

# Chapter 11: Ecosystem Services



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## 11 Ecosystem Services

### 11.1 Introduction

International Finance Corporation (IFC) Performance Standard (PS) 6 defines ecosystem services as “*the benefits that people, including businesses, obtain from ecosystems*” (Ref. 11.1), which accords with the definition provided by the Millennium Ecosystem Assessment (MA) (Ref. 11.2). While there is no single system for categorising ecosystem services, the MA framework is widely accepted and, as acknowledged in IFC PS6 (paragraph 2), provides a useful starting point. The MA identifies four broad categories of ecosystem service:

- *Provisioning services*: the products people obtain from ecosystems. In the context of the marine environment these may include *inter alia* (i) fisheries; (ii) oil and gas; and (iii) chemical compounds. In most cases, the exploitation of provisioning services involves a significant input of man-made capital and labour, for example in the form of fishing boats, oil rigs, and their crews (Ref. 11.3);
- *Regulating services*: the benefits people obtain from the regulation of ecosystem processes. In the marine environment these may include *inter alia* (i) climate regulation through carbon storage and sequestration; (ii) waste absorption and detoxification; and (iii) biological control of pests and diseases;
- *Cultural services*: the cultural, educational, and spiritual benefits people obtain from ecosystems. These may include *inter alia* (i) cultural, spiritual, or religious upliftment from cultural heritage, spiritual, or sacred sites; (ii) opportunities for recreation such as sport, fishing, ecotourism, or recreational enjoyment; and (iii) opportunities for scientific exploration, knowledge-building, and education; and
- *Supporting services*: the natural processes that maintain the other services such as provision of habitat, nutrient cycling, water cycling or exchange, primary production, and resilience.

Supporting services differ from provisioning, regulating, and cultural services in that, unlike the other types of service from which people can directly benefit, their impacts on human well-being are indirect (Ref 11.4 and Ref 11.5). Supporting services are strongly interrelated to each other and are generally underpinned by a vast array of physical, chemical, and biological interactions. It is these supporting services that underpin the provision of the final services which are of direct value to people.

The benefits of ecosystems are conferred at many scales and often to multiple different beneficiaries. At the local level, ecosystem services are frequently the basis for rural livelihoods and subsistence, particularly for the poor. Artisanal fishing, for example, provides both cash income and food for low-income families. Benefits can also be regional—such as the fisheries that contribute to the Gross Domestic Product (GDP) of various Black Sea countries—or national, such as sites that form part of a country’s cultural heritage. At a global scale, ecosystems regulate climate and support the biodiversity which underpins all biological production.

Businesses and projects may also benefit from ecosystem services through, for example, the direct use of inputs, such as water, or through protection from natural hazards. Identifying and protecting such services can have further benefits such as avoiding punitive regulation and negative publicity, strengthening the organisation's reputation and, in some cases, providing effective natural alternatives to more expensive engineering solutions.

This chapter presents an assessment of the potential impacts and dependencies on ecosystem services resulting from the Construction and Pre-Commissioning, Operational and Decommissioning Phases of the Project. In addition, mitigation measures which aim to avoid, minimise and, where residual impacts remain, to compensate and offset impacts on priority ecosystem services are proposed.

Specifically, the purpose of this chapter is to:

- Systematically identify and assess the likely impacts of Project activities on Ecosystem Services (ESS) and the nature and significance of these impacts on ESS beneficiaries;
- Evaluate Project dependence on ESS in order to help manage risks and take advantage of opportunities related to ecosystem change; and
- Help inform, for unavoidable impacts, the selection of appropriate mitigation measures which aim to maintain the value and functionality of priority ESS and enhance the resource efficiency of Project operations.

This chapter is not intended to be read in isolation; instead it presents and assesses the key ecosystem service considerations relevant to the topics presented in other chapters of this ESIA Report, including key inter-linkages, to ensure that the values which ecosystem service beneficiaries attach to ecosystem goods and services are appropriately considered and addressed throughout the ESIA process.

## **11.2 Approach**

The approach to, and methodology for, the ecosystem services assessment in this chapter is based on a URS proprietary tool: Ecosystem Services Identification, Valuation, and Integration (ESIVI) (Ref. 11.6). The ESIVI tool was created in order to provide a rigorous and transparent framework for ecosystem service assessments that meets the requirements set out in the 2012 IFC PSs.

The development of the ESIVI tool was informed by both the conceptual framework established by the MA, which explicitly links ecosystem services and human well-being, and the World Resources Institute (WRI's) conceptual framework for Ecosystem Services Review for Impact Assessment (Ref. 11.7). The WRI framework puts the Project at the centre of the interactions between human well-being, ecosystem services, ecosystems, and drivers of ecosystem change, recognising that the Project has the potential to affect all the components of the framework and is itself affected by them. It reflects the two ways the Project relates to ecosystem services in terms of:

- Potential impacts on the existing relationships between human well-being, ecosystem services, and ecosystems; and

- Project dependence on these relationships for the achievement of successful performance.

The development of the ESIVI tool was informed by expertise built up from carrying out policy and project level work on ecosystem service assessments over the past ten years as well as a number of Good International Industry Practices (GIIP) and guidelines, including:

- IFC Performance Standards 1, 4, 5, 6, 7, 8, and their accompanying Guidance Notes (Ref. 11.8);
- Landsberg et al. (2011), 'Ecosystem Services Review for Impact Assessment: Introduction and Guide to Scoping' (Ref. 11.7);
- International Petroleum Industry Environmental Conservation Association (IPIECA) / Oil and Gas Producers (OGP) (2011), 'Ecosystem Services Guidance: Biodiversity and Ecosystem Services Guide and Checklists' (Ref. 11.9);
- Convention on Biological Diversity (2006), 'Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment' (Ref. 11.10);
- The Economics of Ecosystems and Biodiversity (2010), 'The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature' (Ref. 11.11);
- Bateman et al. (2010), 'Economic Analysis for Ecosystem Service Assessments' (Ref. 11.12);
- Burkhard et al. (2009), 'Landscapes' Capacities to Provide Ecosystem Services – A Concept for Land-Cover Based Assessments' (Ref. 11.13);
- Landsberg et al. (2013), 'Weaving Ecosystem Services into Impact Assessment: A Step-by-Step Method' (Ref.11.14); and
- United Nations Environment Programme – World Conservation Monitoring Centre (2012), 'UK National Ecosystem Services Assessment' (Ref. 11.15).

The ecosystem services assessment process in the ESIVI tool comprises four stages<sup>1</sup>:

