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Economic Analysis of Datça-Bozburun Special Environmental Protection Area

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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 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
GDP	Gross Domestic Product
MoEU	Ministry of Environment and Urbanisation
MCPA	Marine and Coastal Protected Area
REDD	Reduced Emissions from Deforestation and Degradation
SEPA	Special Environmental Protection Area
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme

Yönetici Özeti

Datça-Bozburun bölgesi 1990 yılında Özel Çevre Koruma Bölgesi (ÖÇKB) ilan edilmiştir. Bölge Reşadiye (Datça Yarımadası) ve Bozburun Yarımadalarını kapsamaktadır. 1.443,89 km² lik yüzölçümü ve 763 km² lik denizel alanıyla Akdeniz havzasındaki en büyük ÖÇKB'dir (Optimar, 2010). Akdeniz'deki en temiz kıyı alanlarına sahip olan Datça-Bozburun ÖÇKB'si sayısız ve benzersiz biyoçeşitliliği yanında arkeolojik varlıklarıyla da Türkiye'deki önemli koruma alanlarından birisidir (Okuş *ve diğ.*, 2007).

Çalışmanın Amacı ve Yaklaşım

Bu çalışmanın amacı Datça-Bozburun ÖÇKB'sinin 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 sürdürebilir 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.

Bu çalışmanın da bir parçasını oluşturduğu TVKGM-GEF-UNDP projesi kapsamında, Datça-Bozburun ÖÇKB'si için alternatif gelir kaynakları seçeneklerinin tespit edilmesi ve bir iş planının geliştirilmesi öngörülmüştür. Raporda alandaki ekosistem hizmetlerinin ve değerlerinin tespit edilmesine odaklanılmış, potansiyel finansal mekanizmalar hakkında sadece genel bir çerçeve çizilmiştir.

Datça-Bozburun ÖÇKB'sinin ekonomik analizi; alan hakkında mevcut veri ve literatür taramasına ve Mart 2012'de kilit paydaşlarla yapılan görüşmelerden elde edilen verilere dayanmaktadır. Ayrıca muhtemel yarar transfer değerlerini temin edebilmek, alan için belirlenen değerleri karşılaştırmak ve değerleme yaklaşımlarına dair farklı anlayışları görebilmek için, bölgedeki deniz ve kıyı alanlarında yürütülmüş ekonomik değerleme çalışmalarına dair bir literatür taraması 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

Çalışmada Datça-Bozburun ÖÇKB'sinin bir yıllık ekonomik değeri yaklaşık 38 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.

Alanda potansiyel olarak varolduğu düşünülen fakat bilimsel bilgi ve/veya veri noksanlığından incelenemeyen ekosistem hizmetleri arasında doğal ilaçlar gibi hammaddeler, genetik kaynaklar ve dekoratif ürünler; denizel ortamın mikro-iklim düzenlemesinde, sel ve fırtınadan korumadaki rolü, alanın eğitim, peyzaj ve miras değerleri gibi henüz üzerinde çalışılmamış hizmetler bulunmaktadır.

Alana dair toplam değerin %50'si düzenleme hizmetlerine aittir. Deniz çayırları yılda 2,5 milyon ABD dolarına karşılık gelen karbon tutma ve yılda 1,6 milyon ABD dolarına karşılık gelen erozyon kontrolü hizmetini karşılamakta; Datça-Bozburun ÖÇKB kıyıları ise yılda 14,8 milyon ABD dolara karşılık gelen atıksu arıtımına katkıda bulunmaktadır. Bu hizmetlerin değerlemesinde alanda finans içerikli yeterli bilimsel araştırma bulunmadığı için yarar transferi tahminlerine dayanmaktadır.

Kültürel hizmetlerden, turizm ve rekreasyon alanın toplam değerinin %47'sini oluşturmaktadır. Bu ekosistem hizmetine dair değerin tespitinde

de yarar transferi yöntemi kullanıldığı göz önüne alındığında, alandaki yıllık turizm değeri 18 milyon ABD$ dır. Alana ait ayrıntılı turizm harcamaları ve ziyaretçi sayılarına (hem geceleyen hem de günü birlik) ihtiyaç duyulmaktadır.

Denizel ekosistem hizmetleri istihdam ve yerel kalkınma açısından da önemlidir. Turizm bölgede ticaret, ulaşım, inşaat ve küçük ölçekli endüstri dahil olmak üzere birçok sektöre katkı koymaktadır. Bozburun'da Eylül – Mayıs ayları arasında 500 kişi gulet üretimi ve tamirinde çalışmaktadır. ÖÇKB'de yaklaşık 270 balıkçı bulunmakta, Bozburun'daki balıkçıların %43'ünün, Datça'dakilerin %35'inin geçimleri sadece bu işe dayanmaktadır.

Öneriler

Çalışma sonucunda, değerleme yöntemlerinin iyileştirilmesine ve denizel ekosistem hizmetlerinin daha etkin ve sürdürebilir yönetilmesiiçin bazı öneriler geliştirilmiştir.

- Atıksu ve katı atık altyapısının sağlanabilmesi için ÖÇKB'deki yerleşimlerin imar planları sürecinin tamamlanması önemlidir. Bu gibi altyapıların eksikliği, ÖÇKB'nin kıyı alanlarında deniz suyu kalitesinin bozulmasına neden olmaktadır. Kıyı Kanununa göre uygulamada kıyıya 100 metredeki kısıtlamalar dikkate alınarak, Kanun öncesinde varolan bina ve yerleşimlerle birlikte, kıyılardaki yapılaşmaların izlenmesi yararlı olacaktır.
- ÖÇKB'deki balık stokları ekonomik, ekolojik ve biyolojik olarak izlenmelidir. Balıkçılık ekonomisini anlamak sürdürülebilir balıkçılık yönetim planlarının geliştirilmesi açısından kilit konumdadır. Sürdürebilir av oranlarının tespit edilebilmesi için alandaki balık stoklarının düzenli bilimsel araştırmalarla incelenmesi gerekmektedir.
- Turizm bölgenin deniz koruma alanı statüsünü bütünleyici bir şekilde gelişmeli ve yönetilmelidir. Datça-Bozburun ÖÇKB'sinde turizm deneyimini geliştirmek ve böylece alanda turizm ve rekreasyon kaynaklı gelirleri uzun vadeli olarak üst seviyeye çıkarmak için birçok fırsat bulunmaktadır. Öneriler şu şekilde sıralanabilir:
  * Alandaki turizm gelişiminin sınırlarının belirlenmesi için *alanın denizel ve karasal turizm taşıma kapasitesi araştırılmalıdır*
  * Alanın taşıma kapasitesini dikkate alan bir *turizm master planı/stratejisi* oluşturulmalıdır.
  * Planlama çalışmalarını desteklemek için *ziyaretçiler hakkında daha kapsamlı veri toplanmalıdır (ziyaretçi sayıları, profili, ziyaret nedenleri, vb).* Mevcut durumda ziyaretçi sayılarına dair güvenilir veriler bulunmamaktadır.
  * Mevcut rekreasyonel faaliyetlerin çeşitlendirilmesi yoluyla turizm sezonu uzatılabilir. ÖÇKB için öngörülen dalış, rüzgar sörfü, yelken, doğa yürüyüşü gibi ekoturizm faaliyetleri ve kırsal turizm seçenekleri geliştirilebilir.
  * Alanın ekolojik ve arkeolojik önemi, koruma statüsü hakkında ziyaretçiler ve ikâmet edenlere yönelik *daha iyi bilgilendirme ve işaretlendirme* yapılmalıdır. Alana gelen yerli ve yabancı tüm turistler , bölgenin bir koruma alanı olduğunun *farkına varmalı bilgi edinmelidir.* Bölgenin görünür yerlerinde bilgilendirme panoları ayrıca türkçe seyir haritaları ve GPS, alanın koruma statüsünü, göstermeli; alanın özellikleri, *alan kullanım* kuralları aktarılmalı, en az iki dilde (Türkçe ve İngilizce) gerekli bilgilendirme ve işaretlendirme yapılmalıdır.
  * Demirleme faaliyetleri denetlenmeli ve demirleme gereksinimlerini karşılamaya yönelik gerekli altyapının kurulması için çalışmaların başlatılması, bölgenin korunmasına katkı sağlayacaktır.
  * Oteller ve deniz araçları kaynaklı sıvı ve katı atık kirliliğini en aza indirecek tedbirleri alınması sağlanmalıdır. Marinalar, çekek yerleri ve tersanelerden gelen yağ, boya, petrol gibi deniz kirleticileri önlenmelidir.
- Alana özel düzenleme hizmelerine odaklı bilimsel çalışmalar, bu hizmetleri daha iyi anlamak ve değerlemeye ışık tutması açısından önemlidir. Öncelikli araştırma alanı olarak Datça-Bozburun ÖÇKB'sindeki *Posidonia oceanica* çayırlarının sağladığı karbon tutma ve depoloma oranları incelenmelidir. Bu Türkiye'yi yeni gelişen Mavi Karbon piyasasında avantajlı bir konuma taşıyabilir. Bölgede sağlıklı *Posidonia oceanica* çayırlarının bulunması alanın temel özelliklerinden birisidir ve daha iyi anlaşılması, korunması ve izlenmesi bölge için önemlidir.
- Ekosistem kaynaklı faydaların değerindeki değişimi ve bunlar arasındaki dengeleri gözlemlemek amacıyla Datça-Bozburun ÖÇKB'sinde değerleme çalışmaları düzenli aralıklarla yürütülmelidir. Gelecekteki değerleme çalışmaları senaryo analizleri içermeli ve böylece farklı yönetim seçeneklerine ışık tutmalıdır.

Tablo . Datça-Bozburun ÖÇKB'si değerleme sonuçları özeti

Hizmet	Değer/ yıl ABD$	Değerleme yöntemi	Not
Balık	975.000	Piyasa değerleri	Bu değer sürdürebilir av oranına göre hesaplanmamıştır (alan için bilinmiyor). Brüt değerlerdir – masraflar düşülmemiştir.
Karbon tutma	2.510.234	Piyasa değerleri (kaçınılan harcama yaklaşımı)	Orman karbon piyasasına benzer şekilde Mavi Karbon Kredi piyasasının gelişeceği varsayılmıştır. Dolayısıyla bu değer henüz "yakalanmamaktadır'. Karbon piyasa değeri 11,2 $/ t CO_2 eşdeğeri olarak alınmıştır.
Erozyon kontrolü	1.696.500	Yarar transferi	Mangos *ve diğ.* (2010). Her kıyı metresi için 160.000 avro, Datça-Bozburun ÖÇKB'sindeki 272 km lik Posidonia çayırlarına ve alanın %3'nün risk altında olduğuna dayanarak.
Atıksu arıtımı	14.950.000	Yarar transferi	Mangos *ve diğ.*'na (2010) dayanarak, Türkiye kıyıları için hesaplanan 229 milyon €'luk arıtım hizmeti Datça-Bozburun ÖÇKB'sindeki kıyısal alana (417 km) taksim edilmiştir.
Turizm / Rekreasyon	18.044.000	Piyasa değerleri	Bölgeye gelen ziyaretçi sayılarına dair tahmini yılda 300.000 geceleyen ziyaretçi ve ortalama turizm harcamalarına (Bann ve Başak 2011a ve 2011b'ye göre diğer ÖÇKB'lerde yürütülen çalışmalar) dayanarak günübirlik ziyaretçiler dahil edilmemiştir. Günübirlik tekne turlarını (655.200 ABD$) ve kurum tarafından kiralanan günübirlik alanların kiralarını (100.000 ABD$) içermektedir. Sadece Datça'daki belediye limanı gelirleri (104.000 ABD$) dahil edilmiştir. Martı Marina veya Bozburun Belediye Limanı hesaplamada yoktur; bu marinaların ekonomide istihdam ve yan endüstriler gibi kollarda yarattığı ek değerleri yansıtmamaktadır. Brüt değerlerdir – masraflar düşülmemiştir.
TOPLAM	38.175.788		

Executive summary

Datça-Bozburun was declared a Special Environmental Protection Area (SEPA) in 1990. It consists of two peninsulas Reşadiye (Datça Peninsula) and Bozburun Peninsula and is the largest SEPA of the Mediterranean basin covering an area of 1,443.89 km² with a total marine area of 763 km² (Optimar 2010). Datça-Bozburun SEPA is considered to be one of the cleanest areas of the Mediterranean and in addition to its rich biodiversity its archaeological richness makes it one of the most important conservation areas within the borders of Turkey (Okuş *et al.*, 2007).

Objectives of study & approach

The objective of this study was to undertake an economic analysis of Datça-Bozburun SEPA 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
- 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 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 Datça-Bozburun SEPA. 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 Datça-Bozburun SEPA is based on a review of the available data and literature on the site, interviews with key stakeholders and data gathered through a site visit in March 2012. 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

This study estimates the economic value of Datça-Bozburun SEPA at around US$38 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, 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, educational and landscape and amenity value.

