



# **H.M. Government of Gibraltar**

## **Marine Strategy Framework Directive**

### **Initial Assessment and Proposals for Good Environmental Status in British Gibraltar Territorial Waters**

December 2012



Produced in collaboration with AMEC Environment & Infrastructure UK Limited.

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## Report for

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Shoal of *Boops boops* over Europa Reef: Clive Crisp

*Felimare picta* on SS Roslyn (artificial reef): Dr. Darren Fa



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## Glossary

<b>ACCOBAMS</b>	Agreement on the Conservation of Cetaceans Of the Black And Mediterranean Seas.
<b>BGTW</b>	British Gibraltar Territorial Waters
<b>BOPA</b>	Benthic Opportunistic Polychaetes and Amphipod – a biotic index
<b>CBD</b>	Convention on Biological Diversity
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>DBT</b>	Dibutyltin
<b>dB re 1µPa</b>	Decibel relative to 1 micro Pascal - measure of sound pressure level.
<b>°C</b>	Degrees Centigrade
<b>DIN</b>	Dissolved Inorganic Nitrogen
<b>EAC</b>	Ecologically Acceptable Concentration
<b>EC</b>	European Commission
<b>EEC</b>	European Economic Community
<b>EIA</b>	Environmental Impact Assessment
<b>EQS</b>	Ecological Quality Standards
<b>EU</b>	European Union
<b>GES</b>	Good Environmental Status
<b>GHG</b>	Green House Gas
<b>GONHS</b>	Gibraltar Ornithological & Natural History Society
<b>HWMB</b>	Heavily Modified Water Body
<b>Hz</b>	Hertz
<b>IAS</b>	Invasive Alien Species
<b>kg</b>	Kilograms
<b>kHz</b>	Kilohertz
<b>km</b>	Kilometre
<b>m</b>	Meter
<b>MAP</b>	Mediterranean Action Plan
<b>MCZ</b>	Marine Conservation Zone
<b>ml</b>	Millilitre
<b>MoD</b>	Ministry of Defence
<b>MPA</b>	Marine Protected Area
<b>MSFD</b>	Marine Strategy Framework Directive
<b>NPA</b>	Nature Protection Act
<b>NGO</b>	Non-Governmental Organisation
<b>NIS</b>	Non-Indigenous Species
<b>nm</b>	Nautical Mile
<b>ppt</b>	Parts Per Thousand
<b>REACH</b>	Registration, Evaluation, Authorisation and Restriction of Chemical substances
<b>SAC</b>	Special Area Conservation
<b>SPA</b>	Special Protection Areas
<b>t</b>	Tonnes
<b>TBT</b>	Tributyltin
<b>UK</b>	United Kingdom
<b>UNEP</b>	United Nations Environment Plan
<b>WFD</b>	Water Framework Directive