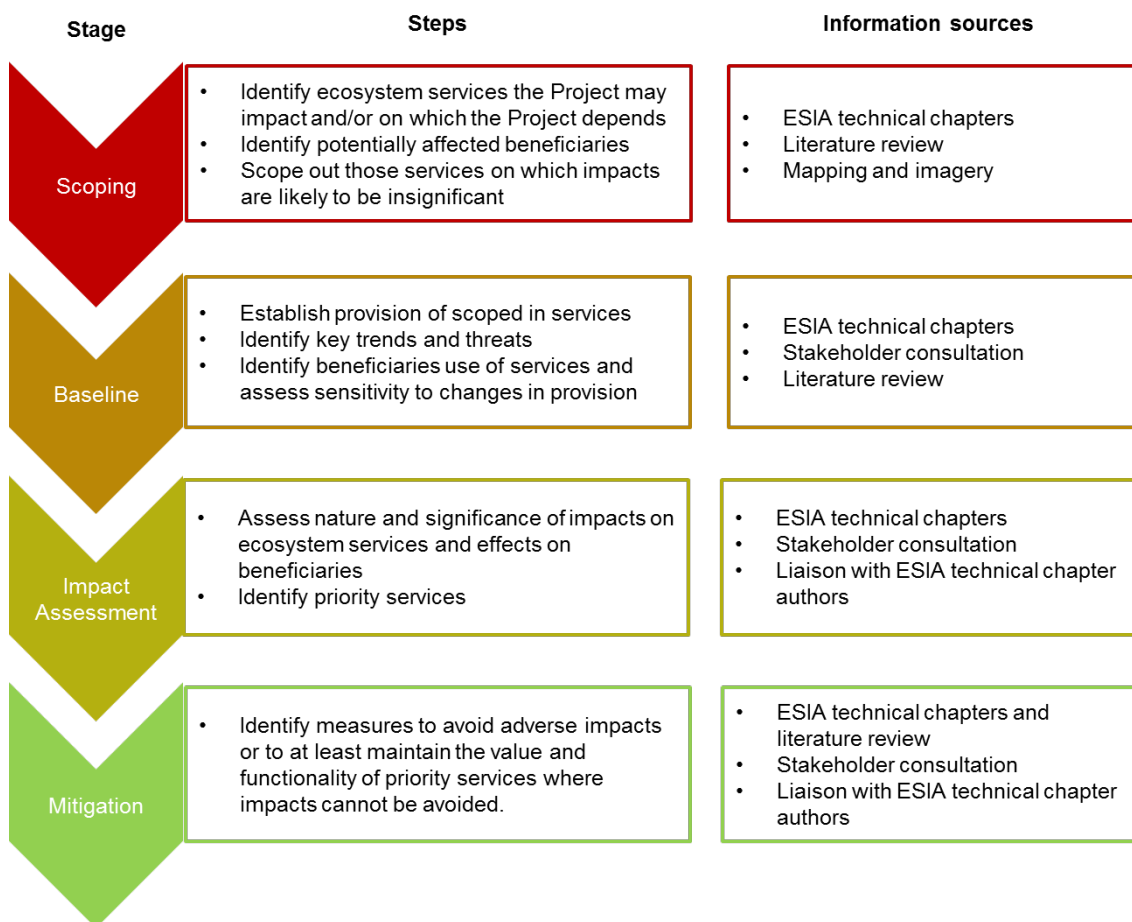
- *Scoping*: to identify the key services provided by affected ecosystems that could potentially be impacted by the Project or that the Project may depend upon;
- *Baseline establishment*: to assess the status of key services within the affected ecosystems in the absence of the Project, as well as the location of ecosystem service beneficiaries and the extent to which they benefit from the services provided;
- *Impact assessment*: to identify the likely impacts of Project activities on ecosystem services and their beneficiaries, the significance of these impacts, and which services should be considered *priority ecosystem services*; and
- *Mitigation and residual impact assessment*: to identify the range of measures that may be implemented to avoid, minimise, and compensate or offset adverse impacts on priority ecosystem services and to determine the residual impacts once mitigation is in place.

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<sup>1</sup> Note that these stages of the ESIVI tool are consistent with the methodology described in **Chapter 3 Impact Assessment Methodology** and used in other chapters.

Figure 11.1 provides a schematic overview of the assessment process and the key sources of data at each stage.

**Figure 11.1 The Ecosystem Services Assessment Process**



### 11.3 Scoping

The objective of the initial scoping exercise is to identify those ecosystem services which could potentially be affected by Project activities or that the Project may depend upon and which, therefore, ought to be subject to more detailed investigation.

Due to the complexity and interconnectivity of ecosystems, together with the uncertainty surrounding how each process within an ecosystem is likely to respond to change, isolating and assessing each of the likely impacts of a project on particular ecosystems services is a difficult task. Further, the potentially wide range of people who benefit from ecosystem services and the different values they attach to such services mean that assessing the impacts and dependencies of a project on ecosystem services is an extensive undertaking.



As such, a comprehensive assessment of every impact or dependency on each ecosystem service is beyond the scope of an ESIA<sup>2</sup>. An effective ESIA should therefore focus resources on assessing the services which are likely to be of highest priority, with further, more detailed assessments being carried out where necessary to inform the development of follow up reports.

An important element of the scoping stage is therefore to identify which services can be excluded from the ESIA in order to provide a comprehensive and manageable assessment. This was done using the ESIVI tool which contains a checklist of ecosystem services that has been compiled using the guidance, checklists, and other relevant information contained in the studies listed in the previous section. In this assessment the ESIVI checklist (Table 11.1) was used to systematically identify the services which may potentially be impacted by the Project or upon which the Project may depend. Definitions and examples of each of the ecosystem services are provided in Appendix 11.1: Ecosystem Service Checklist.

**Table 11.1 Ecosystem Services Checklist**

Provisioning Services	Regulating Services	Cultural Services
Crops	Local climate regulation	Tourism and recreation values
Livestock and fodder	Global climate regulation	Cultural and spiritual values
Capture fisheries	Air quality regulation	Scientific and knowledge values
Aquaculture	Hazard regulation	Wild species diversity
Wild foods	Water quality regulation	
Timber	Pollination	
Energy	Disease and pest control	
Oil, gas, and minerals	Noise regulation	
Biochemicals and medicine		
Water (supply)		
Fibres and ornamental resources		
Genetic resources		

Note: It is important to note that impacts on supporting services are not explicitly accounted for in the ESIVI ecosystem services assessment in order to avoid double-counting.

<sup>2</sup> Note, IFC Guidance Note 6 states that “client requirements are focused on the mitigation of impacts on ecosystem services and the benefits that ecosystem services might bring to companies rather than on the economic valuation for such services”.

Using the ESIVI checklist (Table 11.1), the range of ecosystem services potentially provided, the affected ecosystems, and the likely beneficiaries (direct or indirect) of each of those services were identified. The type of beneficiary was identified at this stage because different types of beneficiary are assessed differently with regards to mitigation requirements. For example, IFC PS 6 applies to ESS whose beneficiaries are at the local or regional scale, while PS 1 applies to ESS with global beneficiaries, such as carbon sequestration. Further, the type of beneficiaries also informs whether an ecosystem service is classed as a Type 1 service, where impacts on ecosystem services may adversely affect communities, or a Type 2 service, where the project directly depends on an ecosystem service for its operations.

Once the broadest possible range of potential ecosystem services and their associated beneficiaries were identified, each service was systematically reviewed and scored against the inclusion criteria shown in Table 11.2 to identify which ecosystem services should be included in the more detailed impact assessment and which should be scoped out of the assessment.

**Table 11.2 Criteria for Determining the Scope of the Ecosystem Services Assessment**

Inclusion Criteria	Assigned Score		
Is this service provided by affected ecosystems?	No 0	Potentially 1	Yes 2
Is the Project likely to have an impact on the ecosystem which provides this service?	No 0	Potentially 1	Yes 2
Is the Project likely to reduce any of the benefits that any people derive from this ESS?***	No 0	Potentially 1	Yes 2
Does the Project depend on this ESS for successful performance?	No 0	Potentially 1	Yes 2
Does the client have direct management control or significant influence over this ESS?†	No 0	Potentially 1	Yes 2
Is the Project likely to have an overall beneficial impact on service use or provision?	No 0		Yes 15
Ecosystem Service Relevance		Score	
Negligible	Service not present and unlikely to be affected Does not have to be assessed further	0	

*Continued...*

Inclusion Criteria		Assigned Score
Low	Project may have an insignificant impact/dependence on the service Does not have to be assessed further	1-4
Moderate	Project likely to have a significant impact on beneficiaries of the service or likely to be dependent on the service Must be assessed further	5-8
High	Project likely to have a significant impact on beneficiaries of the service and likely to be dependent on the service Must be assessed further	9-10
Benefit	Project is likely to have a positive impact on service provision Does not have to be assessed further	>10

Note, under the scoring system set out in Table 11.2, a service can only be classed as high relevance if it is both a Type 1 and a Type 2 service i.e., the Project could reduce the benefits that people derive from the service and the Project itself depends on the service for successful performance.