Of this total value 50% is related to regulating services. The seagrass communities provide a carbon sequestration benefit worth US$ 2,510,234 per year and an erosion protection service valued at US$ 1.6 million a year, while the coasts in Datça-Bozburun SEPA help assimilate waste a service valued at US$14.8 million annually. However, valuation of these services is based on value transfer estimates as scientific studies on the provision of these services at the site are unavailable.

The cultural services of tourism and recreation account for around 47% of the total value. 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$18 million per year clearly could be refined. Site specific evidence of tourist expenditures is required, along with a better understanding of the number of visitors (both overnight and day visitors).

Marine ecosystems are also important in terms of employment and local livelihoods. Tourism contributes to a number of sectors in the region including trade, transportation, construction and small scale industry. Between September and May around 500 people are employed in boat maintenance and construction in Bozburun. There are an estimated 270 fishermen in the SEPA. For 43% of Bozburun fishermen and 35% of Datça fishermen, fishing is their sole source of income.

Recommendations

The study has identified a range of recommendations aimed at the refinement of the valuation estimates and sustainable management of the SEPA's ecosystem services.

- The SEPA urgently needs its urban plans approved by GDPNA in order that the appropriate sewage and solid waste infrastructure can be provided for existing buildings. The lack of such infrastructure poses an increasing risk to the SEPA's marine environmental quality. This requires a solution to the Coastal Law's restrictions within 100 meters of the coast as *applied to buildings and communities pre-dating the law*.
- Fisheries in the SEPA need to be monitored economically, ecologically and biologically. Understanding the economics of fishing is key to the development of sustainable fisheries management plans. Scientific studies of fish stocks are required to determine sustainable harvesting rates and 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.
- Tourism needs to be developed and managed in a way that complements that area's status as a marine protected area. A number of opportunities exist for developing the tourism experience in Datça-Bozburun SEPA, and hence contributing to the maximization of the long term revenues from tourism and recreation at the site. Recommendations include:
  * A study of the site's marine and terrestrial tourism *carrying capacity* to understand the limits to tourism development in the area.
  * A *tourism master plan / strategy* for the SEPA taking the carrying capacity of the area into account.
  * Better *data collection on visitors* to assist planning efforts (visitor numbers, profile, motivation for visit). Currently reliable estimates of visitor numbers do not exist.
  * Extending the tourism season through the *diversification* of the currently available activities. Ecotourism activities such as scuba diving, wind surfing, sailing, nature trekking activities and agro-tourism options that have already been envisioned for the SEPA could be further developed.
  * *Better signage and information* for visitors and residents on the ecological and archeological importance of the area and its protection status. Everyone visiting the site should be aware that it is a protected area. Nautical maps and GPS should indicate the status of the area and set out the rules of conduct.
  * Anchoring activities should be regulated and studies initiated to establish the infrastructure needed to meet anchoring requirements.
  * Hotels and marine vessels should take measures to minimize the solid waste pollution. Discharge of oils, paints, fuel oil and other wastes to the sea from marinas slipways and shipyards should be prevented.
- Site specific scientific studies of the provision of regulating services are required to better understand these services and inform their valuation. A priority area of research is site specific studies of the carbon sequestration and storage rates of Datça-Bozburun SEPA's Posidonia meadows. This would position Turkey to potentially benefit from the emerging market in Blue Carbon. The relatively healthy presence of Posidonia meadows in the area is a key feature of the SEPA and represents a significant asset for the area which needs to be better understood, protected and monitored.
- Valuation studies should be carried out in Datça-Bozburun SEPA at regular intervals in order to observe changes in the value of ecosystem benefits and the trade-offs that occur between these. Future valuation studies should undertake scenarios analysis and thereby help choose between different management options.

Table . Summary of valuation results for Datça-Bozburun SEPA

Service	*Value/ year US$*	*Valuation approach*	*Comment*
Fish	*975,000*	*Market prices*	*This is not based on a sustainable harvest rate, which is unknown. This is a gross value – costs have not been deducted.*
Carbon sequestration	*2,510,234*	*Market prices (avoided cost approach)*	*Assumes development of market in blue carbon credits analogous to the forest carbon market. This value is therefore not currently 'captured'. Based on market price of carbon of US$ 11.2 / tCO_2eq and 4,120 ha of Posidonia meadows.*
Erosion protection	*1,696,500*	*Benefits transfer*	*Mangos et al (2010). Based on 160,000 Euro per meter of coastline, 272 km of Posidonia beds and 3% of the area at risk.*
Waste treatment	*14,950,000*	*Benefits transfer*	*Based on Mangos et al (2010) estimate for Turkey of 229 million Euros apportioned to the study site based on length of its coastline (417 km).*
Tourism / Recreation	*18,044,000*	*Market prices*	*Based on a conservative estimate of tourist numbers (about 300,000 overnight visitors per year) and average tourism expenditures (based on other Turkish MCPAs in Bann & Başak 2011a and Bann & Başak 2011b). Day visitors not included. Includes daily boat tours (US$655,200) and rental fees (US$100,000). Includes municipal harbour in Datca only (US$104,000). Reflects gross value, costs have not been deducted. Does not include Martı Marina or Municipal harbor in Bozburun, or account for economic impact of marinas on the economy in terms of employment generation and support to secondary industries.*
TOTAL	*38,175,788*		

Introduction

This study is an activity under the General Directorate for Protection of Natural Assets (GDPNA) & Global Environment Facility - United Nations Development Programme (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 Datça-Bozburun Special Environmental Protection Area (SEPA) 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;
- 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 Datça-Bozburun SEPA. 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 Datça-Bozburun SEPA is based on a review of the available data and literature on the site, and interviews with key stakeholders and data gathered during a site visit 21-23 March 2012. 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 refinement of the economic estimates presented.

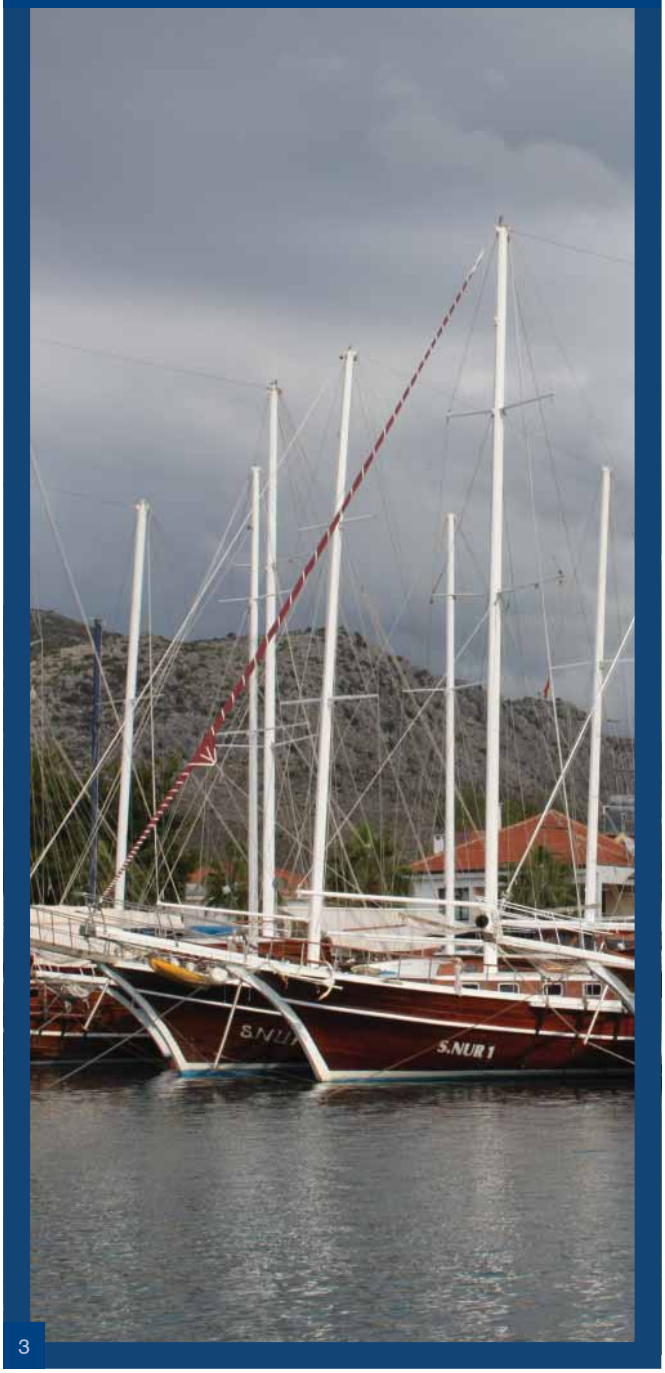
A series of technical and scientific studies have been commissioned by GDPNA on the biological and socio-economic aspects of the Datça-Bozburun SEPA and have been used in this economic analysis. In 2001, Hacettepe University Biology Department conducted research on the biological wealth of the protected area (mainly focusing on terrestrial biodiversity) with the intent of determining sensitive ecological zones and developing appropriate management strategies for the site (Yerli, 2001). In 2004, the Institute of Marine Sciences and Management, Oceanos, of İstanbul University carried out a marine and coastal biodiversity assessment of Datça-Bozburun Peninsula (Oceanos, 2004). This assessment covered the marine environment between the coast and 75 m depth and involved 831 scuba and 382 skin dives over 148 days in order to determine the species present in the protected area. Furthermore, in 2010, Optimar Consultancy undertook a study on the socio-economic, historical and cultural values of the SEPA (Optimar, 2010). The objectives of this study were to: determine the demographic, economic and social statistics of the SEPA; understand the interactions between economic sectors; and, prepare an inventory of rural settlements and architectural in the area to inform a management plan for Datça-Bozburun SEPA. This study conducted 240 household surveys using Participatory Rapid Appraisal methods and focus groups.

An Ecosystem Service Valuation Framework was developed for this economic 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.

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 March 2012.

Background on site



Datça-Bozburun was declared a SEPA in 1990 by a Turkish Cabinet Decree. It consists of two peninsulas Reşadiye (Datça Peninsula) and Bozburun Peninsula and is the largest SEPA of the Mediterranean basin covering an area of 1,443.89 km² with a total marine area of 763 km² (Optimar, 2010). The Datça (Reşadiye) Peninsula is located in the Southwest of Muğla province between the Gökova Gulf in the north and the Hisarönü Gulf in the south. It extends 70 km in an East-to-West direction into the Aegean and Mediterranean seas. The Bozburun Peninsula lies to the south of the Datça Peninsula and extends towards Rhodes Island in the south (Okuş *et al.*, 2007).

Administratively Datça-Bozburun SEPA consists of Datça district center, nine villages tied to Datça, Bozburun town, five villages tied to Bozburun and three villages tied to Marmaris district.

The Datça-Bozburun Peninsulas are protected on account of their archaeological, urban, natural and historical aspects that reflect various civilizations dating from 2000 BC up to the Ottoman period. The area has a Mediterranean climate with a mean annual temperature of 19°C and a mean annual rainfall of 730 mm (Taşlıgil, 2008).

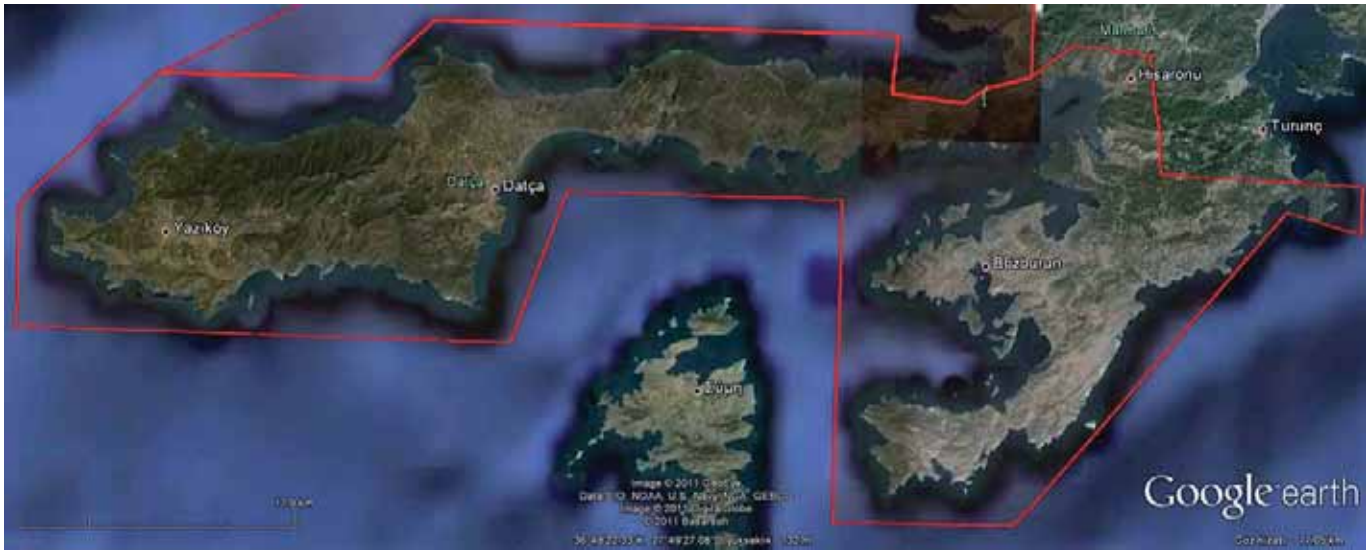
The following bays are found on the Datça Peninsula facing the Aegean Sea - Gökçeler Bükü, Küçük Çatı, Çatı, Kızılağaç, Alavara, Çakal, Damlacık, Mersincik, Murdala and İskandil. While on the Mediterranean side there are the followng bays - Palamut Bükü, Akvaryum, Akça Bük, Kuru Bük, Ova Bükü, Hayıt Bükü, Kızıl Bük, Domuz Bükü, Kargı, Karaincir, Sarı Liman, Kara Bük, Çiftlik, Kuruca Bük, Günlücek and Lindos are the main bays. On the tip of the peninsula the ancient city of Knidos is located (Datça Governorship, 2012a).