# 1. Introduction

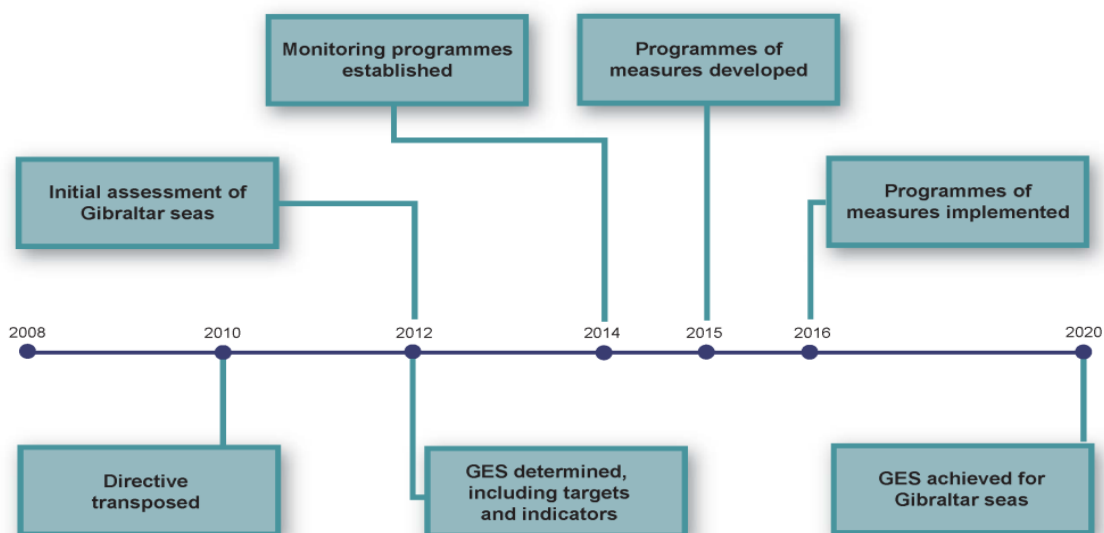
## 1.1 Introduction

1.1.1 Within Europe marine habitats and species continue to be affected by human activities. The Marine Strategy Framework Directive (MSFD) (2008/56/EC) was developed in response to concerns that although existing legislation protected the sea from some specific impacts, it was sectoral and fragmented. There was also recognition that since some of the activities that impact on the marine environment are managed at a European or international level (e.g. fisheries and shipping) and other impacts can cross national boundaries (e.g. litter, eutrophication, noise), national action to protect the marine environment needs to be supported by a framework to ensure action is taken across Europe.

1.1.2 The MSFD requires Member States to put in place the necessary management measures to achieve Good Environmental Status (GES) in their marine waters by 2020. GES is defined in the Directive<sup>1</sup> and described in more detail by 11 high-level Descriptors (see p.8) which set out what Member States must achieve in their marine waters. Achieving GES involves protecting the marine environment, preventing its deterioration and restoring it where practical, whilst at the same time providing for sustainable use of marine resources.

1.1.3 The MSFD requires Member States to go through a number of stages before the eventual implementation of management measures to achieve GES (see Figure 1.1, below). The first stage, to be completed by July 2012, was for Member States to carry out an initial assessment of the current status of their seas and to determine specific characteristics of GES for their marine waters, setting out specific environmental targets and indicators to underpin this (based on the 11 Descriptors of GES given in the Directive). The second stage, to be completed by 2014, is for Member States to put in place monitoring programmes to measure progress towards GES. The final stage is the implementation of management measures to achieve GES by 2020. These have to be developed by 2015 and implemented by 2016. Each stage of the implementation process then has to be reviewed every 6 years and if necessary updated.

**Figure 1.1 Key stages in the MSFD implementation**



<sup>1</sup> MSFD, 2008/56/EC Article 3(5) – Good Environmental Status means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations. A fuller description is set out at MSFD, 2008/56/EC Article 3(5).

1.1.4 The Government of Gibraltar has already committed to taking numerous measures which have and will continue to improve the state of Gibraltar's marine environment as part of ensuring sustainable development, most notably through the Nature Protection Act (NPA) 1991, Public Health (Water Framework Rules) 2004, Public Health (Pollution of the Aquatic Environment) Rules 1994, Environment (Quality of Bathing Water Regulations (2009) Marine Strategy Regulations 2011 and the Marine Protection Regulations . Equally, other existing pieces of EU legislation, such as the Birds and Habitats Directives that have been transposed into the NPA 1991, also contribute to improving the state of Gibraltar's marine and coastal environments. These existing measures will all support the achievement of GES under the MSFD.

1.1.5 This report sets out the Government of Gibraltar's proposals for the first stage of the MSFD implementation process. The proposals cover the following:

- The initial assessment of the current state of British Gibraltar Territorial Waters (BGTW) as required under Article 8 of the MSFD. The Initial Assessment is based primarily on evidence from the River Basin Management Plan, as well as other various reports such as those under the Habitats Directive, Bathing Waters Directive, and monitoring evidence.
- Proposals for Gibraltar characteristics of GES (as required under Article 9 of the MSFD).
- Proposals for more detailed UK targets and indicators of GES (as required under Article 10 of the MSFD).

