tanrısever, 2010). A conservative estimate of the erosion protection service offered by *Posidonia* meadows in Ayvalık would be 261,200 € per year (US\$ 339,460).

4.2.3. Waste treatment

4.2.3.1. Existing estimates

Mangos *et al.* (2010) considered the liquid waste produced by human activities, which is the main pollutant of the marine environment. The "combined approach" is recommended for wastewater treatment by the European Commission (EC) and MEDPOL (MEDPOL, 2004). This is based on the emission threshold for waste and a quality objective for the receiving environment. However, some waste is still inadequately treated such as diffuse waste, for which no viable treatment solution has been found.

Mangos *et al.* (2010) value this service on the basis of an environmental tax. Such a tax would allow environmental costs to be included in water pricing, and is in line with the EC's Water Framework Directive (EU_WFD, 2000/60/CE) which requires EU members to introduce water pricing policies which reflect both financial and environmental costs. In France, these taxes are levied by the Water Agencies and are based on the specific situation and usage (domestic or non domestic pollution and diffuse pollution). In 2005 the environmental tax for domestic use at the department of the Bouches du Rhône, stood at 0.18€/m³. This zone is considered to be representative of the French Mediterranean seafront and features both highly urbanized and industrialized sectors (Marseilles, Fos) and other protected sectors (Camargue, Calanques). This is used to value the waste assimilation service provided by marine ecosystems across the Mediterranean states.

In 2005 the Mediterranean coastal population stood at about 148 million (adapted from Attané & Courbage, 2001). Average domestic water consumption for these countries stands at 99 m³/yr per inhabitant (FAO Aquastat, 2000). Given that 35% of the Mediterranean population lives in coastal areas, and assuming an identical *per capita consumption*, water consumption is estimated in coastal areas at 14.5 km³ per year. At the regional level, the value of the service for domestic consumption is estimated at 2.6 billion Euros. The value of this service for industrial use is based on the volume of industrial water discharged directly into the Mediterranean sea, as assessed by MEDPOL, (in *Blue Plan 2005, statistical appendix*), i.e. 557 million m³ per year (or 0.56 km³/yr) and evaluated on the same basis as for domestic consumption at 0.18€/m³, i.e. 100 million Euros. The total value for the service is therefore estimated at 3 billion Euros (excluding agriculture).

The value of waste treatment per country is calculated on the basis of the estimated consumption per country of domestic water by the coastal populations and discharge of industrial water into the Mediterranean Sea, breaking down the overall assessment of the benefit by country according to the method described. The value for Turkey is estimated at 229 million Euro per annum.

The absorption by marine ecosystems of toxic substances (heavy metals, organic pollutants, persistent organic pollutants) or the treatment of recyclable substances such as nutrients beyond the reprocessing capability of these ecosystems should not be counted as a service. Therefore the service is limited to the treatment of recyclable matter, within the limits of these ecosystems' capacities. It was assumed that the limit is not exceeded when waste is treated using the combined approach. This waste treatment service is valued on the basis of a tax paid in order to consolidate and perpetuate a situation which is already acceptable from an environmental point of view.

4.2.3.2. Valuation at Ayvalık Adaları Nature Park

Mangos *et al.* (2010) estimated the waste treatment service of Turkey's marine environment to be 229 million Euro per annum. The total length of the Turkish coastline including the islands is 8,592 km. Total length of the coastlines in Ayvalık Adaları Nature Park is 100 km (or 1.2%) (personal communication with Atasay Tanrıseven). This suggests that 2.75 million Euros (US\$ 3,575,000 million) per annum can be apportioned to Ayvalık Adaları Nature Park's waste treatment service¹¹.

4.3. Cultural services - tourism and recreation

4.3.1. Background

The proximity of Ayvalık district to Izmir, Bursa and Balıkesir, the historical and archeological heritage of the town, the presence of long sandy beaches such as Sarımsaklı and Altınova to the South as well as the culinary reputation of Ayvalık has increasingly made it a popular tourism destination. The high season, which is geared towards sun and sea experiences, in Ayvalık is between July and August when

¹¹ This reflects a conservative approach, as the total length of the Turkish coastline is taken (i.e. including the Sea of Marmara, Black sea and Mediterranean coastlines) rather than the Mediterranean coastline only which totals 5,370 km.

weekly package tours dominate (Egeplan, 2001). During April, May, September and October tourism is more oriented to cultural expeditions (ibid).

There are 185 tourism establishments, with a bed capacity of 15,025, in the Ayvalık-Küçükköy zone; 20 of these are licensed by the Ministry of Tourism and Culture (Ayvalık İlçe Turizm Müdürlüğü, 2010). In 2006, a total of 80,514 visitors consisting of 55,898 Turkish and 24,616 foreigners stayed overnight in the district (Ayvalık İlçe Turizm Müdürlüğü, 2007) compared with 73,706 people in 2000 (Egeplan, 2001). The average length of stay is reported as 2.6 days for Ayvalık (ibid). The most up to date statistics are presented in section 4.3.2.1.