*Complete.*

\*\* Note, this criterion specifically refers to potential impacts on users of a service while the preceding criterion refers to potential impacts on the ecosystem which provides the service. This is an important distinction because a Project may have significant impacts on an ecosystem (such as by withdrawing significant amounts of water from a river), however, whether or not people are using this service is an important factor in assessing the significance of the impact.

† Note, this criterion follows the guidelines set out in the IFC PS and identifies whether a client can be said to have control over a Project's impacts on an ecosystem service (this may exclude, for example, upstream manufacture of inputs or downstream use of a product) and whether the impacts are likely to be of significant influence (while a Project may impact on a service, for example, it may be possible to exclude these impacts from the assessment if it is known at the scoping stage that the impacts will be insignificant in terms of beneficiaries well-being).

The purpose of this initial scoping exercise was to identify any ecosystem services which may be provided by affected ecosystems, the extent of use, and how likely each of these services are to be impacted by the Project. Once the likely relevance was assessed, a shortlist of ecosystem services to be included in the baseline and impact assessment sections was compiled. Since this is a scoping exercise, the potential impact ratings shown in Table 11.3 should not be interpreted as an ultimate determination of impact significance; rather they are intended as an indication of the potential for an impact on a service to occur and the potential level of that impact.

The scoping exercise was undertaken through a review of both the information and data collected for the EIA Report and other ESIA chapters, including satellite mapping, and stakeholder consultation. A review of published literature was also carried out to supplement the existing evidence and to provide more detailed technical information where needed. As further information became available throughout the baseline and impact assessment process, the initial scoping exercise was revisited and updated where necessary in order to ensure that all relevant ecosystem services were included in the impact assessment. The full results of the scoping exercise are found in Appendix 11.2: Scoping Results, while a summary of the rationale for inclusion or exclusion of each ecosystem service is provided in the Table 11.3.

**Table 11.3 Scoping Exercise: Summary of the Rationale for Inclusion or Exclusion of Each Ecosystem Service**

<b>Ecosystem Service</b>	<b>Relevance*</b>	<b>Include in Impact Assessment</b>	<b>Justification</b>
Crops	Negligible	No	Project activities take place wholly within the marine environment and therefore there are no impacts on crops.
Livestock and fodder	Negligible	No	Project activities take place wholly within the marine environment and therefore there are no impacts on grazing lands or livestock.
Capture fisheries	Low	No	Fishing is undertaken within the Black Sea and supports income and livelihoods dependent on fishing industries across a number of countries. Fishing takes place along Turkey's coastline in water depths of up to around 100 to 150 m, and does not occur near the Project Area ( <b>Chapter 9 Socio-Economic</b> ). Due to the location of the Project Area in Turkey's EEZ, and its closest point to Turkey's coast being more 100 km to the south, it is highly unlikely that any Turkish fisheries will be affected. Commercially important fish species such as the European anchovy migrate through the Project Area, however, <b>Chapter 8 Biological Environment</b> concludes that there is unlikely to be any significant impact on fish migration routes and patterns across the Black Sea, including for the key species targeted by Turkish fishing fleet. Artisanal or small scale fisheries workers in Turkey may have low incomes and are more likely to have fewer financial resources to rely on, which can make them vulnerable to economic fluctuations, i.e. considered a vulnerable group using IFC PS1 guidelines. However, considering that no fishing takes place in the Project Area, and the ESIA Report concludes no impact on fish or fisheries, there are unlikely to be impacts on the well-being of any beneficiaries.
Aquaculture	Negligible	No	There is no aquaculture practised within the Project Area or potentially affected by Project Activities.
Wild foods	Negligible	No	There are no wild foods collected from within the area potentially affected by Project Activities.

*Continued...*

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Timber	Negligible	No	Project Activities take place wholly within the marine environment and therefore there are no impacts on timber or other wood products.
Energy	Negligible	No	There are no known uses of biomass fuel, tidal energy, offshore wind, or biofuels within the Project Area.
Oils, gas, and minerals	Low	No	There is significant oil and gas exploration activity within the Black Sea region (Ref. 11.16). The Turkish Petroleum Corporation (TPAO) is responsible for the exploration of petroleum and natural gas in Turkey. TPAO has identified a large area of the Turkish EEZ in the Black Sea that could potentially be utilised for petroleum exploration and has defined several exploration license areas that overlap with the Project Area. As part of the design process, South Stream Transport has liaised with the TPAO regarding the width of the pipeline corridor so as to reduce any potential impact on future TPAO activities. As a result of these consultations, it is proposed that the pipelines will be laid within a 420 m width corridor, in agreement with the relevant Turkish authorities. Due to the narrow width of the pipeline corridor, there will be no impact on the feasibility of potential oil and gas exploration or development activities occurring in the vicinity of the Project. As such, the Project is unlikely to significantly impact provision or use of this service ( <b>Chapter 9 Socio-Economic</b> ).
Biochemicals and medicine	Negligible	No	The deep seas represent the largest reservoir of genetic resources and biological substances, including some of major biotechnological interest. The unusual characteristics of deep sea organisms, their unique adaptations that enable them to survive in dark, cold, and highly pressurised environments offer unique opportunities; making them the subject of considerable excitement in the scientific community with many potentially interesting commercial possibilities (Ref. 11.17 and Ref 11.18). However, there are no known stores substances of biochemical or medicinal interest present within the Project Area.
Water (supply)	Negligible	No	Project Activities take place wholly within the marine environment and therefore there are no impacts on freshwater resources.

*Continued...*

<b>Ecosystem Service</b>	<b>Relevance*</b>	<b>Include in Impact Assessment</b>	<b>Justification</b>
Fibres and ornamental resources	Negligible	No	There are no fibres or ornamental resources collected from within the Project Area.
Genetic resources	Negligible	No	As noted above the deep seas represent the largest reservoir of genetic resources and biological substances. However, there is no evidence that there are any unique genes or genetic information present within the area potentially affected by Project activities. While it is possible that there may be as yet undiscovered genetic resources, there is no recorded scientific interest in the immediate vicinity of the Project Area and the habitat is widely replicated throughout the Black Sea.
Local climate regulation	Negligible	No	It is unlikely that the area affected by Project activities has a significant influence on local or regional temperature, precipitation, or other climatic factors.
Global climate regulation	Low	No	The role of oceans in sequestering carbon is well documented (Ref. 11.19) and it is possible that disturbance of the seabed could potentially lead to the release of methane deposits. However, the impact of Project Activities on greenhouse gas storage and sequestration relative to global greenhouse gas emissions and their effects on the well-being of populations affected by climate change is considered to be negligible.
Hazard regulation	Negligible	No	The potentially affected ecosystems play no known role in hazard regulation.
Air quality regulation	Negligible	No	The affected marine ecosystems are unlikely to play a significant role in the regulation of air quality.

*Continued...*

<b>Ecosystem Service</b>	<b>Relevance*</b>	<b>Include in Impact Assessment</b>	<b>Justification</b>
Water quality regulation	Low	No	The Project could potentially impact marine water quality through accidental spills from vessels during construction. However, the affected marine ecosystems are unlikely to play a significant role in the filtration and decomposition of organic wastes and pollutants in water. Further, there are no identified beneficiaries who are dependent on the water quality regulation service in the Project Area. As such there is unlikely to be a significant impact on the well-being of any beneficiaries of this service.
Pollination	Negligible	No	Project Activities take place wholly within the marine environment and do not affect any ecosystems that might support pollination.
Disease and pest control	Negligible	No	There is no evidence to suggest that the ecosystems or any particular species within the vicinity of the Project Area play a significant role in pest control. There is also no evidence of any habitats which may influence the incidence and abundance of human pathogens.
Noise regulation	Negligible	No	The marine ecosystems within the Project Area do not play a role in noise attenuation.
Waste absorption and detoxification	Low	No	Waste absorption and detoxification are important regulating services as marine organisms store, bury, and transform many waste materials through assimilation and chemical transformation, either directly or indirectly. Oceans have a unique (though not infinite) ability to clean up sewage, waste material, and pollutants. In particular, bioturbation, the biogenic mixing of sediments on the seafloor by burrowing organisms (Ref. 11.20), and accumulation regulate the processes of decomposition and/or sequestration (e.g. by burial) of organic wastes. Given the limited scale and scope of Project activities relative to the total Black Sea area, it is considered unlikely that the ecosystem functions and processes that support waste absorption and detoxification will be significantly affected.
Tourism and recreation values	Negligible	No	Project activities will not impact any areas used for tourism or recreational activities.