## 1.2 Background to the Marine Strategy Framework Directive (MSFD)

1.2.1 The MSFD establishes a framework within which Member States shall take the necessary measures to achieve or maintain GES in the marine environment by 2020 at the latest. The aims of the Directive are to:

- 'Protect and preserve the marine environment, prevent its deterioration or, where practicable, restore marine ecosystems in areas where they have been adversely affected'; and
- 'Prevent and reduce inputs in the marine environment, with a view to phasing out pollution, so as to ensure that there are no significant impacts on or risks to marine biodiversity, marine ecosystems, human health or legitimate uses of the sea.'<sup>2</sup>

1.2.2 Member States must apply an ecosystem-based approach to the management of human activities. In this context this means ensuring that the collective pressure of human activities is kept within the levels compatible with the achievement of GES, ensuring that the capacity of the marine ecosystem to respond to human-induced changes is not compromised, whilst enabling the sustainable use of the marine environment now and in the future<sup>3</sup>.

1.2.3 The aims of the Directive are to be delivered through the development of marine strategies covering the following elements:

- (a) An Initial Assessment of marine waters analysing the essential features, characteristics and environmental status of those waters (by July 2012, with subsequent assessments carried out on a six-yearly basis);
- (b) Determination of a set of characteristics for GES, based on the 11 GES Descriptors set out below (by July 2012, reviewed on a six-yearly basis);
- (c) Establishment of comprehensive environmental targets and indicators to guide progress towards achieving GES (by July 2012, reviewed on a six-yearly basis);
- (d) Establishment and implementation of a coordinated monitoring programme for the ongoing assessment of GES (by July 2014, reviewed on a six-yearly basis);

<sup>2</sup> MSFD 2008/56/EC Article 1(2)

<sup>3</sup> MSFD 2008/56/EC Article 1(3)

- (e) Development of a programme of measures designed to achieve GES by 2020 (by Dec 2015, reviewed and revised on a six-yearly basis); and
- (f) Implementation of the programme of measures described above (by Dec 2016, reviewed on a six-yearly basis).

1.2.4 Each stage of the marine strategy must be reviewed every six years and revised if necessary<sup>4</sup>. As explained in the introduction, this paper covers Gibraltar's proposals for the first three elements of the marine strategy – (a), (b) and (c) above.

1.2.5 GES is defined in the Directive as follows: 'Good Environmental Status means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations'<sup>5</sup>.

1.2.6 GES is also described in more detail by 11 high-level Descriptors of GES which Member States must use as the basis for their GES targets and indicators<sup>6</sup>. The 11 GES Descriptors are set out in Box 1.1 below.

#### Box 1.1 Qualitative descriptors for determining GES

- **Descriptor 1 (D1):** Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.
- **Descriptor 2 (D2):** Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.
- **Descriptor 3 (D3):** Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.
- **Descriptor 4 (D4):** All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.
- **Descriptor 5 (D5):** Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.
- **Descriptor 6 (D6):** Sea floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.
- **Descriptor 7 (D7):** Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.
- **Descriptor 8 (D8):** Concentrations of contaminants are at levels not giving rise to pollution effects.
- **Descriptor 9 (D9):** Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.
- **Descriptor 10 (D10):** Properties and quantities of marine litter do not cause harm to the coastal and marine environment.
- **Descriptor 11 (D11):** Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

<sup>4</sup> As required under Article 17(2) of Directive 2008/56/EC

<sup>5</sup> MSFD 2008/56/EC Article 3(5) – a fuller definition can be found in this Article