The MCPA can be accessed by both land and sea. As such, yacht tourism is significant in Ayvalık. One private marina operated by Setur since 1997 adheres to international standards and has a 200 (sea) plus 150 (land) boat capacity. In 2010, 899 docking contracts were made (Ayvalık Turizm Master Planı, 2007 & personal communication with Serhat Maya). A smaller port, run by the local fisheries cooperative, is found in Cunda Island. One private boat repair/construction/wintering site exists in Ayvalık, Sadan Yatçılık, with a boat capacity of 140 (personal communication with Sadan Boat Repair).

Daily visitors come to Ayvalık mainly from İzmir, Çanakkale, Manisa, Bursa and Balıkesir provinces (personal communication with Mustafa Tekin). In recent years, there are increasing numbers of Greek visitors coming to Turkey and especially to Ayvalık, Foça and Datça by daily boat tours (Keskin *et al.* 2011). These boat tours remain relatively cheap due to competition (e.g. a round trip from Lesbos Island in Greece to Ayvalık was 12 Euros in 2010). The regular passenger boats operating between the Lesbos Island and Ayvalık transported around 39,000 people to the town in 2010 (Ayvalık Gümrük Muhafaza Müdürlüğü, 2010). Greek tourists come to Ayvalık to shop for food, textiles and other goods, which are cheaper than on the mainland. In particular the weekly Ayvalık open market, held on Thursdays, attracts many Greeks from Lesbos (personal communication with Mustafa Tekin). Visitor numbers were seen to increase in 2010 following the economic crisis in Greece.

In 2006, the Tourism Master Plan for the town was prepared by the relevant Ministry; however, this has not been implemented. On the other hand, in 2010 a "Service Unit" was established within the district tourism directorate in order to develop Ayvalık's

tourism and its infrastructure (personal communication with Mustafa Tekin). One of the main problems concerning tourism in the Southern Marmara Region is reported to be the clustering of secondary houses on the coastal zones, rather than touristic facilities (Güney Marmara Kalkınma Ajansı, 2010). According to Balıkesir Tourism Master Plan, the province has the highest conglomeration of secondary houses in the whole country (ibid).

Box 3 provides an overview of the main tourist attractions in Ayvalık.

4.3.2. Valuation of Key Activities

Section 4.3.2.1 values annual tourism revenues in Ayvalık, while section 4.3.2.2 estimates the value of specific recreational activities carried out in the area.

4.3.2.1. The value of tourism

Given the lack of formal entrance points to the nature park, there are no official data on the number of visitors coming specifically to the MCPA. It is apparent that the main tourism centers in the district such as the Cunda Island's coastal strip (camping areas as well as the stretch of restaurants), Ayvalık town center situated in the inner bay of the nature park and Sarımsaklı beach (which all, strictly speaking, fall outside of the protected area borders) are closely intertwined with the marine and terrestrial zones of the nature park. Consequently, in order to value tourism in Ayvalık Adaları Nature Park, it is assumed that all of the visitors coming to Ayvalık district make use of the protected area.

Site specific data of tourism expenditures is not available for the site. Therefore average daily tourism expenditures estimated in other MCPAs in Turkey has been used based on studies by Bann & Başak (2011a & b) conducted in Foça and Gökova SEPAs. Accordingly, an average daily expenditure of 115 TL/person is applied.

According to the Ministry of Culture and Tourism's most recent statistics, in 2010, 251,396 overnight visitors (4,490 foreigners and 246,906 Turkish nationals) stayed in the municipality-licensed establishments of Ayvalık which constitute the majority of the accommodation options. The average length of stay is 2.3 days (Ministry of Culture and Tourism, 2011). Based on the above information, tourism in Ayvalık is estimated at 66,494,242 TL (US\$ 35,109,000) a year¹².

¹² Based on 251,396 overnight visitors/year * 2.3 days of average stay * 115 TL/day expenditures

Box 4. Red corals of Ayvalık Adaları Nature Park

Red coral (*Corallium rubrum*) is a rocky bottom species inhabiting depths with weak luminosity mainly between 20-200m with sufficient amounts of oxygen (i.e. presence of currents). It's a slow growing (a few centimeters per year) and long living species whose diet is based on small zooplankton organisms captured with the help of the polyps tentacles. While the genus *Corallium* is widely represented in tropical and subtropical waters, *Corallium rubrum* is only distributed in the Mediterranean. In Turkey it only occurs in Ayvalık Adaları Nature Park making the area especially attractive to scuba divers and underwater photographers as their rocky bottom habitat also hosts a wide range of fish diversity.

Corals are an important part of marine ecosystems as they add three-dimensional complexity to the benthos and thereby increase biodiversity. Coral can provide multiple ecosystem services. In terms of provisional services they provide fish, medicine (red coral is used as a homopathic treatment, and it may also hold the potential to contribute to medicinal cures in the future), and ornamental values (it is commonly used in jewelry in other parts of the world). Like seagrasses, coral performs important regulating services including the creation of refuge for other marine species thus indirectly aiding fish stocks and the protection of beaches and coastlines from storm surges and waves through the buffering of waves and currents. Coral reefs are an important source of tourism revenues around the world, attracting divers, as is the case in Ayvalık Adaları Nature Park. Roman folklore speaks of the

protective metaphysical properties of red coral and it is also mentioned in Greek mythology.