*Continued...*

Ecosystem Service	Relevance*	Include in Impact Assessment	Justification
Cultural and spiritual values	Negligible	No	<b>Chapter 10 Cultural Heritage</b> identifies no marine or nautical-related nationally, regionally, or locally registered elements of intangible cultural heritage† or Turkish Living Human Treasures‡ in the vicinity of the Project. There are, however, a number of identified and potential Cultural Heritage Objects (CHOs) within the Project Area. Due to the anoxic conditions of the Black Sea, which inhibits corrosion and microbial degradation, and the depth at which they are located, CHOs are likely to be well preserved. Impacts to known CHOs are avoided as a result of the design control to re-route the pipelines during detailed design to ensure a minimum separation distance of 150 m from these known CHOs.
Scientific and knowledge values	Benefit	No	Marine surveys for the Project collected geophysical data from Black Sea locations not previously studied. Preliminary analysis of these data suggests that the Project has facilitated the discovery of information which will be valuable to scientific knowledge. Publication of the results of this research will be explored in appropriate academic publications when available. Due to the potentially significant contribution to science that such surveys have revealed, the impact of the Project on this service is considered to be beneficial.
Wild species diversity	Moderate	Yes	While there are no known natural areas within the affected marine environment that are critical to the maintenance of species populations or for the protection of the capacity of ecological communities to recover from disturbances, the Project has the potential to impact upon vulnerable and endangered species which could impact on the well-being of those who place value on the diversity of life within the Black Sea. The area of the Black Sea in which the Project is located has been considered a Critical Habitat in terms of the species of conservational concern which could be present such as Black Sea bottlenose and common dolphins and the Mediterranean Shearwater. Marine mammals such as dolphins are highly charismatic species which are valued by people throughout the Black Sea region and as such, impacts on such species could impact on the well-being of groups who value these species. More information on these species and the potential impacts of the Project is presented in <b>Chapter 8 Biological Environment</b> .

\* As calculated using the approach set out in Table 11.2, see Appendix 11.2 for full details.

† Intangible cultural heritage refers to cultural resources, knowledge, innovations and/or practices of local communities embodying traditional lifestyles.

‡ Living Human Treasures are persons who possess to a high degree the knowledge and skills required for performing or re-creating specific elements of the intangible cultural heritage.

<http://www.unesco.org/culture/ich/?pg=00061>.

*Complete.*



Based on the results of the scoping exercise, wild species diversity was the only ecosystem service taken forward for more detailed impact assessment.

## 11.4 Spatial and Temporal Boundaries

Ecosystem services are the contributions that ecosystems make to human well-being and business performance. As such, the focus of the ecosystem services assessment is on assessing changes in beneficiary well-being as a result of impacts on ecosystems and their associated services (Figure 11.2).

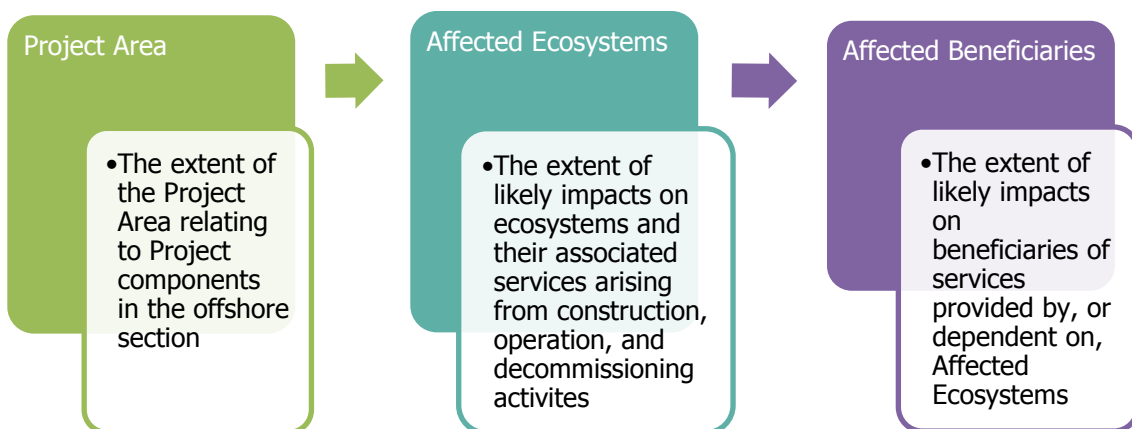
**Figure 11.2 Impact Pathway for Assessing Impacts on Ecosystem Services**



The assessment in this chapter therefore differs from other chapters in that it involves a two-stage process. First, the impacts on the ecosystem and its associated services (the biophysical receptor) need to be understood before the implications for ecosystem service beneficiaries (the social receptor) can be assessed. As such, the spatial boundaries of this assessment are determined by the Project Area and the ecosystems within it which are affected by the Construction and Pre-Commissioning, Operational and Decommissioning Phases of the Project, the flows of ecosystem services generated by these ecosystems and, ultimately, the locations of the ecosystem service beneficiaries (a socially defined area).

The relationship between the Project Area, the Affected Ecosystems, and the Affected Beneficiaries is illustrated in Figure 11.3. Further details on each of the assessment areas are provided in the following sections.

**Figure 11.3 Defining Spatial Boundaries for Assessing Impacts on Ecosystem Services**



### **11.4.1 Project Area**

As described in **Chapter 1 Introduction**, the Project Area is some 470 km in length and 2 km in width, extending along an east west orientation across the north of the Turkish EEZ.

### **11.4.2 Affected Ecosystems**

The Affected Ecosystems are defined by the extent of the ecosystems or habitats which are most likely to be impacted by the Construction and Pre-Commissioning, Operational, or Decommissioning Phases of the Project.

Identifying the ecosystems most likely to be impacted by the Project provides a useful starting point from which to identify both the potential impacts on the ecosystem services supplied by these habitats and the people who benefit from them.

For the purposes of this assessment, the starting point for assessing the potential impacts of the Project on ecosystem services and their beneficiaries has been defined as the entire Central Black Sea, including the Turkish EEZ.

### **11.4.3 Affected Beneficiaries**

Due to the interconnectedness of ecosystem processes and the flows of services they provide, impacts on Affected Ecosystems may impact the ability of people to use or access particular services outside of the Affected Ecosystems. For example, fish species may breed at particular sites within Affected Ecosystems and then migrate throughout the marine environment supporting fishing industries across multiple countries.

As such, beneficiaries living outside of the Affected Ecosystems may be impacted by changes to the services provided and the assessment therefore needs to consider, *"...project-related impacts across the potentially affected landscape or seascape...which does not necessarily correspond to any one pre-defined unit of geographical space"*(Ref 11.8).

Further, the location of beneficiaries can vary depending on the type of service and, as such, beneficiaries are not restricted to a particular spatial area or landscape. For example, while the beneficiaries of local climate regulation services may be restricted to the surrounding area, the beneficiaries of global climate regulation may be located throughout the world. As such, the extent of impacts on beneficiaries of ecosystem services can extend far beyond the Project Area or the Affected Ecosystems.