<sup>6</sup> MSFD 2008/56/EC Annex 1

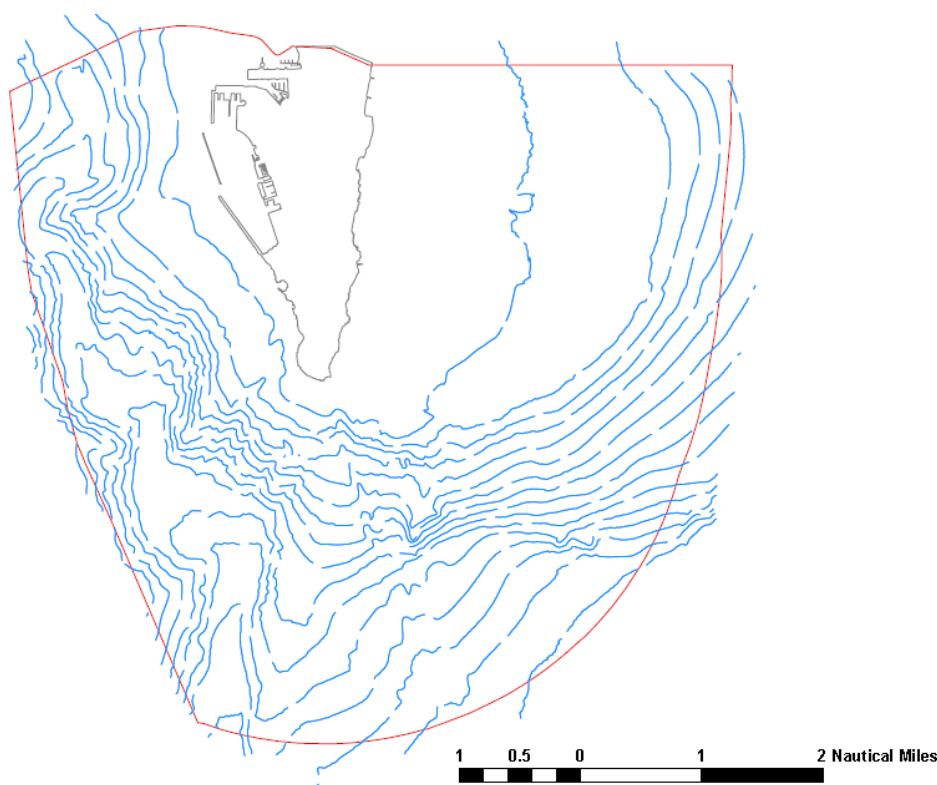


1.2.7 Member States are required to further develop these 11 GES Descriptors by determining a more detailed set of characteristics for GES<sup>7</sup>. In turn, these characteristics must be underpinned by the more specific GES targets and indicators<sup>8</sup> which will be used to assess progress towards the achievement of GES.

1.2.8 The Directive covers the extent of the marine waters over which Gibraltar has jurisdiction. This area extends from the landward boundary of coastal waters as defined by the WFD (which is equivalent to Mean High Water Springs) to the outer limit of Gibraltar's median line. The area of Gibraltar waters over which the MSFD applies is shown below in Figure 1.2.

1.2.9 Gibraltar has transposed the Directive via the Marine Strategy Regulations (Gibraltar) (2011). The Directive is being implemented in a coordinated way across the UK Administrations and Gibraltar (which is a British Overseas Territory). Gibraltar will lead the development of GES monitoring programmes and programmes of measures for its marine waters.

**Figure 1.2. Area of British Gibraltar Territorial Waters over which the MSFD applies.**



## 1.3 The European and Regional Context

### Regional coordination

1.3.1 A key requirement of the Directive is that European Member States must take a coordinated approach to implementation, cooperating with other Member States in the relevant marine region or sub-region to ensure each element of their marine strategies is coherent and coordinated.

1.3.2 The Directive splits Europe's waters into four marine regions and associated sub-regions set out in Table 1.1 below.

<sup>7</sup> As required by Article 9 of the MSFD

<sup>8</sup> As required by Article 10 of the MSFD

**Table 1.1 MSFD Marine regions and associated sub-regions**

Marine regions	Relevant sub-regions (if any)
The Baltic Sea	No sub-regions specified.
The North East Atlantic Ocean	The Greater north Sea, including Kattegat and the English Channel
	The Celtic Seas
	The Bay of Biscay and the Iberian Coast
	The Macronesian biogeographic region (the waters surrounding the Azores, Madeira and the Canary Islands)
The Mediterranean Sea	The Western Mediterranean Sea
	The Adriatic Sea
	The Ionian Sea and the Central Mediterranean Sea
	The Aegean-Levantine Sea
The Black Sea	No sub-regions specified

1.3.3 BGTW are located in the Mediterranean region and will therefore rely on developments made under the Barcelona Convention where applicable (see 1.3.9 below).

#### European level coordination

1.3.4 Coordination between countries is taking place both at a European-wide scale (for generic issues) and within the specific marine regions set out above (for more detailed issues). At a European level, coordination is being carried out through a series of informal Working Groups led by the European Commission.