The General Fisheries Commission for the Mediterranean (GFCM) has adopted a binding recommendation for the management of red coral to ensure that the species is properly conserved in the future, a move the IWMC World Conservation Trust praised as being consistent with the principle of sustainable use. IWMC has demonstrated that the conservation of red coral is intertwined with the livelihoods and ancient traditions of thousands of people across the Mediterranean Sea, and argued that common management measures should be implemented in the region. The adopted binding recommendation, based on a proposal by the European Union, requests contracting parties to prohibit the exploitation of red coral populations at depths of less than 50 metres, ensure that authorised fishermen record and report to national authorities the daily catches and fishing effort by area and depths (e.g. number of fishing days, numbers of diving, etc), engage in capacity building efforts and other research cooperative activities to improve knowledge on red coral and red coral fisheries, including entering into cooperative arrangements with other appropriate international bodies, and promote participatory programmes with relevant stakeholders.

The main threat facing the red corals of Ayvalık Adaları Nature Park is ghost fish nets that destroy the reefs.

Source: Adapted from FAO 2012, Tsounis *et al.* 2006 and www.turkishmaritime.com.tr

Figure 4. Scuba diving spots in Ayvalık Adaları Nature Park (source: Körfez Diving)



It is important to note that this figure does not capture day visitors to Ayvalık thus it is an underestimate of the real tourism value of the site.

4.3.2.2. Recreational Activities' Valuation

Scuba Diving

Scuba diving is a marine recreational activity which offers an alternative to popular mass tourism (Gökdeniz *et al.*, 2010). Ayvalık is ranked among the top dive destinations in Turkey besides Kaş-Kekova SEPA and Saros Gulf SEPA, and demand for scuba diving in the park is increasing (ibid; Ayvalık İlçe Turizm Müdürlüğü, 2007). A key attraction for divers in Ayvalık is the presence of red coral (*Corallium rubrum*) that can be seen at 30-50 m depths (ibid), (see Box 4). Figure 4 presents the scuba diving locations in Ayvalık Nature Park.

Five diving schools operate in Ayvalık offering excursions to over 60 spots in the archipelago as shown in Figure 4 (Ayvalık İlçe Turizm Müdürlüğü, 2007). Scuba diving is prohibited around the Maden and Küçükmaden Islands within the MCPA due to some archeological remains. Unlike daily excursion boats which are limited to a season of about three months, the diving operators are active for around 11 months of the year. Each of the five dive operators have a boat capacity of 30-40 people and during the high season 250-300 people a day are reported to dive in the region (personal communication with Mustafa Yana).

Based on 250 surveys conducted in the study area by Gökdeniz *et al.* (2010), 47% of the scuba divers coming to Ayvalık are from Istanbul, 17% from Bursa, 10% from Ankara, 9% from İzmir and 7% from other countries. The same study reports the number of scuba divers in Ayvalık at more than 4,000 in 2008 reaching 9,000 people in 2009 and a total of 30,000 dives the same year or about 800 people per month. Based on 30,000 dives and an average 40€ fee per dive, the study estimates scuba diving activities in Ayvalık at 1.2 million € in 2009 (US\$ 1.56 million). This is considered to be a conservative estimate of the value of scuba diving in Ayvalık Adaları Nature Park.

Boat Excursions

A popular recreational activity within the Nature Park is daily boat excursions, which operate between the beginning of June and the end of September. The boat tour operators are mainly concentrated at Ayvalık port, although smaller excursion

boats also depart from Cunda Island. The daily boat tours cater mainly for daily tourists and visitors to the region but also host special occasions such as cocktail parties, weddings and henna celebrations (personal communication with Ali Jale). A typically boat tour leaves at 11:00am and returns at 18:30 and offers a fish & salad meal three swim breaks (Gökdeniz *et al.*, 2010).

There are eighteen daily excursion boats operating out of Ayvalık center that visit the various bays of the MCPA for swimming and exploring. The two biggest companies - Veysel and Jale Tours, have boats that can accommodate 300-400 people and account for 65% of the guests. The total capacity of the excursion boats in Ayvalık is reported as 3,550 people per day (Ayvalık İlçe Turizm Müdürlüğü, 2010) during the peak season (45 days). Based on an average daily boat excursion fee of 15 TL/person, this amounts to 2,396,250 TL annually (US\$ 1,265,220).

Jale Tours reports their seasonal consumption of fish on ted ail tour boats as 15 tons (mainly sardines). According to the owner of Jale tours the buoying system proposed for the Nature Park is impractical for the excursion boat operators due to the unpredictability of the weather conditions in the bays of Ayvalık, which means it is not feasible to restrict boats to anchoring at specific spots. Therefore buoys stationed in the Nature Park may not be used. However, anchoring of tour boats is negatively impacting the seagrasses in the MCPA and solutions that mitigate this impact need to be found.