The Affected Beneficiaries are therefore defined by the location of the beneficiaries of the services provided by or dependent upon the Affected Ecosystems. While most of the beneficiaries are likely to be located within or around the ecosystems providing services, they vary across different services and can be located regionally, nationally, or even globally.

As such, the location of Affected Beneficiaries are not restricted to a single pre-defined unit of geographical space and instead are defined for each ecosystem service depending on the beneficiaries of that service.

#### **11.4.4 Temporal Boundaries**

The temporal boundaries of this assessment are defined by the five key phases of the Project as set out in **Chapter 1 Introduction**. These include:

- Feasibility Phase (2007 to early 2012);
- Development Phase (late 2011 to late 2013);
- Construction and Pre-Commissioning Phase (2014 to end of 2017);
- Full Operational Phase (2017 to 2065); and
- Decommissioning Phase (2065 onwards).

Unless otherwise indicated, the temporal boundaries of this assessment are assumed to be the operational life of the Project (i.e. 50 years). Decommissioning is considered in less detail because the decommissioning program will be developed during the Operational Phase of the Project. A review, and relevant studies if necessary, will be undertaken during the Operational Phase to confirm that the planned decommissioning activities utilise GIIP and are the most appropriate to the prevailing circumstances.

### **11.5 Baseline Data**

#### **11.5.1 Methodology and Data**

Following the scoping exercise, the next step was to establish the present condition of the scoped-in services as well as broad trends in their provision and use. The baseline provides an analysis of the existing condition of an ecosystem and the services it provides in the absence of the Project, taking into account external factors (i.e. not related to the Project) that may affect future service provision including, for example, changes in fisheries policy, etc. Ultimately, the baseline provides a counterfactual or reference scenario from which the impacts of the Project can be measured and covers:

- Current provision of services and how the ecosystem or habitat supports their delivery;
- The importance of ecosystem services to beneficiaries; and
- How ecosystem services and the benefits they provide are likely to change in future in the absence of the Project.

The data used for the baseline assessment was obtained from a wide range of sources including secondary sources (i.e. existing data including government or academic reports etc.) and primary sources (i.e. new data collected through interviews and stakeholder engagement activities) as described in **Chapter 6 Stakeholder Engagement**.

The remainder of this section sets out the data sources in more detail and the limitations of the assessment in terms of the availability of data collected.

## **11.5.2 Secondary Data**

Secondary data and information was obtained through a literature review of relevant peer-reviewed journal articles, research reports, and publically available databases.

## **11.5.3 Data Gaps**

Due to the fact that the importance of services provided by different ecosystems depends upon how people interact with and value them, the analysis of secondary data revealed a number of information gaps in relation to the provision and use of services which were not captured through secondary data sources.

### **11.5.3.1 Primary Data and Baseline Surveys**

In light of the data gaps that emerged from the review of secondary data, a data collection exercise was undertaken which sought to supplement the secondary data gaps as well as to verify the secondary data available. Primary data on ecosystem services was collected during country visits in 2013. These visits included meetings and interviews with government authorities and fisheries enterprises representatives.

A series of marine baseline surveys were also conducted between 2009 and 2011 to collect data on marine ecological receptors that might be present in the Project Area. These surveys collected ecological and physico-chemical data over a wide area and during several seasons. More information on these surveys is presented in **Chapter 8 Biological Environment**.

Since ecosystem services represent the intersection between the natural and human environment, this chapter also draws upon the baseline information and analysis conducted in other relevant chapters of this ESIA Report. Any gaps in the baseline data relating to ecosystem services were discussed with the relevant technical chapter specialists in case the information was readily available and/or could be obtained through on-going data collection and stakeholder engagement.

### **11.5.3.2 Data Assumptions and Limitations**

Accurate, quantifiable data on the use of ecosystem services is used where possible, however, for many ecosystem services the data were not available to establish a detailed and quantifiable metric in terms of baseline provision or use for each ecosystem service.

While this is a potential limitation, it does not significantly undermine the results of the assessment since the ecosystem services assessment refers to and builds upon the assessments undertaken in each chapter of this ESIA Report which use measurable metrics for assessing changes in the natural environment. The emphasis of this assessment is placed on drawing together the information presented in other chapters of this ESIA Report to assess the impacts on the well-being of beneficiaries resulting from changes in the natural environment. As such, the ecosystem services assessment aims to measure changes in well-being as a result of changes in the provision of ecosystem services.

Due to the fact that there is a high degree of variance between the values different beneficiaries attach to different services, measuring well-being impacts using a single metric

across all services and beneficiaries is a difficult task. One approach is to use economic valuation techniques to estimate the value of changes in well-being resulting from changes in ecosystem service provision in monetary terms.

However, due to the need for detailed, high quality primary data to establish reliable economic valuation estimates, the time consuming nature of undertaking such primary data collection exercises, and the relatively limited value this would add to the overall assessment, an economic valuation of ecosystem service use has not been undertaken here. This is in line with IFC Guidance Note 6 which states, "...client requirements are focused on the mitigation of impacts on ecosystem services and the benefits that ecosystem services might bring to companies rather than on the economic valuation of such services" (Ref 11.8).

In light of this, the value of services provided by Affected Ecosystems has been assessed in a qualitative manner through stakeholder engagement, discussions with relevant specialists, and literature review.

## 11.6 Baseline Characteristics

### 11.6.1 Wild Species Diversity

**Definition:** People derive value from interaction with wild species as well as from knowledge of their continued existence; these values may extend locally, regionally, nationally, or even globally. Species are considered to be locally important if they are valued by local communities for reasons in addition to the other ecosystem services they may provide. Species are considered to be regionally important if they are listed on the Black Sea Red Data Book and globally important if listed on the International Union for Conservation of Nature (IUCN) Red List as being vulnerable, endangered, or critically endangered.

The Project is located within a marine ecosystem that provides habitats for several species, including plankton, fish, seabirds, and marine mammals. While there are no local groups of beneficiaries identified who may place particular value on the area or the species within it, there are several fish, bird, and mammal species are of regional and international importance which are likely to be of value to the conservation community.

The habitat of the abyssal plain is a fairly uniform expanse of muddy seabed. Although very little is known about the seabed of the Black Sea abyssal plain it is an area that is devoid of meiofaunal and macrofaunal life. Anoxic conditions and the presence of hydrogen sulphide mean that only sulphur or methane metabolising bacteria, and one infaunal species of microscopic metazoan, have been observed to survive in these zones. However, the diversity and abundance of microscopic organisms in this habitat is not fully known. In some circumstances deep sea bacterial communities can form microbial mats or reef structures, although no such communities were observed along the proposed Pipeline route (Ref. 11.21).

In this area of the Black Sea **plankton** abundance is low and in terms of the larvae and juveniles of commercially important species, only anchovy, sprat, and horse mackerel were

observed in the Project Area. There are no **benthic invertebrates** known to inhabit the anoxic abyssal plain of the Black Sea.

For **birds**, most feeding takes place in coastal areas although there are likely to be some species foraging offshore when pelagic fish species like anchovy are migrating between the northern and southern coasts of the Black Sea. The most common birds seen in the Project Area were the Mediterranean shearwater (*Puffinus yelkouan*), which has an IUCN status of vulnerable and the Caspian gull (*Larus cachinnans*).

In addition to seabirds, there are a number of bird species observed which are not linked to the sea, or generally not found in the open sea. During surveys two falcon species were observed: the peregrine falcon (*Falco peregrinus*) listed as endangered in the Red Data Book of the Black Sea and the Saker falcon (*Falco cherrug*) listed as endangered in the IUCN Red List and vulnerable in the Black Sea Red Data Book.