The Bozburun Peninsula, located less than 50 km from Marmaris district center, consists of Hisarönü, Orhaniye, Turgut, Selimiye, Bayır, Söğüt, Kızılger and Taşlıca villages. The tip of the peninsula hosts important Blue Cruise stop-over harbours such as Serçe Bay and Bozukkale (antique Loryma). In total, ten antique settlements are known to exist in Bozburun Peninsula which is characterised by zigzagging bays (MARTAB, 2011).

2.1. Ecological Overview

In general Datça-Bozburun SEPA consists of steep slopes and stony land which is in bad condition and at risk from erosion. Approximately 95% of the 47,698 hectares of land is stony, and only 10,000 is

Figure 1. The Peninsulas of Reşadiye and Bozburun makes up the Datça-Bozburun SEPA (Source: EPASA)



suitable for agriculture. The total forest area in the region is 110,359 hectares.

The biodiversity study conducted by Hacettepe University highlights the SEPA's rich biological wealth represented by 167 terrestrial invertebrates, 110 species of fish, 4 amphibian, 27 reptile, 123 bird, 45 mammal and 1,047 plant species (Yerli, 2001). Among these plants, 57 are endemic to the SEPA with 6 species listed as endangered and 30 others as vulnerable (ibid).

Some of the most important ecosystems and related species of the SEPA are described below.

Sand Dunes: The Gebekum sand dune area, located in the southern part of Datça Peninsula, is important for its flora and includes the following dominant species - *Maedicago marina*, *Eryngium maritmum*, *Euphorbia paralias*, *Pancratium maritmum* and *Alkanna tinctoria.* The sand dune areas in Kızılbağ, Eksera, Hisarönü Çubucak, İnbükü, Karabük Headland, Periliköşk, Hayıtbükü, Mesudiye, Hisarönü Kocakür and Söğüt areas possess similar characteristics and are of similar quality.

Forests: Forest vegetation consists of areas where red pine (*Pinus buritia*) is dominant, including undisturbed areas of high ecological quality and value. *Arbutus andrachne* (Sandal tree) in the Northwest also comprise undisturbed areas. In Değirmen Bükü, *Cupressus sempervirens* (cypress) are common over the rocky valley steeps, with forest patches found in Sındı Village and Bozburun Peninsula and between İçmeler and Bakırköy.

Datça Date Palm (*Phoenix theophrasti*) grows on valley floors and is found in the steeps of Eksera Stream in the North and around Azganak Hill, Karacahapibaşı, Yarımcabaşı Hill, Kovalıca Hill, Tanışman Hill, Lindasbaşı Hill, and Andızcıl Hill in the southern coastal area. Sweetgum trees *(Liquidambar orientalis*), which is endemic in the region, is seen in seasonal stream beds and in the valley interiors.

Examples of rare species associated with Datça-Bozburun SEPA ecosystems are: sand dune plant species such as *Maedicago marina, Eryngium maritmum, Euphorbia paralias*; plant species such as cypress (*Cupressus sempervirens*), red pine (*Pinus buritia*) and sandal tree (*Arbutus andrachne*), Datça date palm (*Phoenix theophrasti*) and sweetgum tree (*Liquidambar orientalis*).

Studies have identified 123 avifauna species belonging to 38 families in the SEPA. This bird diversity is considered to be an important biodiversity indicator (Yerli, 2001). The main reasons for the rich avifauna are the SEPA's location on the migration route of birds (e.g. the *Hirunda rustica* (barn swallow), *H.daurica* (redrumped swallow), *Merops apiaster* (The European bee-eater), *Apus apus* (Common Swift) and *Apus melba* (Alpine Swift)), the favorable climatic conditions and the habitat diversity that characterizes the protected area (untouched coastal zones, rocky areas, forests, sand dunes, plains, rivers, agricultural lands etc).

Twenty two species of raptors and 63 passerines have been recorded in the Datça-Bozburun SEPA

which indicates a healthy food chain and ecosystems (Yerli, 2001). Rare bird species include, black falcon (*Falco elenoroae*), blue falcon (*F. pereginus*), small kestrel (*F. naumanni*), Bonelli's Eagle (*Hieraetus fasciatus*), island gull (*Larus audoinii*) and Common Shag (*Phalacrocorax aristotelis desmarestii).*

Rare mammal species include *Monachus monachus* (Mediterranean monk seal) found around Datça Peninsula, *Capra aegagrus* (wild goat) in Kocadağ and *Lutra lutra* (Otter).

Marine biological diversity studies, supported by physical and chemical findings, have shown that the Datça-Bozburun SEPA is one of the cleanest areas of the Mediterranean, and in addition to its rich biodiversity, its archaeological richness makes it one of the most important conservation areas within the borders of Turkey (Okuş *et al.*, 2007).

A marine biodiversity assessment was conducted at Datça-Bozburun SEPA from 2002 to 2004, by the Institute of Marine Sciences and Management of Istanbul University, in order to determine marine biodiversity, the distribution and condition of endangered or protected species and to make suggestions on management of coastal areas. This study revealed 536 species of fauna and flora. Some problems were observed in areas around settlements. Despite the wide coverage of *Posidonia oceanica* beds in the region, the distribution of *Caulerpa* species point out the severity of the invasion problem.

A total of 807 marine species belonging to 19 groups were found. The most diverse phylums are Mollusca with 187 species, fishes with 184 species, and algae with 139 species. *Pinna nobilis*, which is under conservation, was the most frequent species in the phylum of Mollusca (57.8%). The most frequent species observed among fish are *Chromis chromis* (priest fish), *Coris julis* (sunfish), *Serranus scriba* (painted comber) and *Diplodus vulgaris* (two-banded seabream). In terms of algae *Padina pavonica is the most* frequent (58%), followed by *Codium bursa (*51.4%)[1].

[1] In the Polychaeta class with 26 observed species, *Hermodice carunculata* is the most frequent species with a frequency of 70.9%. The sea urchin *Arbacia lixula* is the most frequently observed echinoderm (59%), represented by 42 species. 22 species have been observed in Tunicata class and the most frequent species are *Halocynthia papillosa* (42.3%) and *Microcosmus sabatieri* (33.5%). The phylum Magnoliophyta is represented by 4 species (*Posidonia oceanica*, *Cymodosea nodosa*, *Zostera marina* and *Halophila stipulacea*), with *Posidonia oceanica being the most* frequent (78.9%). 38 species of Porifera (sponges) were identified; the most frequent being *Ircinia muscarum* with a frequency of 76.7%. Among the 48 species of Cnidaria, *Cerianthus membranacea* is the most frequent species with a frequency of 37%.

Caretta caretta (loggerhead sea turtle) *and Delphinus delphis* (common dolphin) both under conservation were observed. Fishermen reports state that the Mediterranean monk seal (*Monachus monachus)* inhabit the region and is seen frequently in some areas. These species are faced with extinction in the Mediterranean, and were declared of conservation concern by the Bern and Barcelona conventions, to which Turkey is a signatory, and by national regulations such as the "Fisheries Law/Circular no 1380" and the "Coastal Law".

Okuş *et al.* (2007) concluded that Datça-Bozburun SEPA contains a total of 35 marine species of conservation concern such as *Posidonia oceanica*, *Cymodocea nodosa*, *Mesophyllum lichenoides, Cystoseira amentacea*, *Scyllarides latus*, *Palinurus elephas*, *Epinephelus marginatus*, *Charonia tritonis variegata*, *Lithophaga lithophaga*, *Pinna nobilis*, *Tonna galea*, *Centrostephanus longispinus*, *Paracentrotus lividus*, *Sciaena umbra*, *Umbrina cirrosa* and *Caretta caretta*.

Demir and Okuş (2004) also studied the sponges of the SEPA as part of the Oceanos research study. The samples were collected from all areas at a depth of 0 to 55 metres by scuba and freestyle diving. As a result, 20 species, belonging to 17 families were found from the Datça-Bozburun SEPA, including a new recorded taxon for Turkish sponge fauna (*Ciocalypta carballoi*).

2.2. Pressures

Marine environmental quality is relatively good within the SEPA and it is not under intense pressure due to the fact that the region is not densely populated or facing high tourism pressures (Yerli, 2001). The environment is largely preserved apart from the rural and urban settlements in Datça and Bozburun, agricultural areas and the present transportation network. This is partly due to the fact that until recently the Datça-Bozburun highway was a winding road of insufficient width (Keskin *et al.*, 2011).

The main problems facing the SEPA are - yacht tourism and anchoring, alien species, over fishing, recreational use of the coasts, coastal fillings and rubble dumping (Okuş *et al.*, 2007). These pressures could intensify overtime if not properly managed. The main pressures facing the site are summarised in Table 1, along with an identification of the sectors responsible.

Table 1. Overview of Pressures in Datça-Bozburun SEPA

Pressure	Description	Policy Driver / Context	Sector Responsible
Overuse of some of the bays within the SEPA	Bozburun Peninsula and in particular Bozburun bay receives boats and yachts that spill over from Fethiye-Göcek SEPA during the high season. That is boat restrictions in other SEPA's result in over-crowding in the bays of Datça-Bozburun SEPA, which have no such restrictions in place.	- No formal marine carrying capacity studies have been conducted for the SEPA's bays and beaches.	Marine tourism
Marine pollution	The majority of the settlements on the Bozburun Peninsula do not have sewage infrastructure. In areas where marine tourism is intense such as Selimiye bay, Bozukkale and Serçe Bays, there are indications of marine pollution. There are no bilge water collection units in Hisarönü Bay and currently MoEU's Blue Card system for the managment of bilge water is not functioning effectively. The SEPA is at further risk from marine pollution originating in neighboring Bodrum peninsula & Marmaris.	- Sewage system infrastructure in Bozburun awaits the approval of the city building plan which ironically is challenged of the Coastal Law. Under this law any buildings within 100 meters of the coast are illegal, restricting the construction of infrastructure to support existing establishments and communities. - MoEU's Blue Card system is operational in Fethiye-Göcek SEPA but remains inadequate in other MCPAs.	Marine tourism, housing and tourism developments
Alien species	The area is increasingly threatened with an invasion of the marine plant Caulerpa racemosa. In regions where Posidonia oceanica meadows are damaged, the advantage is shifted to C. racemosa. Similarly, the puffer fish (Lagocephalus sceleratus) is an invasive species present in the SEPA that damages fishing gear.	- Commercial marine transportation linking the Red Sea to the Mediterranean results in the introduction of alien species through the ballast waters. This is often very difficult to control.	Commercial maritime activities
Uncontrolled anchoring	Damage to the sea bottom is mainly caused by uncontrolled anchoring. This occurs particularly in bays with settlements such as Datça, Selimiye, Orhaniye, and Bozburun, and tourism areas such as Serçe, Bozukkale and Körmen harbour. Unhealthy seagrass meadows have been observed.	- Buoy systems have not been set up within the SEPA by the relevant state authorities.	Marine tourism
Illegal selective fishing	While traditional fishing practices do not seem to put pressure on the area illegal selective fishing of species such as groupers, swordfish and crayfish is an increasing problem. These legally protected species are subject to illegal catch typically by spearguns. Illegal trawlers have been spotted in Bozburun Bay, Datça and elsewhere and fish populations are decreasing in the region.	- Lack of enforcement of the present laws and regulations - Lack of control mechanisms (Coast Guard posts remain too far away and are inadequate in number)	Recreational and commercial fishing
Illegal buildings and construction	In Bozburun, 90% of the buildings are reportedly illegal based on Turkish Coastal Law. The city plan, which remain unapproved, is restricted by the Turkish Coastal Law, which limits any construction/ development activity within 100m of the shore line. However, even public buildings in the town fall within this 100m zone. Other settlements in the SEPA such as Palamutbükü, Mesudiye, Yaka, Hisarönü, Selimiye villages among others also lack an urban plan. Datça center is prone to fast and uncontrolled urbanisation with few standards.	- Overlapping and inconsistent legislation - Changes within the MoEU in 2011 postponed the approval and implementation of the SEPA's town plans. - Poor monitoting and control of building codes & corruption	Housing and tourism

Source:Yerli, 2001; Oceanos, 2004; Optimar, 2010; Ünal 2011;and field interviews

2.3. Socio-economic characteristics of site

According to the population census in 2009, the relevant districts and villages that fall within the Datça-Bozburun SEPA have a total population of 26,324 people of which 49% are women and 51% are men (Optimar, 2010).