Birdwatching

Ayvalık Adaları Nature Park encompasses brackish wetlands such as the wetlands in Badavut section and other coastal habitats that are suitable for birdwatching, especially for rare marine species such as Cory's shearwater (*Calonectris diomedea*) (personal communication with Erdem Vardar). Furthermore, slightly south of the district there is an area where greater flamingoes can be easily observed, making the whole region attractive to birdwatchers.

There is a birding community in Ayvalık, organized under a small local conservation organization named Yuva Derneği, which conducts regular surveys and monitoring of the wetlands, carries out mid-winter bird counts and organizes birding outings. They have identified two hundred bird species in the Nature Park, a higher figure than the Egeplan

biodiversity study (ibid). The association has around seventeen members of which 5-10 people can be considered as birdwatchers; however, the number of visitors who come for birdwatching to Ayvalık is not known. It is reported that British and other foreign tourists who come to the Natura2000 sites in Lesbos could be attracted to Ayvalık if the site was properly marketed and the right birdwatching infrastructure provided such as an interpretation center and bike rental. There are, on the other hand, important pressures facing the wetlands of the MCPA such as new housing developments, daily usage, grazing and drainage due to mosquitoes (ibid), which could affect the bird populations and hence the opportunity to develop birdwatching tourism in the area.

Gürlük and Rehber (2008) estimated the economic value of bird watching in the Kuş Cenneti National Park (KNP) at Lake Manyas using the (zonal) Travel Cost method at around US\$ 103 million per year. This value is considerably higher than the annual investment and operational expenditures of the KNP. Consumer surplus per capita is estimated 3.41-6.11 TL. Lake Manyas, located in the Province of Balıkesir is considered to be Turkey's most important Ramsar site. It is an important natural reserve for migratory and wildlife species and an important breeding area for endangered species. KNP also provides hiking trails, walking paths, picnicking areas, sites for scientific research on plants and animals, sightseeing and camping facilities. This study demonstrates that considerable value can be attributed to bird-watching areas of regional and international significance.

Sailing

The Ayvalık Sailing Club located in the Inner Ayvalık Gulf was established in 1969 and has 90 members. The club offers sailing courses. Further data collection and analysis is required to value this activity at the site.

Table 6 summarizes the value of sea related recreational activities on offer at Ayvalık Adaları Nature Park. These estimates are based on a number of assumptions and are gross estimates, that is costs have not been deducted.

Table 6. Marine related recreational activities' valuation

Activity	Value /year US\$	Comment
Boat Tours	1,265,220	Based on a daily usage of 3,550 people for 45 days during the peak season at an average cost of 15 TL/person per excursion. Gross (expenses not deducted)
Scuba Diving	1,560,000	Based on 30,000 dives and an average 40€ fee per dive, as reported by Gökdeniz <i>et al.</i> (2010).
Birdwatching	No estimate	-
Sailing	No estimate	-
TOTAL	2,825,220	

4.4. Summary of Valuation

The total annual value of the ecosystem services in Ayvalık is estimated to be around US\$ 43 million per year (Table 7).

A significant proportion of this total value (88%) is related to tourism and recreational benefits. Given that the value-transfer method has been used for determining the tourism value of the site, the estimate for the value of tourism of US\$ 36.5 million per year clearly could be refined. Site specific evidence of tourist expenditures is required, along with an understanding of the number of day visitors (who are not included in the estimate provided).

Due mainly to the presence of *Posidonia oceanica* meadows in the study area, the value of the areas provisioning services is also significant. The seagrass communities provide a carbon sequestration benefit worth US\$ 658,000 per year as well as tempering the coastal erosion risks present in the area. The coasts in Ayvalık Nature Park also help assimilate waste a service valued at US\$ 3.5 million annually.

Table 7. Summary of valuation results for Ayvalık Adaları Nature Park

Service	Value/ year US\$	Valuation approach	Comment
Fish	216,546	Market prices	This is not based on a sustainable harvest rate, which is unknown. Only includes fish registered at the Ayvalık fish market. It excludes fish sold directly to restaurants and individual customers and recreational fishing and may also be based on an under-reporting of fish catch. This is a gross value – costs have not been deducted
Salicornia	142,560	Market price	Market price of 6 TL/kg and assumption that all of the fish restaurants in the area demand 900 kg per season. Considered to be an underestimate as excludes salicornia exported outside of the area. This is a gross value – costs have not been deducted
Carbon sequestration	658,022	Market prices (avoided cost approach)	Assumes development of market in blue carbon credits analogous to the forest carbon market. This value is therefore not currently 'captured'. Based on market price of carbon of US\$11.2 / t CO ₂ eq
Erosion protection	339,460	Benefits transfer	Mangos <i>et al.</i> (2010). Based on 160,000 Euro per meter of coastline, 40.8 km of Posidonia beds in Ayvalık Adaları Nature Park and 4% of the area at risk.
Waste treatment	3,575,000	Benefits transfer	Based on Mangos <i>et al.</i> (2010) estimate for Turkey of 229 million Euros apportioned to the study site based on length of its coastline (100 km).
Tourism / Recreation	37,934,220 ¹³	Market prices	Based on a conservative estimate of tourist numbers (about 250,000 overnight visitors per year) and average tourism expenditures (based on other Turkish MCPAs in Bann & Başak 2011a & b) and the annual revenue estimates of the marine recreational activities conducted in the Nature Park
TOTAL	42,856,808		

¹³Based on an estimate of expenditure by overnight visitors of US\$ 35,109,000 plus an expenditure on recreational activities of US\$ 2,825,220.