1.3.5 **The Working Group on GES** – this Working Group has been set up to support Member States in developing their characteristics of GES and the associated targets and indicators, with the aim of ensuring a comparability of approaches across the EU. The group has led the development of two key documents:

- *The Commission Decision on GES<sup>9</sup>* - this is a formal document which sets out specific criteria and indicators for each of the 11 GES Descriptors which Member States must follow when developing their national GES targets and indicators.
- *The Common Understanding of Articles 8, 9 and 10<sup>10</sup>* - this is an informal document jointly drafted by the European Commission and the EU Member States Finland, France, Germany, Greece, Romania, Sweden and the UK. The document provides a common understanding of the development of the initial assessment and GES characteristics and associated targets and indicators (Articles 8, 9 and 10) to aid Member States in implementing the requirements of the MSFD in a comparable and consistent way.

1.3.6 This Working Group also has two technical sub-groups, one on litter (Descriptor 10) and one on noise (Descriptor 11) which have a remit to review monitoring methodologies and develop proposals for new monitoring, provide a platform for sharing best practice on the development of GES characteristics, targets and indicators, and recommend proposals for further research.

1.3.7 **The Working Group on Economic and Social Analysis** – this Working Group is co-chaired by the UK and has been set up to support Member States in meeting the economic and social assessment requirements of the Directive, with the aim of ensuring comparability of approaches across the EU. It has led the development of an informal guidance

<sup>9</sup> Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters 2010/477/EU <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF> (accessed 11/12/2012)

<sup>10</sup> Copies available on request from Defra

document on Economic and Social Analysis for the Initial Assessment<sup>10</sup> which sets out informal guidance for Member States on possible approaches for this assessment.

**1.3.8 The Working Group on Data, Information and Knowledge Exchange** – this Working Group has been set up to develop a coordinated MSFD information and data reporting process. It is in the process of developing proposals for reporting sheets to capture Member States’ data and information associated with the initial assessment, characteristics of GES and associated targets and indicators. The Working Group will also concern itself with the development of the data infrastructures that are needed to facilitate the implementation of the Directive at European and Member State level, working as far as possible to use existing data initiatives and to remove duplication of reporting with related Directives.

#### **Regional level coordination**

**1.3.9** Article 6 of the MSFD<sup>11</sup> recommends Member States to use existing regional institutional cooperation structures, such as those under Regional Sea Conventions, in order to achieve coherence and coordination of their marine strategies and build upon relevant existing programmes and activities. The key forum for regional coordination in the Mediterranean Sea is the Barcelona Convention, implemented through UNEP’s Mediterranean Action Plan (MAP). The following recent activities in relation to the MSFD have been carried out at a regional level in line with the Barcelona Convention:

- The Contracting Parties to the Barcelona Convention developed a set of ecological objectives, operational objectives, and indicators, which reflect Mediterranean priorities and are coherent with the MSFD. The ecological objectives were defined through an intensive process of consultation led by the UNEP/MAP Secretariat.
- The publication of UNEP’s MAP final report for the ‘Support to the Barcelona Convention for the Implementation of the Ecosystem Approach, Including the Establishment of MPAs in Open Seas Areas, Including Deep Sea Final Report’<sup>12</sup>.
- As a result an adaptive and integrated strategy for the implementation of the Ecosystems Approach in the Mediterranean will aim to achieve 11 ecological objectives, which are all in line with the MSFD objectives.
- The publication of the following report ‘State of the Mediterranean Marine and Coastal Environment, Highlights for Policy Makers’ (UNEP 2012) as an overarching regional-scale assessment of the environmental quality status of the Mediterranean. The work to prepare this report and its underlying thematic assessment reports provides the primary basis for coordination of national initial assessments across the region.

## **1.4 Role of existing policies in supporting the achievement of GES**

### **Water Framework Directive (2000/60/EC)**

**1.4.1** The Water Framework Directive is designed to create a Europe wide way of measuring and monitoring water bodies with a specific aim of assessing water quality. Within the Water Framework Directive are the definitions of Good Ecological Status for both terrestrial and coastal water bodies. Its main aims are to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands which depend on the aquatic ecosystems;
- promote the sustainable use of water;
- reduce pollution of water, especially by ‘priority’ and ‘priority hazardous’ substances; and

<sup>11</sup> MSFD 2008/56/EC Article 6(1)

<sup>12</sup> The report is available at [http://195.97.36.231/dbases/publications/SBCI\\_ECAP\\_FinalReport.pdf](http://195.97.36.231/dbases/publications/SBCI_ECAP_FinalReport.pdf) (accessed 11/12/2012)

- ensure progressive reduction of groundwater pollution.