The economy of the peninsula is based on the service sector. Tourism contributes to a number of sectors in the region including trade, transportation, construction and small scale industry. Trade mainly focuses on merchandise such as daily consumption products, construction materials, furniture or catering and souvenirs that serve the tourism sector.

The socio-economic structure of Datça-Bozburun SEPA including information about population, household numbers, infrastructure and income sources are provided in Table 2.

Datça-Bozburun Peninsulas have limited agriculture potential due to their physical and natural characteristics and poor water availability. Agriculture land covers 10,000 ha (8,500 ha in Datça and 1,500 ha in Bozburun Peninsula) and is dominated by almond and olive groves. About 1,343 ha of almond groves exist, covering 49% of the overall agricultural land (268,720 trees), while olive groves cover 30% of the land (166,540 trees) (Datça Directorate of Agriculture, 2008). Animal husbandry is practiced in the forested zones, with 1,250 cattle and 2,000 sheep and goats (Datça Directorate of Agriculture, 2008).

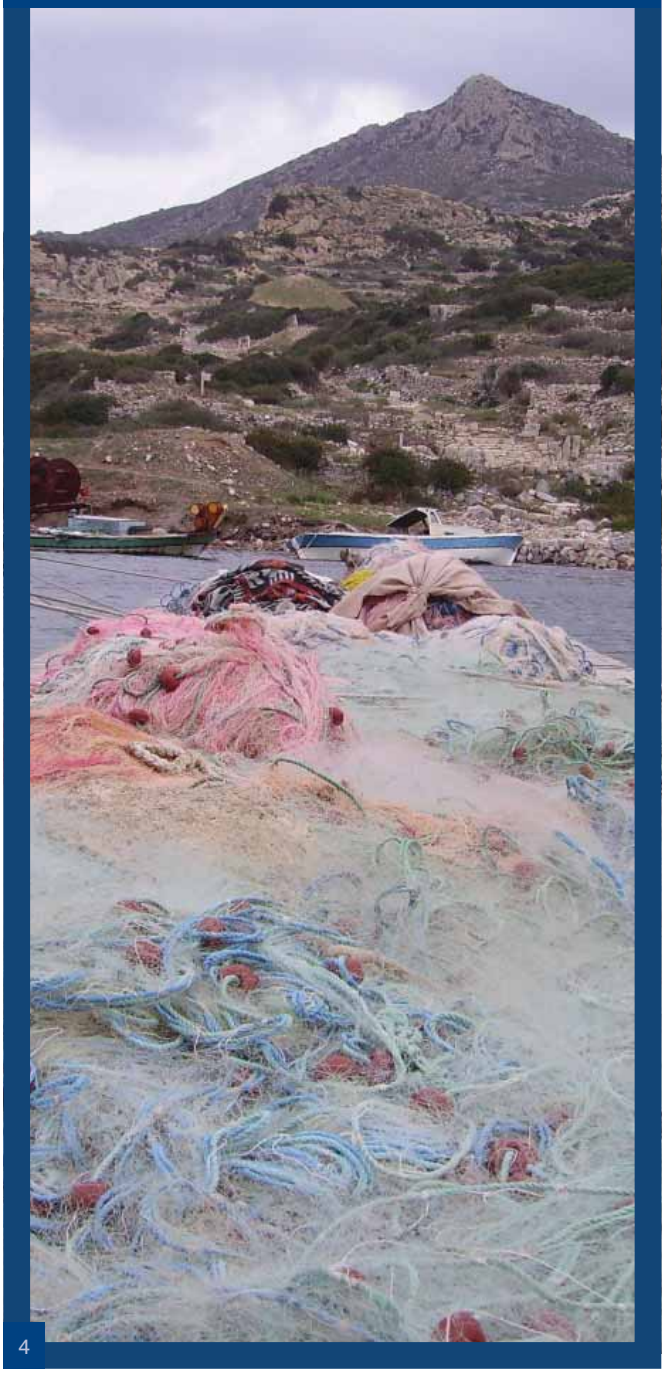
There are 3 agricultural development cooperatives and 3 fisheries cooperatives in Datça. Almond is a key source of livelihood for the region, especially income obtained from crude almond sales. In 2006, 5,850,000 TL was raised from almonds, and 4,160,000 TL from olive oil. This was followed by tomato production (3,750,000 TL) and honey (2,000,000 TL) (Datça Directorate of Agriculture, 2008). Beekeeping and the collection of NTFPs such as laurel, thyme carob etc. are also important income generating activities in the region (Keskin *et al.*, 2011).

Datça-Bozburun SEPA hosts mastic trees (*Pistacia lentiscus*). Mastic resin is a key ingredient in Turkish ice cream and puddings, is used in the production of cosmetics such as toothpaste, lotions for the hair and skin, and perfumes and has medicinal properties. However, these trees are not utilised for any of these purposes at present (Keskin *et al.*, 2011).

Table 2. Socio-economic structure of Datça-Bozburun SEPA (source: Optimar 2010)

Place		2009 Population	Hh	Infrastructure	Income Sources
Villages tied to Datça	Datça Center	9,958	3,100	Drinking water and sewage systems, but these are insufficient. Waste water treatment	Tourism, Yachting, Agriculture (almond-olive-vegetable), fisheries, bee-keeping
	Cumalı	719	320	No sewer system. Septic system present. Drinking water network. No water purification	Agriculture (Olive-Almond), Bazaar sales
	Emecik	866	300	No sewer system. Septic system present. Drinking water network. No water purification	Agriculture (almond-olive-vegetable), Tourism, Animal Husbandry
	Hızırşah	482	250	No sewer system. Septic system present. Drinking water network. Water treatment system is not active	Apiculture, Agriculture (almond-olive), Natural Plant, Tourism, Animal Husbandry
	Karaköy	786	286	No sewer system. Septic system present. Drinking water network. No water purification	Agriculture (almond-olive-vegetable), Fisheries, Beekeeping, Natural Plant
	Kızlan	1,039	400	No sewer system. Septic system present. Drinking water network. No water purification	Agriculture (Olive-Almond), Bazaar sales
	Mesudiye	564	220	No sewer system. Septic system present. Drinking water network. No water purification	Apiculture, Greenhouse, Tourism
	Sındı	365	140	No sewer system. Septic system present. Drinking water network. No water purification	Apiculture, Agriculture (almond-olive), Tourism Services Sector
	Yaka	577	250	No sewer system. Septic system present. Drinking water network. No water purification	Agriculture (almond-olive), Beekeeping, Tourism, Animal Husbandry, Fisheries
	Yazı	545	250	No sewer system. Septic system present. Drinking water network. No water purification	Almond, Olive and Olive Oil Production, Fishing
Villages tied to Bozburun	Bozburun center	2,121	850	Drinking water network, No sewerage network, septic system present. Waste Water Treatment does not exist.	Yacht - Boat manufacture, tourism, agriculture (Almond - Olive) Bee-keeping
	Bayır	716	230	No sewer system. Septic system present. Drinking water network. No water purification	Apiculture, Greenhouse, Tourism
	Selimiye	1,026	510	No sewer system. Septic system present. Drinking water network. No water purification	Apiculture, Tourism
	Söğüt	1.750	1.000	No sewer system. Septic system present. Drinking water network. No water purification	Fishing, tours, tourism, bee-keeping
	Taşlıca	526	170	No sewer system. Septic system present. Drinking water network. No water purification	Fisheries, Livestock, Beekeeping
	Turgut	627	185	No sewer system. Septic system present. Drinking water network. No water purification	Beekeeping, Tourism, Tours
Vilages tied to Marmaris	Hisarönü	2,129	1,700	No sewer system. Septic system present. Drinking water network. No water purification	Beekeeping, Tourism, Fisheries
	Orhaniye	1,058	400	No sewer system. Septic system present. Drinking water network. No water purification	Beekeeping, Tourism
	Osmaniye	470	158	No sewer system. Septic system present. Drinking water network. No water purification	Beekeeping, Tourism

Qualitative Assessment of Ecosystem Services



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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

Table 3. Qualitative assessment of marine ecosystem services and benefits at Datça-Bozburun SEPA

ES Type	Service	Benefit / outcome	Significance	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	
	Ornamental resources	Ornamental resources	-	Industry	
	Source of energy (fuel etc)	Energy provision e.g., hydropower & windpower	*	Energy, Industry	
	Transport	Commercial use of waterways	**	Industry	
Regulating Services	Regulation of GHGs	Carbon sequestration	**	Potentially all	Potentially all
	Micro-climate stabilization	Air quality	*	Potentially all	
	Water regulation (storage and retention)	Flood and storm protection	*	Tourism, Industry, Households/ Urban Settlement, agriculture	
	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). Use of marine environment in books, film, painting, folklore, national symbols, architecture, advertising	**	Tourism, Households	
	Educational	A 'natural field laboratory' for understanding marine and coastal processes	*	Households	Potentially all
	Recreation and ecotourism	Recreational fishing, birdwatching, hiking, canoeing, Holiday destination (aesthetic views, hot springs), archaeological ruins (historical not recreational value)	**	Tourism	Potentially all
	Landscape and amenity	Property price premiums due to views	**	Tourism	Potentially all
	Biodiversity non-use	Enhanced wellbeing associated for example with bequest or altruistic motivations	**	Potentially all	Potentially all

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

associated with the services they support. Supporting services include soil formation and retention, primary production and habitat provision[2].

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 3 provides a typology of marine ecosystem services and a qualitative assessment of the marine ecosystem services provided at Datça-Bozburun SEPA. Each ecosystem services has 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 3 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 3 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 Datça-Bozburun SEPA 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.

[2] 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 main marine food product provided by Datça-Bozburun SEPA is fish.

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 CO_2 emissions and has two interconnected CO_2 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 CO_2 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 CO_2 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).

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/m^2 and an average net production of about 400 g C/m^2 yr, ranking amongst the most productive ecosystems in the biosphere (The Encyclopaedia 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 CO_2 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 such as peats, coral reefs and mangroves besides seagrass meadows (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).

Healthy communities of Posidonia seagrasses have been identified throughout the SEPA. An area of 41.2 km^2 out of SEPA's 763 km^2 marine surface area is estimated to be composed of Posidonia meadows (Oceanos, 2004).

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 flowing 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 witnhin the Meditterranean is about 38,000 km^2 (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 CO_2. 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 O_2/m^2/day capacity on average

The 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 both the marine and wetland ecosystems of Datça-Bozburun SEPA, 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 Datça-Bozburun SEPA, 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 limits hydrodynamics by 10 to 75% under the leaf cover (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 matte 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.

Data specific to coastal erosion in Datça-Bozburun SEPA does not exist. However, it is reported that the topography of the protected area is very irregular due to the domination of hills and mountains with 60% of its surface area of medium, high and very high slopes (Yerli, 2001). The SEPA is subject to 28% high and 32% very high erosion risk resulting in shallow soil depths (20-50 cm). Erosion is not only related to the climatic regime, the topography and insufficient organic matter of the area but also to poor management of the grasslands and forests, and the patchiness of the land (ibid). The Hacettepe study further reveals that 93.6% of Datça-Bozburun SEPA faces land degradation and that measures should be taken to protect the soil and water resources and to increase agricultural potential.

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 increase 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 Datça-Bozburun SEPA, 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).

The remains found in Datça Peninsula date back to 2000 BC and are closely related to the sea (Ministry of Culture and Tourism, 2009). The earliest settlers known in Datça are Carians; however, the Dorian period marks the golden age. Carians originally came from Thrace and Greece around 1000 BC

and settled around today's Burgaz, located 1.5 km northeast of Datça and later founded Knidos which then became the centre of Dorian civilization.

Key historical features of the SEPA are highlighted below:

- Amos is in Bahçealtı, in the South of Turunç. The area is strewn with ruins of ancient theatres and has been declared as an archaeological site.
- Laryma. Not enough information is available about when and by whom the Kocaman Hisar, known as Bozukkale, was built. The area has been declared an archaeological site.
- Bybassium is situated in the interiors of Turgutlu settlement.
- Patakis includes Kızılada at the inlet of Bozburun Bay and the surroundings where church ruins are strewn. The area has been declared as an archaeological site.
- Tymnos and Soronda archaeological sites consist of two adjacent sites surrounding Söğüt location.
- Knidos, which was one of the six Dor cities of the Ancient Ages is situated on Datça Peninsula. Ancient Knidos was founded in the environs of Datça town in 7th century B.C., and it was moved to Terki in the mid-4th century B.C. This may have been due to the highly developed sea commerce, exporting wine, vinegar and olive oil. Another reason was that the harsh winds impeded the ships coming from the south to cruise around the headland. Knidos was a cultural centre in the Ancient times. Eudoksos of Knidos (409-355 B.C.) was not only a mathematician, physicist, geographer, philosopher and astronomer, but also a law maker. It is thought that the laws he set for the city played an effective role in the transition to democracy.