Opportunities to increase revenue flows from Ayvalık Adaları Nature Park



6

This section draws on the economic analysis undertaken to identify new potential income generating activities that can increase revenue flows to Ayvalık Adaları Nature Park.

A key component of the GDPNA-GEF-UNDP project, under which this economic assessment has been undertaken, is to identify new and innovative financing arrangements for the site. Underpinning the identification of appropriate financing mechanism is a clear scientific understanding of the services being provided by the marine ecosystem, a quantification of this service (in biophysical terms), and an understanding of its economic value and of the beneficiaries. Potential services provided at the Ayvalık Adaları Nature Park include (in addition to fish) carbon sequestration, disturbance regulation, waste assimilation and tourism and recreation benefits.

It should be noted that other components of the GDPNA-GEF-UNDP project are focused on the identification of feasible income generating options for the site and the development of a business plan for Ayvalık Adaları Nature Park. Therefore this section only provides an overview of the opportunities for financing based on the economic analysis and a high level discussion of potential new and innovative financing mechanisms. Many of these mechanisms such as carbon credits for blue carbon and PES type arrangements are only considered to be viable in the long term due to the fact that markets in these services are still developing globally and/ or institutional arrangement in Turkey do not yet permit their use.

A typology of potential financing mechanism is provided in Table 8. This categorizes potential mechanisms into external flows, mechanism for generating funding such as taxes, and market based charges. At present the site is financed through central budget allocations from the Turkish Ministry of Forestry and Water Affairs. In addition, revenue from fishing is important to local communities in the area.

Markets in marine ecosystem services are beginning to emerge around the world. Formal markets now exist to regulate commercial fisheries and potential markets are being proposed for marine biodiversity offsets and carbon sequestration. In addition focused business deals and payments for ecosystem services (PES) are being forged to invest in restoration and conservation of specific marine ecological

Table 8. Typology of potential financing mechanisms

External flows	Generating funding	Market based charges
Domestic government / donor assistance Private voluntary donations Environmental funds & debt for nature swaps	Licensing and royalty fees Fiscal instruments Benefit & revenue sharing Cost sharing Investment, credit & enterprise funds	Tourism charges Resource-use fees Payments for Ecosystem services (PES) Mitigation banking and biodiversity offsets Blue Carbon Markets

Source: Adapted from Emerton et al. 2006

systems and the services that they provide (Forest Trends and the Katoomba Group, 2010). The sections below discuss some of these potential financing options and their applicability to the Ayvalık Adaları Nature Park. The focus is on opportunities for capturing blue carbon, Biodiversity offsets and PES, as innovative approaches that may present in time new and innovative financing for the site.

5.1. Finance mechanisms

5.1.1. Fiscal instruments

Taxes on summerhouse owners may be an option in some areas.

5.2. Market-based charges

5.2.1. Tourism related revenues and charges

Tourism and recreational revenues could be increased at the site through a combination of improved management and better marketing of tourism and recreational activities (discussed further in Section 6) and the identification of new revenue generating opportunities. Possible revenue generating activities include:

- The implementation of small fee for the boats using the private marina in Ayvalık and the much smaller marina in Cunda island in order to meet the management needs and costs of the park.
- Implementation of user fees for scuba diving and excursion boat operators, and boats and yachts using the Ayvalık marina throughout the year.
- Collection of park entrance fees. Access points to the Nature Park were foreseen in the long term development plan. If these entrance points were established fees could be collected for the park. A system would be required to distinguish secondary home owners who use the area from other visitors.

5.2.2. User fees

There is currently no charge for bee-keeping within the MCPA, as a permit can be acquired free of charge. If the GDNCNP could make a protocol with the MoFWA, a user fee could potentially be applied to the bee-keepers.

5.2.3. Marine Carbon Markets

Due to the fact that they store large amounts of carbon and are threaten by conversion and pollution, seagrasses could be a viable target for carbon finance. This would require data on carbon sequestration rates, on site storage, emission profiles and the cost of protection. There are currently no markets for credits generated by 'blue' (marine) carbon activity. A logical venue for considering blue carbon payments would be through the United Nations Framework Convention on Climate Change (UNFCCC) process. Currently, the only blue carbon activity that could potentially be covered under the UNFCCC would be mangrove protection, possibly falling under the auspices of Reduced Emissions from Deforestation and Degradation (REDD+)¹⁴.

Global markets aimed at reducing GHG emissions offer a potentially large economic incentive to avoid the conversion of coastal ecosystems. This idea is analogous to REDD. Incentives to retain rather than emit blue carbon would preserve biodiversity as well as a variety of other ecosystem services at the local and regional scale (Murray *et al.*, 2010).