For **fish**, the most common species likely to be present in the surface waters of the Turkish EEZ include but are not limited to sprat, anchovy, Black Sea garfish (*Belone belone euxini*), Black Sea pelagic pipefish (*Syngnathus schmidtii*), and Black Sea horse mackerel, Atlantic bonito (*Sarda sarda*), and chub mackerel (*Scomber colias*). Of these species, the Black Sea garfish and Black Sea pelagic pipefish are endemic whilst all other species are cosmopolitan. The Black Sea garfish and Atlantic bonito are listed on the Black Sea Red Data Book as endangered and critically endangered respectively. However, the Atlantic bonito is critically endangered in the western Black Sea near Bulgaria only. Although sprat is not listed in the IUCN Red List, the Azov sprat (*Clupeonnella cultriventris*) which may be synonymous to other sprat species for Black Sea countries is listed as endangered.


Three species of **marine mammals** are known to occur in the Black Sea and are represented by subspecies. These are the Black Sea harbour porpoise (*Phocoena phocoena relicta*), the Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*) and the Black Sea common dolphin (*Delphinus delphis ponticus*). Two of the three cetacean species that occur in Turkish waters, namely harbour porpoise and bottlenose dolphin are globally endangered and included in the Black Sea Red Data Book. All three species are listed in Annex II of the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention) as endangered. The presence of marine mammals is low compared to the continental shelf zones of the Black Sea.

For further information see **Chapter 8 Biological Environment**.

### 11.6.2 Baseline Summary

A summary of the baseline conditions of the key ecosystem services is provided in Table 11.4. Likely future trends are indicated as follows: ↗ increasing provision; ↘ decreasing provision; ↔ no overall change in provision; and ± some increases and some decreases in provision. The importance of the ecosystem service is indicated by: ■ high importance; ■ medium-high importance; ■ medium-low importance; and ■ low importance.

**Table 11.4 Baseline Summary**

Service	Provision	Future Trend and Importance	Key Drivers of Change	Key Beneficiaries
Wild species diversity	A number of vulnerable species are present within the marine environment		Habitat loss, disease, invasive species	National and global conservation community

## 11.7 Impact Assessment

### 11.7.1 Impact Assessment Methodology

The assessment of impacts on ecosystem services broadly follows the approach set out in **Chapter 3 Impact Assessment Methodology**. It follows the same steps and uses the same assessment criteria but differs in one important respect: it assesses impacts from the point of view of the ecosystem service beneficiaries. The impact is therefore measured as the change in human well-being (relative to the baseline) as a result of a change in the level of provision of an ecosystem service.

The nature and significance of impacts are determined using a set of criteria that reflect the value of ecosystem services to beneficiaries; the resilience of ecosystems and their beneficiaries to change; and the extent, duration, reversibility, and frequency of the impacts. These criteria are explained more fully in the sections that follow.

#### 11.7.1.1 Impact Assessment Criteria

##### Receptor Sensitivity

Receptor sensitivity is determined using information from the baseline and provides a detailed understanding of the importance of each ecosystem service to its respective beneficiaries, taking account of:

The **value** of ecosystem services to beneficiaries, i.e.:

- The extent to which beneficiaries are *dependent on the ecosystem service* (e.g. whether fishing is undertaken occasionally as a recreational activity or regularly as an important part of livelihoods); and
- The *scarcity value* of the ecosystem service (e.g. the availability of suitable alternatives or substitutes) and how readily replaceable it is considering accessibility and affordability.

And the **resilience** of ecosystems and beneficiaries to change, i.e.:

- The *sensitivity of the ecosystem* to change (e.g. as a result of climate change, population pressures etc). This will depend on *inter alia* the existing condition of the ecosystem, its

functions, and its thresholds. For example, some fish species (such as anchovy) are particularly sensitive to changes in noise levels (Ref. 11.22); and

- The *sensitivity of beneficiaries* to changes in ecosystem service provision. This will depend on *inter alia* beneficiaries' existing endowments of, or access to, factors such as financial, human, physical, natural, and institutional capital. For example, artisanal fishers are likely to be more sensitive to changes in fish populations than large scale commercial fishing operations.

The extent to which an ecosystem service fulfils each of these criteria is scored on a four point scale as shown in Table 11.5. Note that receptor sensitivity is independent of Project impacts and relates to the existing situation and the capacity of ecosystems and ecosystem service beneficiaries to adapt to any type of change (e.g. climate change, population growth, etc.).

**Table 11.5 Criteria Used to Determine Receptor Sensitivity**

Sensitivity Criteria		Assigned Scores			
		Score 1	Score 2	Score 3	Score 4
Value	What is the degree of dependence by beneficiaries on the ecosystem service?  <i>Note: this can include type of use e.g. subsistence vs. recreational and intensity of use e.g. occasional vs. continual</i>	Negligible	Low	Moderate	High
	To what extent is this ecosystem service replaceable? Or are good substitutes available without entailing significant costs?  <i>Note: this should specifically refer to the availability of alternatives</i>	Service is widely available	Some alternatives available	Few alternatives available	No alternatives available
Resilience	What is the sensitivity of the ecosystem to change?  <i>Note: this should refer to the biological sensitivity of the ecosystem to change</i>	Negligible	Low	Moderate	High
	What is the vulnerability of the human receptors to any change in ecosystem service provision?  <i>Note: this should refer to the socio-economic capacity of people to adapt</i>	Negligible	Low	Moderate	High

The scores assigned to each criterion are then added together for each ecosystem service to arrive at the overall receptor sensitivity score as shown in Table 11.6.



**Table 11.6 Approach to Determining Overall Receptor Sensitivity**

Receptor Sensitivity		Score
Negligible	The service is of low value to beneficiaries (due to low dependency or the existence of widely available alternatives) and the environmental and human receptors are highly resilient.	4
Low	The service is of low value to beneficiaries (due to low dependency or the existence of widely available alternatives) and the environmental and human receptors are moderately to highly resilient.  Alternatively, the service is of moderate value to beneficiaries and the environmental and human receptors are highly resilient.	5-8
Moderate	The service is of moderate value to beneficiaries (due to moderate dependency or the existence of some alternatives) and the environmental and human receptors are moderately resilient.  Alternatively, the service is of high value to beneficiaries and the environmental and human receptors are highly resilient.	9-12
High	The service is of high value to beneficiaries (due to high dependency or the lack of suitable alternatives) and the environmental and human receptors have low resilience.  Alternatively, the service is of moderate value to beneficiaries and the environmental and human receptors have low resilience.	13-16

**Impact Magnitude**

The assessment of Project impacts on ecosystem services follows the methodology described in **Chapter 3 Impact Assessment**. The magnitude of each of the identified impacts on ecosystem services is evaluated on the basis of the following criteria:

- The **severity** of the impact on the well-being of ecosystem service beneficiaries;
- The **reversibility** of the impact (i.e. how quickly is the ecosystem able to recover from the impact);
- The **duration** of the impact *on beneficiaries*; and
- The **frequency** with which ecosystem service beneficiaries are affected by the impacts of Project activities.

Each impact is scored against each of the criteria on a four point scale as shown in Table 11.7.