In 2005 nine shipwrecks were discovered along the south eastern Bozburun Peninsula (Royal, 2006). Of these 5 have historical significance and represent a chronological range from the Roman Imperial to the Renaissance period. These submerged remains highlight the cultural importance of the area. The wrecks represent a span of seafaring history from the 1st Century BC to the early 16th century AD. The ancient settlements of Physkos, Lorima and Tios were founded on the Bozburun Peninsula. Over the centuries, this segment of coast was part of an active trade route between the ancient cities of Rhodes to the south and Knidos to the west, and part of the greater Aegean and eastern Mediterranean mercantile network (Royal, 2006).

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.

Scientific studies on marine species found in the Datça-Bozburun SEPA have been conducted as part of Masters or Doctoral theses in accordance with the Turkish Council of Higher Education. These research activities have mainly been coordinated by Marine Science departments and focus on the investigating the area's marine fauna such as crustaceans, sponges and fish species.

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 GDP.

Tourism is an increasingly important economic activity for the SEPA as the favorable climatic conditions of the region (long summer) facilitate the development of coastal tourism and secondary houses in the peninsulas (Taşlıgil, 2007). The historical heritage of the area makes up a crucial aspect of the recreational activities within the SEPA. Furthermore, 52 coves and bays along the coast of the Datça Peninsula as well as those situated in Bozburun Peninsula are key stopovers for the Blue Cruise boats and yachts traveling between Bodrum and Fethiye (Ministry of Culture and Tourism, 2009).

The SEPA also offers an un-spoilt nature rich in its flora and fauna attracting visitors for ecotourism purposes.

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.

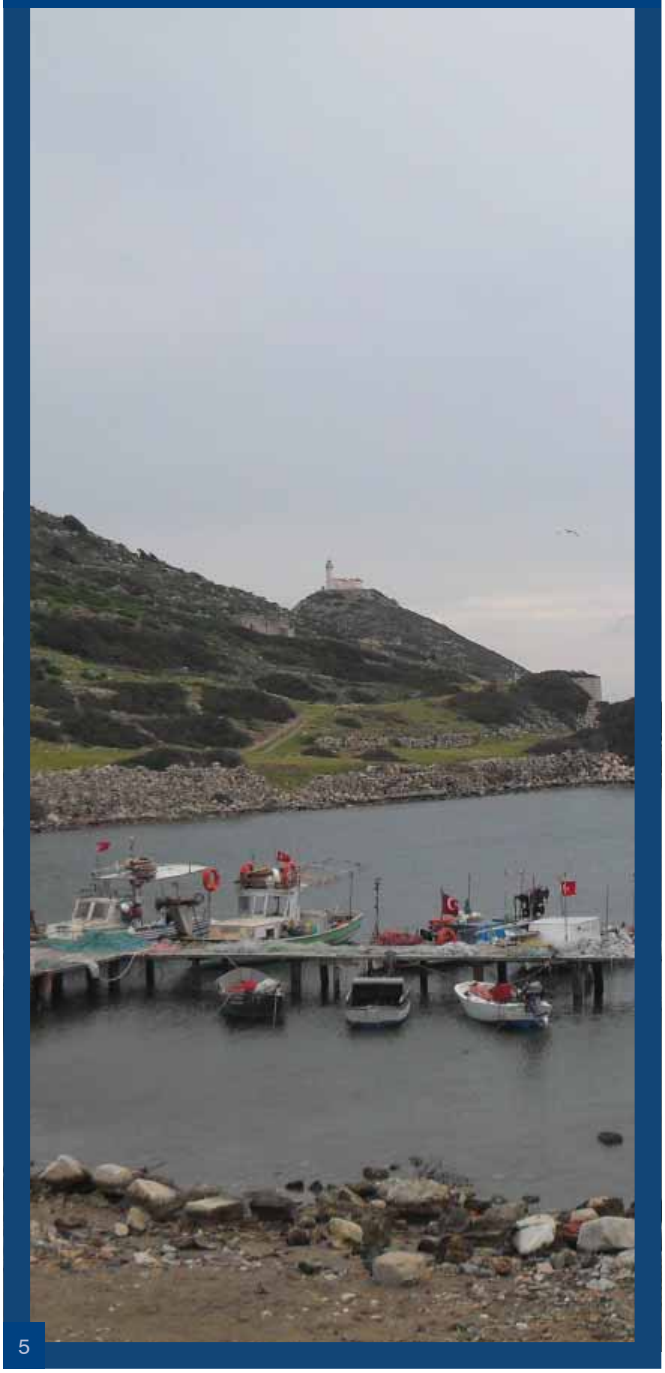
3.4.5. Biodiversity non-use

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 Datça-Bozburun SEPA. 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**. Market prices** for marine ecosystem services that are traded reflect a lower bound estimate of its value, as they do not capture the consumer surplus[3] 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.

[3] 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.

Table 4. Characteristics of the fisheries cooperatives in Datça-Bozburun SEPA (source: Ünal 2011).

Cooperative	Number of Operational years	Primary activity	Secondary activity	Number of staff	Total number of fishermen	Number of shareholders
Datça	8	Fishing	Shelter, Lobbying	1	19	18
Cumalı	3	Fishing	Shelter, Lobbying	-	15	5
Karaköy	6	Fishing	Lobbying	-	15	10

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 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 in this study are – fish, 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. Socio-economic assessment

Ünal (2011) carried out a socio-economic study of the Datça-Bozburun Peninsula from November 2010 to July 2011 covering the fishing ports of Datça, Karaköy, Cumalı (Palamutbükü), Knidos, Hayıtbükü, Selimiye, Hisarönü, Orhaniye, Bozburun and Söğüt-Taşlıca fishery ports. In addition, three fishery cooperatives located in Datça Peninsula were also studied.

Due to the fact that primary information and data on the socio-economics of fisheries are not collected on a regular basis in Turkey and up to date information was not available from the relevant authorities, the study relied on personal interviews. Face to face interviews were held with the heads of the fishery cooperatives and 211 regional fishermen (representing 80% of all fishermen, cooperative and non-members, in the project area), all of whom were vessel owners[4].

There are three active fishery cooperatives in the region: Cumalı Fishery Cooperative, in the west founded in 2008, Karaköy Fishery Cooperative in the North founded in 2005, and Datça Fishery Cooperative founded in 2003. Cooperative members total 49 and about 170 vessels were recorded in the region. The biggest fishery cooperative in terms of members is Datça. The composition of the three cooperatives is given in Table 4.

The only cooperative in Datça-Bozburun SEPA that has staff is the Datça Cooperative. Around 26% of the Datça Cooperative fishermen, 33% of the Karaköy Cooperative and 7% of the Cumalı Cooperative make their living solely via fishing activities.

Fishermen generally fish with longline and gillnets, and operate in wooden vessels 5.3-11 (average 8) meters in length with 6-135 HP (average 21) (Horse Power) engines. The age of fishermen ranges from 26 to 82, with an average age of 48 and an average literacy level of 6 school years. The average household size is 4, with each fisherman providing for about 2 dependants. They have high levels of marital status (92% married), homeownership (95% have own house) and social security (87% have some sort of social security).

Fishermen in Datça-Bozburun Peninsula earn 33% of their total income from fishing and 77% from tourism (working in or running restaurants,

[4] 15 from Karaköy, 6 from Knidos, 17 from Palamutbükü and Hayıtbükü, 19 from Datça center, 10 from Hisarönü-Orhaniye, 48 from Selimiye, 59 from Bozburun, and 37 from Söğüt.

cooking in ships) and agriculture (raising/selling olives, tomatoes, etc.). However it should be noted that 41% of the fishermen in the area live solely on fishing. Selimiye and Bozburun have the highest rates of fisherman who totally rely on fishing as an income source at 46% and 49% respectively. Knidos and Palamutbükü report the lowest percentage of fishermen for whom fish is their only income source at only 17% and 29% respectively. An estimated 59% of fishermen have at least a secondary income besides fishing in these two harbours. Most (42%) work in the tourism industry as a secondary job, followed by free trade (29%), agriculture (24%) and civil service or retired pension (6%). An estimated 43% of Bozburun fishermen and 35% of Datça fishermen have no other income than fisheries. The results indicate that dependence on fishing is higher in the Bozburun Peninsula.

The majority of fishermen, 94%, are pessimistic about the future of fisheries, while 39% are thinking about quitting and 80% do not want their children to become fishermen. According to the heads of the fishery cooperatives in the Datça-Bozburun Peninsula the main problems facing fishermen are: ongoing illegal fishing activities; lack of fishing ports and facilities; and, the lack of financial sources. The problem of Puffer fish (*Lagocephalus sceleratus*) is also cited by almost all fishermen since this species is causing considerable damage to fishermen's nets and longlines in the Datça-Bozburun SEPA.

Fisheries in the peninsula are difficult to sustain economically. In terms of net profits only 21 boats (13 in Bozburun, 4 in Söğüt, 1 in Selimiye, 1 in Palamutbükü-Hayıtbükü and 2 in Datça) stated positive economic results. That is only 10% of the fishermen in the entire Datça-Bozburun Peninsula make a net profit. This ratio is 22% for Bozburun where fishing power and sustenance from fishing are highest. When only variable costs (i.e. difference between total landing value-fishing income and variable costs) are considered, 143 of 211 boats have positive results. An important economic indicator is that 68 boats fail to even meet their operating costs reflecting how difficult conditions are for small scale fishermen.

Comparison on average regional total costs, total landing (catch) value and total operational income indicates an advantage for the Bozburun Peninsula. Total costs are higher in Datça Peninsula fisheries while total catch value and total operational income are lower. These results are harmonious with the fact that Bozburun fishermen regard fisheries as their main source of income.

4.1.1.2. Valuation of fisheries

The coastal fisheries in the region are characterized as small scale fisheries, carried out by traditional longlining, gill and trammel netting (Ünal 2011; Akyol & Ceyhan 2007). The fish and invertebrate species caught from set net or longline fishery are representative of those that inhabit coastal embayments in the Aegean and Mediterranean. *Mullus barbatus, Sphyraena sphyraena, Seriola dumerilii, Pagellus erythrinus, Dentex dentex, Mullus surmuletus, Sarda sarda, Xiphias gladius, Epinephelus aeneus, Loligo vulgaris, Octopus vulgaris* etc. are the main species targeted for commercial purposes. But fishery activities in the region are found to be relatively weak due to short fishing season, low fishing capacity and the limited number of fishermen.

An overview of the targeted commercial fish species in the Datça-Bozburun Peninsula is provided in Table 5.

Table 5: Target fish species in the Datça-Bozburun SEPA
(Source: Adapted from Ünal 2011 and Akyol & Ceyhan 2007)

Target Species

Latin	Turkish	English	Catch season	Type of equipment
Boops boops	Kupes	Bogue	Mar- May/Year round	Fishing nets
Coryphaena hippurus	Lambuka	Dolphinfish	Aug-Nov	Fishing nets
Dentex dentex	Sinarit	Dentex	Apr-Jun/Year round	Fishing nets, Paragat
Diplodus sargus	Sargos	White bream	Apr-May/Year round	Fishing nets, Paragat
Diplodus vulgaris	Karagöz	Two-banded bream	Year round	Paragat
Epinephelus aeneus	Lahos	White grouper	July-Sep /Year round	Fishing nets, Paragat
Epinephelus marginatus	Orfoz	Dusky grouper	Summer months/Year round	Fishing nets, Paragat
Epinephelus alexandrinus	Kara lahos	Blacktip grouper		
Homarus gammarus	Istakoz	Lobster	Summer months	Fishing nets
Lichia amia	Çıplak	Jack	Nov-Dec/Mar-Apr	Fishing nets
Loligo vulgaris	Kalamar	Calamar	Oct-Apr	Fishing nets, fishing line
Merluccius merluccius	Bakalyaro	European hake		
Mugil spp.	Kefal	Mullet	Nov-Dec/Mar-Apr	Fishing nets
Mullus sp.	Barbun-Tekir	Red mullet	Year round	Fishing nets
Octopus vulgaris	Ahtapot	Octopus	Winter months/Year round	Fishing nets, Parangula, Spear gun
Upeneus molluccensis	Paşa Barbunu	Goldbland goatfish		
Pagellus erythrinus	Mercan	Common pandora	Feb-July/Year round	Paragat, Fishing nets
Pagrus pagrus	Fangri	Snapper	Mar-May/Year round	Fishing nets, Paragat
Palinurus elephas	Böcek	Crayfish	April-July	Fishing nets
Penaeus kerathurus	Karides	Shrimp	Year round	
Sarda sarda	Palamut	Bonito	Dec-Jun	Fishing nets, lure
Scomber japonicus	Kolyoz	Chub mackerel	Apr-Aug	Fishing nets
Scyllarides latus	Karavida	Slipper lobster	Mar-Aug	Fishing nets, Hand collection
Sepia officinalis	Supya	Cuttlefish	Apr-May	Fishing nets
Seriola dumerili	Akya	Amberjack	April-September	Fishing nets, lure, fishing line
Siganus sp.	Sokkan	Rabbitfish	May-Aug	Fishing nets
Sparisoma cretense	İskaroz	Parrot fish	Summer months/Year round	Fishing nets
Sparus aurata	Çipura	Sea Bream	July-Oct	Paragat
Sphyraena sp.	Iskarmoz	Barracuda	Nov-Dec/Mar-Apr	Fishing nets
Trachurus sp.	İstavrit	Mackerel	Winter months	Fishing nets
Xiphias gladius	Kılıç	Sword fish	Feb-Apr	Paragat

Table 6. Average costs and revenues in the Datça-Bozburun SEPA (Source: Ünal, 2011).