Participation in a market for blue carbon will involve some costs associated with measuring, monitoring and verifying seagrass loss and carbon stocks, establishing a baseline against which emission reductions are measured, and enforcing contracts and monitoring transactions. There are

¹⁴ Reducing emission from deforestation and forest degradation (REDD) is a payment scheme designed to compensate landowners for the value of carbon stored in their forest that would otherwise be released into the atmosphere. REDD+ additionally recognises efforts for reforestation and sustainable forestry.

no available estimates of these costs and they tend to be 'upfront' and therefore need to be carefully assessed before parties proceed with protection efforts (Murray *et al.*, 2010).

5.2.4. Payments for Ecosystem Services

Payments for Ecosystem Services (PES) are contractual and voluntary transactions where a 'buyer' agrees to pay a 'seller' conditional on delivery of an ecosystem service, or implementation of a land use or management practice likely to secure that service. Following the successful development of terrestrial PES systems, markets for marine ecosystem services are now being explored and could become an important source of new finance for marine protected areas in the future. For example a PES might create a financial incentive to protect, restore, or sustain a marine ecosystem service such as shoreline protection and the provision of fish nurseries. Establishing PES often takes years, requiring detailed studies to define the service being provided (this is crucial for a credible PES), estimate its value and undertake extensive stakeholder engagement to build trust and commitment.

Payments for Ecosystem Services are not operating at present in Turkey. Currently, no state regulations or incentives for PES have been developed.

5.2.5. Biodiversity offsets

Biodiversity markets are a potentially powerful tool for internalising traditionally externalized costs and compensating good practices. For example, if a business has to pay to mitigate its residual impact on marine species, it either has to bear the cost of mitigation or develop elsewhere to avoid this cost. Conversely, if businesses can be financially compensated for protecting or enhancing a rare marine species or habitat there will be an economic incentive to protect habitat.

Payment systems for biodiversity compensation include: biodiversity offsets, mitigation banking, conservation banking, habitat credit trading, fish habitat compensation, BioBanking, complementary remediation, conservation certificates. Some are based on compliance with regulation while others are done voluntarily for ethical, competitive, or pre-compliance reasons. They all aim to reduce biodiversity loss and build the cost of biodiversity impacts into economic decisions through markets or market-like instruments and payments (Marsden *et al.*, 2010).

'Species banking' and biodiversity offsets are mechanisms by which development in one location is exchanged for protection of the same species or community at another comparable habitat. While an offset that attempts to achieve **no net loss** is preferable from an ecological and social standpoint, less comprehensive forms of impact compensation, in which funds are set aside for biodiversity management or valuable biodiversity is protected elsewhere, can be a first step towards better biodiversity footprint management or even eventually a regulated offset system.

Marine biodiversity supports the marine ecosystem services upon which many communities depend. Where regulation for coastal and offshore development is strong, species banking and marine biodiversity offsets could become an important mechanism for marine conservation.

5.3. Possible New Income Generating Activities

A number of opportunities for improving livelihoods related to Ayvalık Adaları Nature Park have been identified. According to Egeplan (2001) the nature park hosts over 60 species of medicinal and/or economic plants that could be managed and sustainably used for income generation purposes. Likewise, the presence of pine nut trees within the MCPA has the potential to generate revenue for local communities through the collection of the nuts and/or for park management. Küçükköy and Çamobağı villagers have made requests to carry out this activity, however, the "Nature Park" conservation status legally prohibits the active usage of the flora in the MCPA (personal communication with Atasay Tanrısever).

Conclusions and Recommendation



6.1. Conclusions

Ayvalık Adaları Nature Park is among the few marine and coastal protected areas in Turkey that is managed under the MoFWA's GDNCNP and hosts both a rich marine and terrestrial biodiversity. Ayvalık's biodiversity supports a range of ecosystems services that contribute to the economic welfare of a range of beneficiaries and support local communities and Turkey's GDP.

The total annual value of Ayvalık Adaları Nature Park is estimated to be around US\$ 43 million per year. This represents an initial valuation of the site, which needs to be refined through further study. This value incorporates provisioning services - fish and salicornia, regulating services - carbon sequestration, erosion protection and waste treatment, and cultural services - tourism and recreation. It is considered to be an underestimate in that conservative estimates have been used for example for tourism and a number of potentially important services are excluded. Ecosystems services thought to be present (or potentially present) at the site which cannot be estimated due to a lack of scientific information and/or data are: raw materials such as natural medicines, genetic resources and ornamental resources, which have yet to be studied at the site; the role the marine environment plays in micro-climate regulation; the role of the marine environment in flood and storm protection; the site's heritage value and educational value; and, the site's landscape and amenity value.

The historical and archaeological features of the town complement the area's natural assets and are reflected by the high tourism value of over US \$36 million (around 88% of the site's value). This highlights the importance of sustainably managing the tourism industry in order to secure this revenue flow. Among the marine based recreational activities in Ayvalık, daily boat tours and scuba diving are the most significant.