**Table 11.7 Criteria for Determining Impact Magnitude**

Magnitude Criteria	Assigned Scores			
	Score 1	Score 2	Score 3	Score 4
<b>Severity:</b> What is the likely severity of the impact on the well-being of any beneficiaries of the service, considering both the number of beneficiaries affected and the degree to which they are affected?	Negligible	Low	Moderate	High
<b>Reversibility:</b> How quickly is the ecosystem (or ecosystem functionality) able to recover from the impact?	Short term <i>Will recover completely in a short period of time once the activity ceases, e.g. turbidity levels in a water column</i>	Medium term <i>Reversible after some time with no intervention. Ecosystem functionality will recover with some changes to ecosystem function at natural recovery rates (e.g. re-establishment of planktonic nutrient cycling process)</i>	Long term <i>Reversible after some time with intervention. Recovery will occur but is retarded by impact (e.g. introduction of species whose numbers were depleted by the impact)</i>	Permanent
<b>Duration:</b> How long is the impact on beneficiaries expected to last?	Short term <i>Impacts occur over a few weeks or for a single season</i>	Medium term <i>Impacts occur over an extended period covering multiple seasons</i>	Long term <i>Impacts affect the current human generation, e.g. 25 years</i>	Permanent <i>Impacts extend over multiple generations, e.g. &gt;25 years</i>
<b>Frequency:</b> How often are ecosystem service beneficiaries affected by the impacts of the Project activity?	Once off	Periodic <i>Effects are intermittent and sporadic over assessment period</i>	Regular <i>Effects are intermittent but regularly repeated over assessment period</i>	Continuous

The scores assigned to each criterion are added together for each ecosystem service to arrive at a total impact magnitude score for each ecosystem service which is classified as shown in Table 11.8.

**Table 11.8 Determining Overall Impact Magnitude**

Impact Magnitude		Score
Negligible	The impact is within the normal range of variation of the ecosystem and is not significant for the ecosystem service beneficiaries	4
Low	The impact results in a small reduction in the availability or functionality of the ecosystem but is unlikely to give rise to any significant, lasting change in service provision or well-being of any beneficiaries and will not impact on Project operations	5-8
Moderate	The impact results in a moderate reduction in the availability or functionality of the ecosystem which may give rise to a change in service provision and the well-being of any beneficiaries and/or may compromise Project operations	9-12
High	The impact results in the loss of all or a significant proportion of the availability or functionality of an ecosystem which is likely to give rise to a significant change in service provision and the well-being of any beneficiaries and/or will compromise Project operations	13-16

### 11.7.1.2 Impact Significance

Once the receptor sensitivity and impact magnitude for each of the ecosystem services is estimated they are then combined to estimate the impact significance using the impacts significance matrix set out in Table 11.9.

**Table 11.9 Impacts Significance Matrix**

		Receptor Sensitivity (Vulnerability and Value)			
		<i>Negligible</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>
Impact Magnitude (Extent, Frequency, Reversibility, Duration)	<i>Negligible</i>	Not significant	Not significant	Not significant	Not significant / Low*
	<i>Low</i>	Not significant	Low	Low / Moderate†	Moderate
	<i>Moderate</i>	Not significant	Low / Moderate	Moderate	High
	<i>High</i>	Low	Moderate	High	High

\* Allows technical discipline author to decide if impact significance is **Not significant** or **Low**

† Allows technical discipline author to decide if impact significance is **Low** or **Moderate**

Based upon the resulting impact significance score, *priority ecosystem services* i.e. those upon which the Project is likely to have a significant impact and which result in adverse impacts on beneficiaries, and/or those upon which the Project is directly dependent for its operations are determined as follows:

- **Not significant** to **Low** impact significance – not a priority service and no mitigation required beyond that which is set out in other Chapters; and
- **Moderate** to **High** impact significance – *priority service* and further mitigation measures required to maintain the value and functionality of the affected service.

A residual impact assessment was then undertaken to evaluate the effectiveness of the proposed mitigation measures and assess the net impacts with these measures in place. The mitigation measures specified in this chapter relate to design controls and mitigation measures outlined in each of the relevant technical chapters. These chapters have adopted a mitigation hierarchy of mitigation selection, from avoidance through to offsetting, which is outlined in full in **Chapter 3 Impact Assessment Methodology**.

## **11.7.2 Assessment of Potential Impacts: Construction and Pre-Commissioning**

### **11.7.2.1 Introduction**

The following sections provide a description of the nature and significance of Project impacts on ecosystem services and their beneficiaries during the Construction and Pre-Commissioning Phase. A detailed breakdown of the scoring assigned to each ecosystem service is provided in Appendix 11.3 Impact Assessment – Construction and Pre Commissioning and Operation.

#### **Wild Species Diversity**

The service considered in this section is the diversity of locally, regionally, nationally, or globally important species which live within, or are dependent upon, the Affected Ecosystems. The beneficiaries include any communities who value and appreciate the existence and diversity of species living within or dependent upon Affected Ecosystems.

The Project Activities which may impact provision of this service include:

- Disturbance to fish through vessel discharges, displacement of food resources, underwater noise emissions, and use of lighting;
- Disturbance to seabirds through physical presence of vessels (bird strikes), displacement of food resources, use of lighting, and vessel discharges; and
- Disturbance to marine mammals through vessel discharges, displacement of food resources, underwater noise emissions, and collisions.

### *Receptor Sensitivity*

Beneficiaries of wild species diversity (i.e. those who value the existence of wild species) do not depend on the service as an important source of livelihoods or income and, due to the distance from land, there are no local groups of beneficiaries which attach particular importance to interactions with any of the species. However, there are a number of threatened species within the marine environment in the Project Area which may be important to conservation communities and any beneficiaries who gain satisfaction from knowing that certain species or the habitats that support them exist. Further, marine mammal species such as dolphins are charismatic and valued by beneficiaries across the Black Sea countries (for example, dolphinariums are popular in both Russia and Bulgaria). Impacts on such species could therefore impact on the well-being of groups who value these species.

While the ecological role of a particular species could potentially be replaced by another, the existence value of that species cannot. Therefore, there are no replacements available to individual species. If a species is lost from an area it could be reintroduced from other areas although there are significant costs associated with such processes and a successful reintroduction can be difficult to achieve.

Due to the presence of endangered and vulnerable bird and mammal species for at least parts of the year in the Project Area (**Chapter 8 Biological Environment**), the sensitivity of the ecosystem to any form of disturbance is considered to be high. However, the sensitivity of human beneficiaries is considered low due to the widespread national and international financial and legislative resources available to adapt to any changes.

In sum, the receptor sensitivity for the wild species diversity service is considered to be moderate.

### *Impact Magnitude*

Construction activities and associated vessel operations and movements, have the potential to temporarily disturb fish, seabirds, and marine mammals.

Collisions may also occur with marine mammals. However, these are highly mobile animals with acute sensory perception and are generally able to avoid areas of disturbance and only a few individuals are likely to be affected. All of the construction impacts on marine mammals are of negligible to low magnitude. Seabirds can be attracted to lights from the vessels or can be displaced by vessel movements. However all of the construction impacts on seabirds are of negligible to low magnitude. Fish can be impacted by waste discharges and noise and light emissions from construction vessels. The majority of impacts on fish are of negligible magnitude with the exception of noise which can be considered of low magnitude.

While there may be some impact on the distribution of populations in the area, there are unlikely to be any significant changes in the size or health of populations of these species. There are no local groups of beneficiaries who are likely to be impacted by this. **Chapter 9 Socio-Economic** states there will be no impact on fisheries from Project Activities. However, due to the protected status of the bottlenose and common dolphin species, such impacts may be of concern to the conservation community. Nevertheless, impacts on the well-being of conservation communities are likely to be low and limited to the construction period.

In summary, the impact magnitude on the wild species diversity service is considered to be low.

#### *Impact Significance*

In combination, the total impact significance on the wild species diversity ecosystem service is considered to be **Low** and is not identified as a priority service.

### **11.7.2.2 Mitigation and Monitoring**

Based on the results of the impact assessment (see Appendix 11.3 for a detailed summary of the scoring assigned to each ecosystem service), no priority services were identified which are likely to be significantly impacted during the Construction and Pre-Commissioning Phases of the Project and which will require additional mitigation beyond that set out in the other chapters.

### **11.7.2.3 Residual Impacts: Construction and Pre-Commissioning Phase**

The residual Project impacts during the Construction and Pre-Commissioning Phase are summarised in Table 11.10.