Economic Activity (boat/TL/yr)	Datça n=19	Palamutkü-Hayıtbükü n=17	Karaköy n=15	Knidos n=6	Datça Peninsula n=57	Hisarönü-Orhaniye n=10	Selimiye n=48	Bozburun n=59	Söğüt n=37	Bozburun Peninsula n=154	Datça Bozburun Peninsula n=211
Variable costs	4,819	6,438	4,513	5,127	4,684	3,336	3,660	3,780	3,588	3,668	3,942
Boat and fishing gear maintenance costs	3,021	3,014	2,470	2,329	2,801	3,257	2,617	2,379	2,813	2,614	2,665
Labour cost	7,847	6,107	7,384	5,823	6,939	4,913	4,757	5,358	5,650	5,161	5,671
Depreciation expense	702	540	585	1,026	676	530	820	627	617	681	679
Capital expenditure	641	509	576	1,020	624	550	630	600	540	592	600
Total costs	17,029	14,699	15,322	15,505	15,724	11,721	12,484	12,775	13,208	12,716	13,528
Total fisheries (catch) revenues	8,730	7,344	5,520	5,659	7,149	4,512	5,720	10,413	6,583	7,647	7,512
Operational income	6,081	6,032	2,279	7,655	4,950	2,106	4,195	8,499	6,462	6,434	6,060

Table 6 provides an overview of costs and revenue for the three cooperatives in the SEPA. Based on Ünal (2011)'s research, total economic revenues pertaining to the fisheries of the SEPA can be deduced (in 2011 prices). Considering that on average a fishing boat in the SEPA generates around 7,500 TL in revenue and there are an estimated 250 boats in the region, fisheries are valued at 1,875,000 TL (US$ 975,000) annually.

4.1.1.3. Fisheries management

The economic status of small-scale fisheries in the Datça-Bozburun Peninsula is working against sustainable fisheries, while fisheries management tools, rules and regulations and traditional management approaches in the area are insufficient to protect resources and the livelihoods of fishermen. More comprehensive management alternatives (Ecosystem Approach to Fisheries, No Take Zones within the MPAs) need to be adopted. The "Benefits of Fisheries Restricted Areas and Designation of Potential Areas for Datça-Bozburun Peninsula" meeting held in March 2012 with fishermen of the area can be considered as an important development towards this change. The meeting discussed the introduction of no-take zones with a broad range of stakeholders.

4.2. Regulating services

4.2.1. Carbon sequestration

4.2.1.1. Existing estimates

Mangos *et al.* (2010**)** estimated the carbon storage function of the Mediterranean Sea as a whole and based on this provided disaggregated values for individual Mediterranean countries. The Mediterranean Sea accounts for only 0.8% of ocean area, therefore it plays a small role in world climate regulation. However, a recent estimate (Huertas, 2009) proposes the value of 78 kilo moles of carbon ±15% per second for the Mediterranean Sea as a whole. This corresponds to an annual average rate of anthropogenic CO_2 sequestration of 11.8 t/km²/yr, which is around twice the average for the World Ocean (Gruber, 2009).

Adopting Huerta's (2009) estimate, Mangos *et al.* (2010) estimate the total sequestered volume for the Mediterranean at 108 million tonnes of CO_2 per year[5]. As reported by Mangos *et al.* (2010) this quantity represents a mere 5% of the CO_2 emitted by activities in the Mediterranean riparian countries (UN Data).

The average price for carbon for the year 2005 was used - 20.5 €/t of CO_2 (World Bank, 2006). This results in an annual regional value of 2.2 billion € (108 Mt x 20.5 €/t). This value was distributed amongst

[5] One tonne of carbon corresponds to 11/3 or 3.67 tonnes of CO_2

the riparian states based on their share of the total volume of CO_2 emitted using statistical data provided by UN Data. The value for Turkey is estimated at 230 million Euros per annum. This provides a ball park estimate of the value of marine carbon sequestration in Turkey generally. Available site specific data and current carbon values were used to estimate this service at Datça-Bozburun SEPA.

4.2.1.2. Value of carbon sequestration at Datça-Bozburun SEPA

The *Posidonia oceanica* seagrass meadows are one of the most important oxygen sources of the Mediterranean. The meadows do not only provide oxidation of the seawater, but they are also the habitat for many invertebrates and fish species and especially larvae. Since the meadows prefer sandy environments, they help these spots to become more stable and become a habitat for many living organisms. If these habitats are destroyed, not only their contributions to the marine ecosystem will end, but they will also have a direct or indirect effect on the whole ecosystem.

The Oceanos marine biodiversity study conducted by Istanbul University (Oceanos 2004), mapped the distribution of the most important marine vegetation types in the SEPA. The studied species were *Posidonia oceanica*, *Caulerpa racemosa*, *Cymodosea nodosa*, *Halophia stipulacea*, *Flabellia petiolata*, *Cystoseira* sp, *Caulerpa prolifera* and *Stypopodium schimperi*. Among the macrophytes observed, the Posidonia meadows, a key species of conservation concern in the Mediterranean Basin, were identified to have the largest coverage at 41.2 km^2. The relatively healthy presence Posidonia meadows in the area is a key feature of the SEPA. Given that the species is limited to 2-40 m, it was concluded that the meadows cover approximately 50% of the SEPA's marine area. This clearly shows that the marine environment has a relatively healthy structure. Considering that the *Caulerpa racemosa* is distributed down to 58 m approximately 75 m of depth, 20% of all this area (0-75 m) is covered by *Posidonia oceanica*.

Although *P. oceanica*, which is very sensitive to damage and pollution, is healthily distributed across large areas at the north of the Datça Peninsula, unhealthy meadows, subject to damage by humans, were observed in the South of Datça and at the Bozburun Peninsula. The damage was particularly concentrated in bays with settlements such as Datça, Selimiye, Orhaniye, and Bozburun, and bays such as Serçe, Bozukkale and Körmen Harbors, which are important for tourism. Damage has been observed along the whole coastal line mainly caused by uncontrolled anchoring.

Studies indicate an important and increasing threat of invasion by *Caulerpa racemosa*. In regions where *P. oceanica* is damaged the advantage is shifted to *C. racemosa*. *P. oceanica* is very sensitive to any kind of alterations in the ecosystem and particularly to physical destruction. Another important finding is that under normal conditions, the *C. racemosa* is distributed below the bottom limits of *P. oceanica* (>40 m). Dense distribution of *C. racemosa* has been detected in 40 m to 75 m depths. From 40 m to shallower depths, any negative effect on *P. oceanica* meadow may result in formation of gaps within the community and these areas are immediately filled by the *C. racemosa*. *C. racemosa* becomes more numerous in the heavily utilized areas. It is important to prevent destruction from anchoring activities and by pollution.

Figure 2. Distribution of *Posidonia oceanica* in the Datça-Bozburun SEPA (Source: Oceanos, 2004)

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 matte walls of the meadows at seven heavily vegetated Mediterranean sites (Mateo *et al.*, 1997). This estimated a matte/sediment storage capacity of 2.1 t CO_2/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 CO_2/ha/yr, assuming an average dry weight of 672 g/m^2 (average depth of 5 m).

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

organic carbon by the Nicholas Institute for Environmental Policy Solutions at the Duke University (Murray *et al.*, 2010) have been adopted (Table 7). This study demonstrates that the biggest carbon pool for *Posidonia oceanica* lies in the soil organic pools, with a global average of 500 t CO_2/ha.

Table 7. 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 (tCO_2 eq/ha/yr)	Living biomass (tCO_2 eq/ha)	Soil organic carbon (tCO_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 CO_2 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 creditabale carbon, associated with their avoided loss. A lower bound of US$ 11.2/t CO_2 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 CO_2 eq (based on EU Emission Trading System (ETS)).

Table 8 presents the results of the analysis. The carbon value of Datça-Bozburun SEPA's Posidonia meadows is estimated at US$ 2,510,234–4,482,560 a year (US$ US$ 609-1,088/ ha), with a present value of US$ 17,934,532– US$ 32,025,951. This assumes that soil carbon is released at 50 t CO_2 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 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

Table 8. Potential carbon sequestration value of Posidonia meadows at Datça-Bozburun SEPA

Posidonia surface (ha)	Carbon sequestration† (tCO_2eq/ha/yr)	Soil carbon released†** (tCO_2eq/ha/yr)	Total Annual C loss per site (tCO_2eq)	Value (US$ 11.2 / tCO_2eq)			Value (US$ 20 / tCO_2eq)		
				Annual value US$/ha	Annual Value / US$	PV (10 yrs, 10%), US$	Annual value US$/ha	Annual Value / US$	PV (10 yrs, 10%), US$
4,120	4.4	50	224,128	609	2,510,234	17,934,532	1,088	4,482,560	32,025,951

† Based on Duarte et al., 2010 & Murray et al., 2010
** Assuming a 10 year release period of soil carbon after habitat destruction

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)[6]. 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 Datça-Bozburun SEPA

There are no site specific studies of the risks faced by Datça-Bozburun SEPA's coastline or the role Posidonia meadows play in defending the coastline against erosion or estimates of expenditure on protection activities or infrastructure.

The total length of coastline with Posidonia beds is estimated to be around 272 km[7]. Using a transfer value of 160,000 € per km of coastline (Mangos *et al.*, 2010), coastal erosion protection provided by Posidonia meadows for the entire coastline would be 43.5 million € per year (160,000 € per km of coastline * 272 km). However, according to Ass. Dr. Ahsen Yüksek (personal communication) only around 3-4% of the Datça-Bozburun SEPA could be at risk to coastal erosion (i.e. secondary homes in Aktur and some sections of Datça harbour). A conservative estimate of the erosion protection service offered by the site's Posidonia meadows is 1,305,000 € per year (US$ 1,696,500).

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 and due to the limits of the treatment techniques applied for example.

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, diffuse pollution or breeding). In 2005 the environmental tax for domestic use at the department of the Bouches du Rhône, stood at 0.18 €/m^3. This zone is considered to be representative of the French Mediterranean seafront and features both highly urbanised and industrialised sectors (Marseilles, Fos) and other protected ones (Camargue, Calanques). This is used to value the waste assimilation

[6] 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).

[7] GIS layers for the site are not available so approximate calculations have been made using Google Earth.

service provided by marine ecosystems across all the Mediterranean riparian 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 m^3/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 km^3 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 m^3 per year (or 0.56 km^3/yr) and evaluated on the same basis as for domestic consumption at 0.18 €/m^3, 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 Datça-Bozburun SEPA

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 kilometres. Total length of Datça-Bozburun SEPA is 417 km (or 5%). This suggests that 11.5 million Euros (US$ 14.95 million) per annum can be apportioned to Datça-Bozburun SEPA waste treatment service.

4.3. Cultural Services - Tourism and recreation

4.3.1. Background

Datça-Bozburun SEPA is mainly characterised by marine (yacht) tourism as the peninsulas have historically remained somewhat secluded from tourism hubs such as Marmaris, Bodrum and Fethiye in Muğla Province, due to limited access. The development of tourism in the Datça-Bozburun Peninsulas dates back to the 1970's with the Blue Cruises coming from Greece. The construction of the main highway in the 1970's, the establishment of the ferry line between Karaköy and Bodrum in 1985 and the opportunity to access the area via Dalaman airport have facilitated tourism development in the area (Taşlıgil, 2008).

Datça-Bozburun SEPA acts like a bridge between the Aegean and the Mediterranean Seas and is an important passage for yachts, sailing boats and Blue Cruise boats between the two important marine destinations, Bodrum and Fethiye-Göcek[8]. The peninsula offers a key stopover for tourist boats due to its climatic advantages and the attraction of its numerous bays. The Bozburun Peninsula in particular is reported to be a prime destination for yachting and boating and to attract high end visitors from both Turkey and abroad (personal communication with Edhem Dirvana).

Sun and beach tourism are also available in the SEPA; however, no large tourist facilities have been built in the area. The most common type of accommodation in the region is secondary homes, concentrated especially in the Datça Peninsula, with an estimated 6,500 individual homes within the SEPA (Taşlıgil, 2008). Overall, the natural and agricultural features of the peninsulas are prioritised in the sustainable tourism vision of the region by Marmaris Tourism Union (MARTAB)[9], Datça Governorship, Datça District Culture and Tourism

[8] Blue Cruises started in Turkey around 1985-90's (personal communication with Muhammed Özdemir).