High value is also attributed to the regulating services of the site, especially the waste assimilation function provided by the coastal zones in the Nature Park (valued at over US\$ 3.5 million per annum) and the carbon sequestration function of the *Posidonia* seagrass communities within the MCPA. The carbon sequestration value could be refined through site specific studies of the storage and sequestration functions performed by Ayvalık's *Posidonia* meadows. Such studies would be timely

given the current interest in developing a market in Blue Carbon.

The value of fish is estimated at US\$ 216,545 per annum. This may be an underestimate as it does not include the value of recreational fishing and may be based on under reporting of actual catch, however it may better reflect a sustainable fishery resource value. The economic value should be based on a sustainable harvest level, which is not specified for the area. Analysis of fish stocks are therefore needed to assess the sustainability of the fishery.

Despite their economic, cultural and economic importance the quality and quantity of Ayvalık Adaları Nature Park's ecosystem services are threatened by a range of pressures including marine pollution, infrastructure and housing development and illegal fishing activities.

6.2. Recommendations

The key recommendations of this study are provided below. These recommendations highlight priorities in terms of the future economic valuation of the site's ecosystem services as well as priority management issues.

Holistic / integrated management of the site

The Nature Park currently lacks a **management plan** as the previously governing Long Term Development Plan has been suspended; thus no legal framework exists for the management of the site. Neither key management activities such as monitoring nor activities to promote tourism such as the use of trained guides are being implemented, while development pressures continue to pose a serious threat to the future of the site. The long term conservation of the site's marine and terrestrial natural assets is therefore uncertain without a legally endorsed and implemented management plan.

Fishery valuation and management

- The valuation should be based on a sustainable harvest rate (quantity) multiplied by revenues minus costs. Scientific studies of fish stocks are therefore required to determine sustainable harvesting rates.
- Time series data is needed to understand the change in stock overtime and to monitor whether or not the fishery is on a sustainable path or not.

- The area needs to be properly monitored in order to stem current illegal activities which threaten the fishery resource and the sensitive corals in the nature park.

Refining the valuation of the site's regulating services

- Good economic valuation is underpinned by good scientific evidence. This is often particularly important for regulating services. Site specific scientific studies of the provision of these services are required to better understand these services and inform the valuation. This includes the following regulating services – carbon sequestration, erosion control, flood and storm protection and waste assimilation.
- A priority area of research is considered to be studies of the services offered by the site's Posidonia meadows. In particular, site specific studies of the carbon sequestration and storage rates of Ayvalık's Posidonia meadows would position Turkey to potentially benefit from the emerging market in Blue Carbon.
- The site's red coral is a major attraction for scuba divers, however the coral's potential regulatory services have not been explored and warrant further research.

Developing a sustainable tourism industry

Tourism needs to be developed and managed in a way that complements that area's status as a marine protected area as well as the region's historical and architectural heritage. A number of opportunities exist for developing the tourism experience in Ayvalık, and hence contributing to the maximization of the long term revenues from tourism and recreation at the site. These include:

- Development and implementation of a tourism master plan / strategy: A Tourism Master Plan was reportedly prepared for Ayvalık in 2006 but not implemented. Due to the high revenues generated by the tourism sector, it is recommended that the Master Plan is reviewed taking into account the carrying capacity of the area.
- A study of the site's tourism carrying capacity is needed to understand the limits to tourism development in the area especially in terms of marine pollution in the inner Ayvalık Bay.
- Secondary housing developments within the Nature Park should be tightly monitored against environmental and architectural standards and illegal developments should be prevented

through good coordination with the local governing bodies, GDNCNP and others.

- Field guides were trained in Ayvalık Nature Park in 2008 but have not been used. This system could be reintroduced and promoted in order to enhance visitor experiences by providing information on the site's natural, cultural and archaeological assets.
- There is the potential to develop the agri-tourism /ecotourism sector. However, this will require the development of a strategy and marketing of the park's range of attractions and activities. In terms of agri-tourism the area offers: oil/olive production and the related culinary traditions of the area; picnic areas and garden centres. In terms of eco-tourism the following activities could be developed: bird watching, which has great potential in the area pending the development of infrastructure and proper marketing; mountain biking; spa/wellness activities; hiking trails (Ayvalık Nature Park Development Plan has already determined potential hiking trails); scuba diving given the site's red corals; and, yachting.
- Ayvalık and Cunda's cultural heritage has left an architectural signature which is an asset for the protected area. A visitor centre could be created in Cunda Island's abandoned neo-Classical Greek buildings to inform visitors of the Nature Park, the area's cultural heritage and local agri-tourism and ecotourism opportunities. These centres can provide information, display local handicrafts and provide an outlet for locally produced goods such as jams and olive-based products.

- The park also offers vast opportunities for educational tourism based on the sites rich flora and fauna and cultural and historical heritage.
- Better signage and information for visitors and residents on the ecological importance of the area and its protection status is recommended. Everyone visiting the site should be aware that it is a protected area and people working in the tourism sector could play a role in disseminating this information. This could help strengthen the area's image / brand and improve the quality of the tourism offered.
- The tourism sector could be strengthened by developing a well trained work force and introducing mechanisms to more fairly share the benefits from tourism amongst the community.