## **11.7.3 Assessment of Potential Impacts: Operational Phase**

### **11.7.3.1 Introduction**

In the following sections the key beneficiaries of each ecosystem service and the relevant Project impacts during the Operational Phase are discussed. For each of the ecosystem services the beneficiaries are grouped together and the Project impact is assessed in terms of the total impacts on that service across all of its beneficiaries. A detailed breakdown of the scoring assigned to each ecosystem service is provided in Appendix 11.3.

### **Wild Species Diversity**

Pipeline inspection and maintenance will involve some vessel movements. The limited frequency and extent of such activities means that any interaction with fish, seabirds, and marine mammals will be minimal and there is unlikely to be any impact on well-being of any beneficiaries.

Impacts on wild species diversity from operational activities are therefore considered to be of negligible magnitude and **Not Significant**.

### **11.7.3.2 Mitigation and monitoring**

There were no priority services identified for the Operational Phase and therefore no mitigation beyond that set out in the other ESIA chapters is required.

### **11.7.3.3 Residual Impacts: Operational Phase**

Table 11.11 presents a summary of the residual effects of impacts on ecosystem services on their beneficiaries.

**Table 11.10 Assessment of Potential Impacts: Construction and Pre-Commissioning**

<b>Ecosystem Service</b>	<b>Activity</b>	<b>Potential Impact</b>	<b>Receptor</b>	<b>Receptor Sensitivity</b>	<b>Impact Magnitude</b>	<b>Pre-Mitigation Impact Significance</b>	<b>Summary of Mitigation Measures</b>	<b>Residual Impact Significance</b>
Wild species diversity	Offshore pipe-laying	Disturbance to marine species	National and Global conservation community	Moderate	Low	<b>Low</b>	None required	<b>Low</b>

**Table 11.11 Assessment of Potential Impacts: Operational Phase**

<b>Ecosystem Service</b>	<b>Activity</b>	<b>Potential Impact</b>	<b>Receptor</b>	<b>Receptor Sensitivity</b>	<b>Impact Magnitude</b>	<b>Pre-Mitigation Impact Significance</b>	<b>Summary of Mitigation Measures</b>	<b>Residual Impact Significance</b>
Wild species diversity	Vessel movements and routine operations	Disturbance to marine species	National and Global conservation community	Moderate	Negligible	<b>Not Significant</b>	None required	<b>Not Significant</b>

#### **11.7.4 Assessment of Potential Impacts: Decommissioning Phase**

Decommissioning of the South Stream Offshore Pipeline will be carried out according to prevailing international and national legislation and regulations and best practices regarding environmental and other potential impacts.

A review, and relevant studies if necessary, will be undertaken during the Operational Phase to confirm that the planned decommissioning activities utilise GIIP and are the most appropriate to the prevailing circumstances. The review will outline management controls and demonstrate that the decommissioning activities will not cause unacceptable environmental and social impacts. The decommissioning activities will also require all relevant approvals and authorisations from the Turkish Government departments responsible at the time.

Two options are available; namely in situ decommissioning or pipe removal:

- In situ decommissioning involves cleaning the pipeline and filling it with seawater. The receptors and degree of impact are thus the same as those for the Operational Phase; or
- Removal of the pipeline is a similar operation to pipe-laying, but in reverse. The receptors and degree of impact will thus be similar to those identified for the Construction and Pre-Commissioning Phase.

Impacts that may be associated with decommissioning will be assessed as part of the process of developing decommissioning management plans and are not assessed in this ESIA Report.

### **11.8 Unplanned Events**

Unplanned events are assessed in **Chapter 13 Unplanned Events**, those relevant to the provision or use of ecosystem services are discussed below.

#### **11.8.1 Construction and Pre-Commissioning Phase**

The use of survey and pipe-laying vessels and equipment could lead to fuel and oil spillages. Oil spills within the marine environment could have significant impacts across a range of ecosystem services including fisheries and wild species diversity. Although the likelihood of unplanned events occurring during construction is very low, given the presence of sensitive marine ecological and commercial species, an oil spill of sufficient size and proximity could have significant adverse consequences.

It is therefore a key objective of the Project to minimise the likelihood of occurrence of an oil spill and for contractors to develop Oil Spill Prevention and Response Plans that would effectively minimise the potential for adverse impacts on potentially impacted marine species and habitats. The mitigation measures described in **Chapter 13 Unplanned Events** contain detailed measures to minimise the probability of an oil spill occurring, and thus reduce the potential adverse impacts to marine habitats, and their beneficiaries, in the event of a spill.

Another risk to wild species diversity and capture fisheries in the marine environment is through the potential for introduction of non-native invasive species which could out-compete species



currently living within the marine ecosystem (**Chapter 8 Biological Environment**). Vessel operations have the potential to inadvertently introduce invasive non-native species, either in ballast water or carried as fouling organisms on the hull. Mitigation measures for invasive species are presented in **Chapter 13 Unplanned events**.

### **11.8.2 Operational Phase**

During the Operational Phase of the Project unplanned events at sea may occur as a result of unplanned leakages of natural gas from the Pipeline. This could be incurred by third-party vessel interaction with the pipeline by events including sinking, grounding and dropped object (such as a container) damage to the Pipeline. **Chapter 13 Unplanned Events** assesses the likelihood of occurrence of such events as being remote.

Gas passage through the water column could also impact upon marine organisms (such as fish and marine benthos), resulting in potential acute or chronic impacts depending upon exposure levels and environmental conditions (e.g. water temperature, dissolved oxygen).

In the event of an uncontrolled gas release from the pipeline, the gas flow will be shut off as soon as practicable. During normal operations, this would occur along approximately one third (the Western end) of the length of Pipeline in the Turkish EEZ. For areas where the water would not ingress, any gas released from a damaged sub-sea pipeline would rise through the water column as a plume of gas bubbles. On reaching the sea surface, the gas would disperse into the air. **Chapter 13 Unplanned Events** provides details of the measures included in the pipeline design that aim to minimise the potential for uncontrolled gas releases from the pipeline.

Maritime vessel operations during the Operational Phase will be limited to the periodic use of maintenance vessels. During operation, there is potential for vessels to be used from outside of the Black Sea which could inadvertently introduce invasive alien species to the marine environment in the same manner as stated during the Construction and Pre-Commissioning Phase. Mitigation measures adopted during construction will also be applicable to operation.

### **11.8.3 Decommissioning Phase**

The expected service lifetime of the South Stream Offshore Pipeline is 50 years. The decommissioning program will be developed during the Operational Phase of the Project. Consequently, unplanned events associated with the Decommissioning Phase are unknown at this stage; however, it is anticipated that some of the potential unplanned events will be similar in nature to some of those that may arise during the Construction and Pre-Commissioning Phase.

## **11.9 Cumulative Impacts Assessment**

The cumulative impact assessment (CIA) considers the incremental impacts of the Project on priority ecosystem services and their associated beneficiaries within the context of other existing, planned, or reasonably defined developments at the time the risks and impacts identification process was undertaken.

However, as discussed in **Chapter 14 Cumulative Impact Assessment**, no significant cumulative impacts have been identified during the Construction and Pre-Commissioning, Operational or Decommissioning Phases.

## 11.10 Conclusions

In terms of ecosystem services, the assessment has identified no priority services on which the Project is likely to have a significant impact during the Construction and Pre-Commissioning Phase or during the Operational Phase. A summary is provided in Table 11.12.

**Table 11.12 Assessment Summary**

Priority Service	Potential Impact	Impact Significance	Mitigation Measures	Residual Impact
Wild species diversity	Disturbance to species as a result of vessel movements and operations	C: <b>Low</b>	None required	C: <b>Low</b>
		O: <b>Not significant</b>		O: <b>Not significant</b>

C: Construction Phase; O: Operational Phase

No mitigation was identified to be required beyond that set out in other ESIA chapters. The combined effects of the Project and other developments are not expected to result in any significant cumulative impacts on ecosystem service beneficiaries.

## References

Number	Reference
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