[9] MARTAB promotes alternative tourism activities in 15 villages around the area of Marmaris the majority of which are located within the Datça-Bozburun SEPA.

Office as well as the GDPNA[10]. For instance, thirteen nature trails are being promoted in the Datça Peninsula by the Datça Governorship (2012b).

4.3.2. Valuation of Tourism

Tourism flows to the Muğla Province are presented in Table 9. The province receives close to 3 million visitors annually from marine ports and international airways.

Table 9: Number of tourists coming to Muğla Province in 2009 (Source: Keskin *et al.*, 2011)

		Foreign Visitors	Local Visitors
By Air	Dalaman Airport	1,451,214	25,828
	Milas-Bodrum Airport	936,033	29,994
By Sea	Marmaris Port	180,526	5,552
	Bodrum Port	200,292	10,818
	Fethiye Port	10,741	2,401
	Datça Port	10,778	1,462
	Güllük Port	161	2,499
	Turgutreis Port	20,906	2,614
	Yalıkavak Port	258	281
TOTAL		2,810,909	81,449

Due to its relative distance, the SEPA attracts few day visitors. Surveys conducted by Optimar (2010) reveal that close to 84% of the visitors stay overnight. Accommodation facilities in the SEPA include: 26 Ministry licensed institutions with a total of 512 rooms and 1,241 bed capacity and 75 Municipality licensed institutions with approximately 3,750 bed capacity (Taşlıgil, 2008; Optimar, 2010). Further scrutiny of Optimar (2010) suggests 7,860 beds based on an aggregation of the village bed capacities provided in the report. This excludes the camp sites in Hisarönü, one of which has 4,000 capacity alone. Based on field interviews for this study, there are 3,500 beds in Datça (Datça Tourism office), while Bozburun has an estimated 2,500 beds (personal communication with Muhammed Özdemir). The overall bed capacity in the SEPA is therefore estimated to be between 6,000 and 8,000. According to the Datça District Culture and Tourism office, the high season in July and August is fully booked in Datça, 50% occupancy between April and end of September and 5% occupancy rates are observed in the winter.

Marmaris, a mass tourism centre that falls outside of the SEPA, receives close to one million foreign visitors annually (personal communication with Sedat Kırt). Official statistics are not kept on the number of visitors coming to the SEPA. Aside from the fact that municipal licensed accommodation is not tracked effectively, it is difficult to track official visitor numbers due to the use of secondary homes (Taşlıgil, 2008). Based on 2004 statistics, a total of 5,458 visitors (1,083 foreigners and 4,375 nationals) have come to the region with a total of 14,475 overnight stays (ibid). Foreigners stay between 3-7 days and Turkish nationals 2-4 days (ibid). More recent data from the Ministry of Culture and Tourism puts the number of overnight stays for Datça only at 170,000 in 2010 (Kültür ve Turizm Bakanlığı, 2012). This is based on accommodation licensed by both the Ministry and the Municipalities. Based on an estimate of a 6,000 bed capacity for the SEPA and 2 month occupancy at 100% (July and August), and 4 months at 50% (April, May, June and September), overnight stays could be in the region of 700,000. A conservative estimate of 300,000 overnight stays has been used in the analysis, based on the Ministry of Culture and Tourism's estimate for Datça (170,000) and an assumption that overnight stays in Bozburun are roughly 75% of this in line with the relative bed capacities in the two peninsulas.

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. The value of tourism is estimated at 300,000 * 115 TL = 34,500,000 TL (US$ 17,940,000).

4.3.2.1. Valuation of key tourism activities

Daily Boat Tours: As in other coastal zones in Turkey, daily boat tours are a popular marine tourism activity in Datça-Bozburun SEPA. In Datça centre, 20-25 boats are available between June and September, with a capacity ranging from 10-80 people. Typically a boat tour leaves the port around 9 am and comes back at 6 pm either offering a long tour towards Knidos or Hisarönü (costing 40 TL) or a shorter tour towards Mesudiye (costing 30 TL),

[10] The Planning Unit of the GDPNA has developed a terrestrial management plan for the SEPA based on rural and agro-tourism activities for all settlements. This plan is still to be approved (as of April 2012).

both with stopovers in the bays and a lunch service. There is a cooperative operating the daily tours. The value of the daily boat tours is estimated at 1,260,000 TL (US$ 655,200)[11].

Box 2. Traditional boatbuilding in Bozburun

Bozburun is a famous for its building of traditional wooden schooner type Turkish "gulets". In and around Bozburun there are about 35 shipyards and 18 workshops where these boats are made. The schooner building tradition has been passed down from father to son in the region over the past 50 years. Every year in October, the Bozburun International Gulet Festival takes place to demonstrate both the construction process itself and to market the gulet at an international level.

There are around 5 companies offering boat repair and construction in Bozburun. During the maintenance season (September to May) around 500 people are employed, usually from the local communities. Bozburun gulet building workshops get orders not only from Marmaris and Bodrum but also from abroad. The largest wooden yacht in the world (143 m), Dream Ship Victory, is currently under construction in the Bozburun Peninsula.

Along the Bozburun Peninsula, private gulets ranging from 3 cabins (for 6 people) to 11 cabins (for 22 people) are available offering 'Blue Cruises'. The rental of private and locally-built gulets operates either from the Bozburun Peninsula or from Marmaris. Datça, Rhodes, Simi and Tilos are all close enough to be included in the cruises. In Bozburun alone, there are reported to be over 200 gulets. Gulet operations are usually a family-run business.

Sources: Field Interviews, Keskin et al., 2011; MARTAB, 2010.

Marinas & Yacht Harbours in the SEPA: There are about three small to medium scale marinas in the SEPA: Martı Marina in Hisarönü Bay, Datça Muncipal marina, and Bozburun Municipal Harbour. In addition there are small pontoons run by village headmen in both peninsulas (with a capacity for around 50 boats). For instance, Palamutbükü in the Datça Peninsula is a touristic spot supporting a group of five villages known collectively as *Betçe* (*the five villages*). The five villages are Mesudiye, Sındı, Yakaköy, Yazıköy and Cumalı. Palamutbükü has a little pier which allows boats to moore (Keskin *et al.,* 2011).

Martı Marina, in operation since 25 years, is located in Orhaniye Bay in Bozburun Peninsula of the SEPA. It is the main marina in the area and has capacity for 400 boats on sea and 70 boats on land. The marina operates at full capacity from early June to the end of September. A hotel on the site catering to the marina and outside guests is due to open in the summer of 2012. The hotel will have a bed capacity of 70. It is reported that the majority of the marina users are Turkish, 20% from the UK and 15% from Germany (personal communication with Didem Gönenli).

Bozburun Bay acts as a naturally protected harbour with its unique geography. During the high season day, 150 boats are reported to anchor in the bay daily (personal communication with Edhem Dirvana). Bozburun Municipal Harbour can accommodate 50 average size yachts a day (twice as many as Datça). During the six month season (2010-2011), a total of 1,934 boats made use of the harbour (personal communication with Murat Merdan Yücel).

According to the Harbour Master, **Datça** is an important stop over harbour. In 2011, 1,900 transit logs or permits to sail in Turkish territorial waters were provided in the district (personal communication with Murat Yıldız). Additionally, 300 private boats, 43 commercial boats, 32 passenger boats and 250 fishing boats are registered in the Datça Harbour Authority (Optimar, 2010). According to the Datça District Culture and Tourism statistics, in 2011, a total of 876 boats/yachts have entered the Datça port and 6,574 visitors have arrived to the region via the sea. This is compared to 8,354 people arriving on 1,111 yachts to Datça in 2009 (Keskin *et al.,* 2011). The Municipality run harbour in Datça provides mooring, electricity, water and waste water collection facilities for the boats and yachts. The harbour generated 200,000 TL (US$ 104,000) in revenues in 2011 from services charges (largely gained over two summer months).

Two marinas are planned, one located in the centre of Datça and one in the north of the peninsular, overlooking Gökova bay. It is argued that Turkey needs more marinas if the sector is to develop. The current total capacity in Turkey is 12,000 boats, compared to around 1,000,000 in Spain.

National & International Ferry Lines: An important access route to Datça takes place from the Bodrum peninsula via Karaköy landing dock on the Northern section of the peninsula. This ferry service is currently available in the summer and winter. During the peak months of July-August the

[11] This assumes that boats are full during the peak season (July and August) and running at 50% capacity in June and September, a conservative assumption of boat capacity of 20 people and a trip cost of 35 TL per person. 60 days * 20 boats * 20 people per boat * 35 TL = 840,000 TL plus 60 days * 10 * 20 people per boat * 35 TL = 420,000.

service operates twice a day. During the summer passenger ferries operate between Datça and Rhodes. A small ferry boat operates once a week between Bozburun and the Greek island of Simi, the demand for this service is said to be high as Greeks travel to Turkey to shop.

The Archaeological Site of Knidos: Knidos at the tip of the Datça Peninsula is an ancient port that receives visitors coming both by land and by sea. Based on Datça District Culture and Tourism office, 26,473 visitors have accessed the site generating about 211,790 TL. This is compared with 26,244 people visitors in 2009 generating 197,560 TL (US$ 102,731) in entrance fees. This value has not been included in the assessment as although the marine environment / landscape is clearly a key part of the Knidos experience, it is a terrestrial based activity.

Scuba Diving: Scuba diving is in the development stage in Datça-Bozburun Peninsula. Currently a handful of operators are providing this recreational activity, including one in Selimiye and one in Bozburun. The sunken boats in the peninsulas could be an attractive feature for scuba divers but currently strict restrictions are in place regarding diving in the historical sites.

There is the potential to develop windsurfing and sailing activities in the SEPA. In Bozburun boat construction could be promoted as a tourism attraction complemented with a museum showcasing the history of Gulets.

Rental income: Currently four rental sites and three landing decks are in operation in Datça-Bozburun SEPA, which generate income for the GDPNA. Rental income for these sites in 2011 is provided in Table 10.

Table 10. Rental income from Datça- Bozburun SEPA

District Name	Rental Site/Operation Name	Fee 2011 (TL)
Datça	Palamutbükü	6,749
Datça	Bozburun Kürbaşı and Kumlu Mevki	6,500
Datça	Mesudiye	18,0000
Marmaris	Bayır Çiftlik Bay	-----
Datça	Emecik	5,200
Datça	Bozburun Pier and Coast	-----
Marmaris	Saygılı Tourism Landing Deck	15,000,
Datça	Gemekum Landing Deck	9,000
Datça	Gölmar Landing Deck	9,000,
TOTAL		69,449

Besides the above-listed yearly rental fees, GDPNA is in the process of levying user fees on operators of bars, hotels and others that make use of the coastal stretches in the SEPA. In Datça-Bozburun Peninsulas fourteen such agreements await implementation whose annual revenues are expected to bring an additional 30,000 TL to the GDPNA.

4.4. Summary of Valuation

The total annual value of the ecosystem services in Datça-Bozburun SEPA is estimated to be around US$ 38 million per year (Table 11).

Of this total value 50% is related to regulating services. The seagrass communities provide a carbon sequestration benefit worth US$ 2,510,234 per year and an erosion protection service valued at 1.6 million a year, while the coasts in Datça-Bozburun SEPA help assimilate waste, a service valued at US$ 14.8 million annually. However, valuation of these services is based on value transfer estimates as scientific studies on the provision of these services at the site are unavailable.

The cultural services of tourism and recreation account for around 47% of the total value. Given that the value-transfer method has been used for determining the tourism expenditure at the site, the estimate for the value of tourism of US$ 18 million per year clearly could be refined. Site specific evidence of tourist expenditures is required, along with a better understanding of the number of visitors (both overnight and day visitors). Revenues generated by the municipal marina in Datça have been included in this estimate, but it excludes the value of other Marinas in the area, in particular Martı Marina a high end operation. Marinas can have a significant economic impact and provide employment opportunities. The economic impact of the marinas has not been investigated.

Marine ecosystems are also important in terms of employment and local livelihoods. The economy of the peninsulas is based on the service sector. Tourism contributes to a number of sectors in the region including trade, transportation, construction, small scale industry. Trade mainly focuses on merchandise such as daily consumption products, construction materials, furniture or catering and souvenirs

that serve the tourism sector. Between September and May around 500 people are employed in boat maintenance and construction in Bozburun.

Of the estimated 270 fishermen in the SEPA, 43% of Bozburun fishermen and 35% of Datça fishermen have no other income than fisheries, so fisheries are important to local livelihoods. Of concern is the fact that recent research indicates that 90% of fishermen in the SEPA do not make a profit, questioning the viability of the small scale fishing industry in the region.