Time series analysis and Socio-economic studies

- Valuation studies should be carried out in Ayvalık Adaları Nature Park at regular intervals in order to observe changes in the value of benefits derived from the range of ecosystem services and the trade-offs that occur between these. Over time, comparative valuation studies can help choose between different management options that will be optimal for the site's sustainability.
- The site has not been subject to a thorough socio-economic analysis since 2001. A socio-economic study specific to Ayvalık Adaları Nature Park could be undertaken to better inform the development of the area and guide the design of possible mechanisms to promote benefit sharing among local communities.

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ANNEX 1 – STAKEHOLDERS INTERVIEWED DURING THE FIELD VISITS (SEPTEMBER 2010 AND JANUARY 2011)

Interviewees	Name	Title
MoEWA - National Parks	Atasay TANRISEVER	Manager
Cunda SS Fishery Cooperative	Mehmet KIRAĞ	Board Member
Cunda SS Fishery Cooperative	İsmail GÜRAN	Vice Chairman
Obsession Cunda Ahşap	Hakkı Deniz OKER	Entrepreneur
Directorate of Agriculture Ayvalık	Nurullah ÖZDEMİR	Manager
Directorate of Agriculture Ayvalık	Sema ÖZDEMİR	Engineer
Directorate of Tourism Ayvalık	Mustafa TEKİN	Manager
Ayvalık Harbor Head	Hüseyin DEMİR	Head
Ayvalık Chamber of Commerce	Rahmi GENÇER	Head
Entrepreneur	Ahmet SÜNEK	Entrepreneur
ÇöpMadam	Tara HOPKINS	Head
Çağdaş Yaşamı Destekleme Derneği	Ornella SINAV	Member
Pelikan Fishery	Ömer AKMAN	Captain
Veysel KAPTAN Ship	Zeki ÇANAK	Guide
Ege University	Denizcan DURGUN	Master Student
Körfez Diving Center	Mustafa YANA	Employee
SETUR Marina	Serhat MAYA	Manager
Yuva Association	Erdem VARDAR	Member
Coast Guard	Alaaddin ATLI	Soldier
Artur Fishery	Levent YILMAZ	Accounting Manager
Jale Tour	Ali JALE	Entrepreneur
Körfez Real estate	Hüseyin ÇALIŞKAN	Entrepreneur
Körfez Real estate	Nilgün SÜSLÜ	Employee
Free Lance	Fırat AYKAÇ	Architect
Free Lance	Gürcan ÜRGÜPLÜ	Entrepreneur
Ayvalık Environment Platform	Şükrü Kaygısız	Member
Sadan Boat Repair & Construction	Mr. Serdar	Operations

ANNEX 2 – DECISIONS OF THE LONG TERM DEVELOPMENT PLAN FOR AYVALIK ADALARI NATURE PARK DATED 2004 (SOURCE: KESKIN *ET AL.* 2011)

1. The pressure and negative impacts brought about by construction of settlements located within the boundaries of nature park should be supervised, controlled and limited;
2. Daily tourism activities undertaken within the nature park result in negative impacts and therefore tourism activities should adhere to a program;
3. The damage & negative effects of aquaculture operating within the territorial waters of the nature park should be minimized / prevented;¹⁵
4. The asphalt roads within the nature park encourage motor vehicles to drive quickly. Necessary arrangements should be made to minimize the negative effects of motorized vehicles in the park;
5. To prevent soil pollution caused by agricultural activities within the nature park, usage of chemical fertilizers and pesticides should be limited;
6. Summer homes and tourist facilities within the nature park should include the construction of biological treatment plants;
7. Churches, monasteries and historical architectural sites within the boundaries of the nature park suffer from a lack of maintenance therefore necessary steps should be taken to protect these assets;
8. To protect and ensure the sustainability of ecological and biological characteristics of the marine biotas of the nature park necessary protective measures should be taken;
9. Measures should be taken to protect the original natural landscapes of the area;
10. As one of the cultural resources of the natural park, the traditional architectural style of buildings should be preserved and features of these traditional architectural structures should be applied to new buildings constructed within the nature park;
11. Although outside of the boundary of natural park, the main cause of water pollution within the nature park is the road connecting the Gulf of Ayvalık and Cunda Island. This connection road was built by land filling and is causing water circulation problems, which need to be resolved;
12. Industrial enterprises are polluting the Nikita creek and should be prevented from discharging their wastewater directly into the creek;
13. The growing number of boat tours around the islands should be controlled. The necessary steps should be taken to preserve the underwater biota and prevent the pollution of the bay;
14. The carrying capacity of residential area during the summer period is considered to have been exceeded and has caused water shortage: The carrying capacity of the Nature Park needs to be evaluated.
15. To avoid deterioration of the natural environment the introduction of alien species into the area should be prevented.

¹⁵ Aquaculture has since been banned in the Nature Park



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