Table 11. Summary of valuation results for Datça-Bozburun SEPA

Service	Value/ year US$	Valuation approach	Comment
Fish	975,000	Market prices	This is not based on a sustainable harvest rate, which is unknown. This is a gross value – costs have not been deducted.
Carbon sequestration	2,510,234	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 and 4,120 ha of Posidonia meadows.
Erosion protection	1,696,500	Benefits transfer	Mangos *et al.* (2010). Based on 160,000 Euro per meter of coastline, 272 km of Posidonia beds and 3% of the area at risk.
Waste treatment	14,950,000	Benefits transfer	Based on Mangos *et al.* (2010) estimate for Turkey of 229 million Euros apportioned to the study site based on length of its coastline (417 km).
Tourism / Recreation	18,044,000	Market prices	Based on a conservative estimate of tourist numbers (about 300,000 overnight visitors per year) and average tourism expenditures (based on other Turkish MCPAs in Bann & Başak 2011a and Bann & Başak 2011b). Day visitors not included. Includes daily boat tours (US$655,200) and rental fees (US$ 100,000). Includes municipal harbour in Datca only (US$ 104,00). Reflects gross value, costs have not been deducted. Does not include Martı Marina or Municipal harbor in Bozburum, or account for economic impact of marinas on the economy in terms of employment generation and support to secondary industries.
TOTAL	38,175,788		

Opportunities to increase revenue flows from Datça-Bozburun SEPA

6

This section draws on the economic analysis undertaken to identify new potential income generating activities that can increase revenue flows to Datça-Bozburun SEPA.

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 Datça-Bozburun SEPA include (in addition to fish) carbon sequestration, 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 possible development of a business plan for Datça-Bozburun SEPA. Therefore this section only provides an overview of the opportunities for financing falling out of 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 Payment for Ecosystem Services (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 12. This categorises potential mechanisms into external flows, mechanism for generating funding such as taxes, and market based charges. At present the site is financed through budget allocations from the Turkish government.

Table 12. Typology of potential financing mechanisms

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

Source: Adapted from Emerton *et al.*, 2006

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 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 Datça-Bozburun SEPA. 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. Tourism related revenues and charges

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

The broader application of mooring charges and the charges for waste collection and other services provided to boats and yachts should also be introduced across the SEPA. These could be based on fees set in other countries such as Italy and Croatia, to be in line with international systems.

5.2. 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+)[12].

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 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).

5.3. 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.

[12] 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.

5.4. Biodiversity offsets

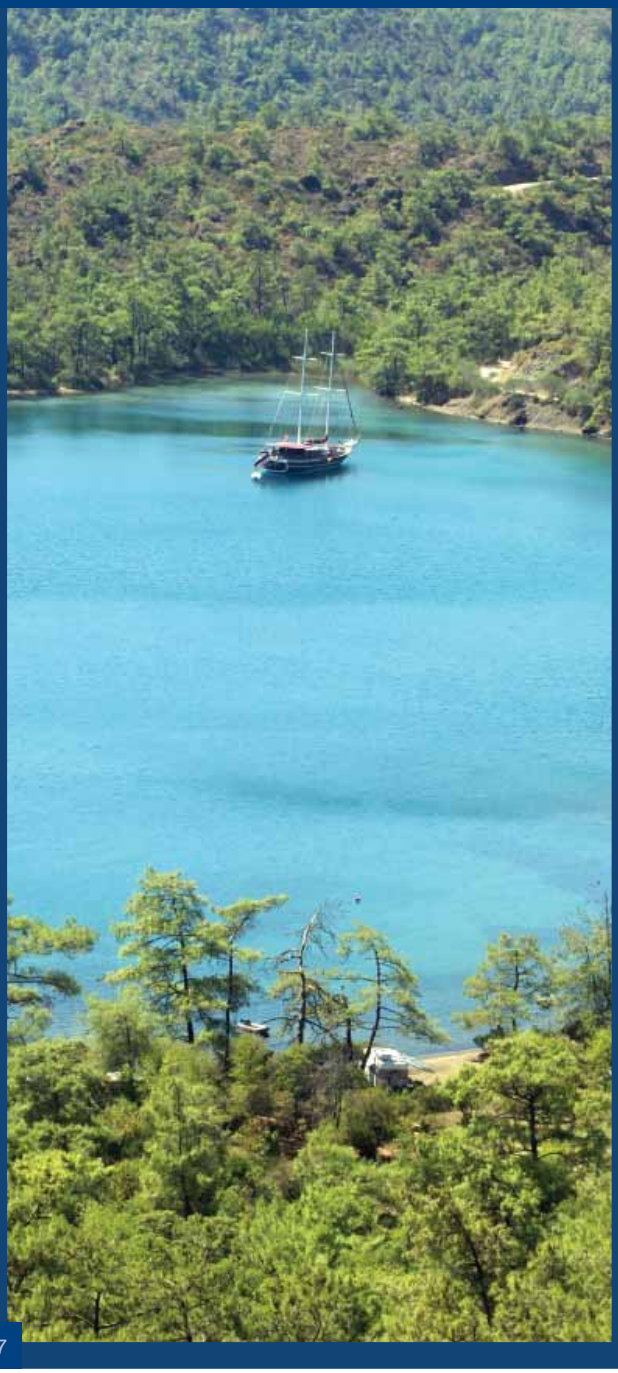
Biodiversity markets are a potentially powerful tool for internalising traditionally externalized costs and compensating good practices. For example, if a business has to pay to mitigate its residual impact on marine species, it either has to bear the cost of mitigation or develop elsewhere to avoid 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.

Conclusions and Recommendation



7

6.1. Conclusions

Marine environmental quality is relatively good within the SEPA and the site is not under intense pressure due to the fact that the region is not densely populated or facing high tourism pressures (Yerli, 2001). The environment is largely preserved apart from the rural and urban settlements in Datça and Bozburun SEPA, agricultural areas and the present transportation network. However the site does face a range of pressures including marine pollution, infrastructure and housing development and illegal fishing activities, which if left unchecked could undermine the SEPA's important ecological assets.

Datça-Bozburun'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 Datça-Bozburun SEPA is estimated to be around US$ 38 million per year. This is considered a conservative estimate and represents an initial attempt to value some of the key ecosystem services provided by the site, which need to be refined through further study.

This value incorporates provisioning services - fish, regulating services – carbon sequestration, erosion control, and waste treatment, and cultural services – tourism and recreation. The values are gross estimates (that is cost have not be deducted) and some values are not yet 'captured', such as the benefits associated with carbon sequestrations, and are as such potential values. However, the estimate may be considered 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.

High value is attributed to the SEPA's regulating services, especially the waste assimilation function provided by the coastal zones in the SEPA valued at nearly US$ 15 million per annum and the carbon sequestration functions of the Posidonia seagrass

communities within the SEPA. The carbon sequestration value could be refined through site specific studies of the storage and sequestration functions performed by Datça-Bozburun's Posidonia meadows. Such studies would be timely given the current international interest in developing a market in Blue Carbon.

The value of fish is estimated at US$ 216,545 per annum. This 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.

The marine environment is also important in terms of employment and local livelihoods. Tourism contributes to a number of sectors in the region including trade, transportation, construction, small scale industry. Between September and May around 500 people are employed in boat maintenance and construction in Bozburun. Of the estimated 270 fishermen in the SEPA, 43% of Bozburun fishermen and 35% of Datça fishermen have no other income than fisheries. According to Ünal (2011) only 10% of the fishermen in the entire Datça-Bozburun Peninsula make a net profit.

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.

Planning

- The SEPA urgently needs its urban plans approved by GDPNA in order that the appropriate sewage and solid waste infrastructure can be provided for existing buildings. The lack of such infrastructure poses an increasing risk to the SEPA's marine environmental quality.
- A solution to the Coastal Law's restrictions within 100 meters of the coast as *applied to buildings and communities pre dating the law* needs to be found. At the moment it is illegal to develop any infrastructure within 100m of the coast and as a result sewage facilities cannot be constructed for buildings and communities that were established (well) before the coastal law.

Fishery valuation and management

- Fisheries in the SEPA need to be monitored economically, ecologically and biologically. Understanding the economics of fishing is key to the development of sustainable fisheries management plans.
- The valuation of fisheries 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.
- No take zones are proposed for the site and discussions are underway with stakeholders to design and implement the no-take zones. Nonetheless improved coordination and monitoring are needed to prevent illegal fishing activities in the SEPA which threaten the fishery resource.
- The use of artificial reefs in selected zones of the SEPA could be a solution for increasing the fish populations as well as controlling the illegal trawling activities.

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. A number of opportunities exist for developing the tourism experience in Datça-Bozburun SEPA, and hence contributing to the maximization of the long term revenues from tourism and recreation at the site. Recommendations include:

- A study of the site's marine and terrestrial tourism *carrying capacity* to understand the limits to tourism development in the area. This is considered to be particularly needed for Bozburun.
- Development of a *tourism master plan / strategy* for the SEPA taking the carrying capacity of the area into account. Development of the ecotourism sector will require a strategy and marketing of the SEPA's range of attractions and activities.
- Better *data collection on visitors* is needed to assist planning efforts (visitor numbers, profile, motivation for visit). It is difficult to plan successfully without reliable estimates of visitor numbers, and these currently do not exist. Airlines could perhaps be utilized to collect this information for all the SEPAs in the Province.

- Extending the tourism season through *diversification* of the tourism offering is a vision set by the Datça District Culture and Tourism officials as well as institutions such as MARTAB and GDPNA. Ecotourism activities such as scuba diving, wind surfing, sailing, nature trekking activities and agro-tourism options that have already been envisioned for the SEPA could be further developed. In Bozburun boat construction could be promoted as a tourism attraction complemented with a museum showcasing the history of Gulets. The SEPA also offers vast opportunities for *educational tourism* based on the site's rich flora and fauna and cultural and historical heritage.
- *Better signage and information* for visitors and residents on the ecological and archeological importance of the area and its protection status. Everyone visiting the site should be aware that it is a protected area. The tourism sector could play a role in disseminating this information. This would help strengthen the area's image / brand and improve the quality of the tourism offering. Nautical maps and GPS should indicate the status of the area and set out the rules of conduct (this should be led by Ministry of Transportation Maritime Affairs, Harbour Heads, Coastal Guards in coordination with GDPNA). At present there is very little signage and visitors are not aware that they are in a protected area.
- Anchoring activities should be regulated and studies initiated to establish the infrastructure needed to meet anchoring requirements. (Okuş *et al.*, 2011)
- Hotels and marine vessels should take measures to minimize the solid waste pollution. Discharge of oils, paints, fuel oil and other wastes to the sea from marinas slipways and shipyards should be prevented. (Okuş *et al.*, 2011)
- A marina project is reportedly under consideration for Bozburun bay. The impacts of a potential marina on the historical and natural assets needs to be assessed thoroughly given that Bozburun bay and its adjacent bays are already saturated in the high season.
- A site specific survey is needed to generate information on tourist expenditure in the area. A study of the contribution of Marianas to the economy could also be undertaken.

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 regulating services (i.e. carbon sequestration, erosion control, flood and storm protection and waste assimilation) are required to better understand these services and inform the valuation. Information is needed on how a change in the structure and function of ecosystems lead to changes in the provision of ecosystem services, and how changes in the provision of ecosystem services affect human well-being.
- A priority area of research is site specific studies of the carbon sequestration and storage rates of Datça-Bozburun's Posidonia meadows. This would position Turkey to potentially benefit from the emerging market in Blue Carbon. The relatively healthy presence Posidonia meadows in the area is a key feature of the SEPA and represents a significant asset for the area which needs to be better understood, protected and monitored.

Time series analysis and Socio-economic studies

- In line with GDPNA's intention to carry out regular biodiversity assessments and socio-economic studies at the different SEPAs of Turkey, valuation studies should be carried out in Datça-Bozburun SEPA 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. Ideally valuation studies should look at different scenarios and thereby help choose between different management options for the area and cast light on the site's sustainability.
- An extensive socio-economic study specific to Datça-Bozburun SEPA's rural settlements, which looks at the implementation of agro-tourism principles has been undertaken by GDPNA. The urban/rural plans developed under this study await approval by the GDPNA and MoEU. These plans could better inform the development of the area and guide the design of possible mechanism to promote benefit sharing among local communities.

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ANNEX 1 - PEOPLE INTERVIEWED DURING THE FIELD VISITS (22-23 MARCH 2012)

Interviewees	Name	Title
Marmaris Tourism Union (MARTAB)	Sedat Kırt	Director
Orhaniye Martı Marina	Didem Gönenli	Public Relations
Turhan Yachting/Mare Nostrum	Galip Turhan	Owner
Sardunya Motel, Selimiye	Muhammed Özdemir	Owner
Fishermen in Serçe Port		
Bozburun Municipality	Murat Merdan Yücel	Planner
Bozburun Yatch Club	Edhem Dirvana	Owner
Datça District Tourism Directorate	Ercan Beydat	Director
Datça Port Authority	Murat Yıldız	Port head
Datça Municipality	Mehm*et al.*i	Harbor staff

Ministry of Environment and Urbanization
General Directorate for Protection of Natural Assets (GDPNA)
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