1.4.2 The directive outlines an assessment methodology to standardise the way that water body quality is assessed. Where water bodies have failed Good Ecological Status, the Directive aims to identify the source and manageable goals with the aim of improving quality. The ultimate aim for the Directive is for water bodies across Europe to be achieving Good Ecological Status (or higher), or to be improving so that Good Ecological Status will be achieved, where possible, by 2015. Implementation the Water Framework Directive will enable Descriptors 5, 7, 8 and 9 to be addressed

### **Habitats Directive (92/43/EEC)**

1.4.3 The Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora ('Habitats Directive') is a Directive that is designed to maintain and improve natural habitats by protecting ecologically important species and habitats. Maintaining biodiversity is an important part of maintaining Good Ecological Status.

1.4.4 The provisions of the Directive require Member States to introduce a range of measures, including:

- Maintain or restore European protected habitats and species listed in the Annexes at a favourable conservation status as defined in Articles 1 and 2;
- Contribute to a coherent European ecological network of protected sites by designating Special Areas of Conservation (SACs) for habitats listed on Annex I and for species listed on Annex II. These measures are also to be applied to Special Protection Areas (SPAs) classified under Article 4 of the Birds Directive. Together SACs and SPAs make up the Natura 2000 network (Article 3);
- Ensure conservation measures are in place to appropriately manage SACs and ensure appropriate assessment of plans and projects likely to have a significant effect on the integrity of an SAC. Projects may still be permitted if there are no alternatives, and there are imperative reasons of overriding public interest. In such cases compensatory measures are necessary to ensure the overall coherence of the Natura 2000 network (Article 6);
- Member States shall also endeavour to encourage the management of features of the landscape that support the Natura 2000 network (Articles 3 and 10);
- Undertake surveillance of habitats and species (Article 11);
- Ensure strict protection of species listed on Annex IV (Article 12 for animals and Article 13 for plants); and
- Report on the implementation of the Directive every six years (Article 17), including assessment of the conservation status of species and habitats listed on the Annexes to the Directive.

1.4.5 The Habitats Directive aims to look at ecosystems and species and offer protection to important and vulnerable species, it provide the framework for addressing Descriptors 1, 2, 3, 4 and 6.

### **The Birds Directive (2009/147/EC)**

1.4.6 The Council Directive 2009/147/EC on the conservation of wild birds ('Birds Directive') is designed to maintain biodiversity and Good Ecological Status through the protection of natural bird wildlife. It is a European wide framework designed to manage and conserve wild bird populations and the interactions between bird populations and humans.

1.4.7 The main provisions of the Directive include:

- The maintenance of the populations of all wild bird species across their natural range (Article 2) with the encouragement of various activities to that end (Article 3);
- The identification and classification of Special Protection Areas (SPAs) for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory species, paying particular attention to the protection of wetlands of international importance (Article 4). (Together with Special Areas of Conservation designated under the Habitats Directive, SPAs form a network of European protected areas known as Natura 2000);

- The establishment of a general scheme of protection for all wild birds (Article 5);
- Restrictions on the sale and keeping of wild birds (Article 6);
- Specification of the conditions under which hunting and falconry can be undertaken (Article 7). (Huntable species are listed on Annex II of the Directive);
- Prohibition of large-scale non-selective means of bird killing (Article 8);
- Procedures under which Member States may derogate from the provisions of Articles 5-8 (Article 9) — that is, the conditions under which permission may be given for otherwise prohibited activities;
- Encouragement of certain forms of relevant research (Article 10 and Annex V); and
- Requirements to ensure that introduction of non-native birds do not threaten other biodiversity (Article 11).

1.4.8 The Birds Directive provides protection for seabirds which are an integral part of marine ecosystems. Aspects from the Birds Directive will be used in addressing Descriptors 1 and 4.

#### **The Bathing Water Directive (2006/7/EC)**

1.4.9 Council Directive 2006/7/EC is the updated version of the original Bathing Water Directive (76/160/EEC). The Directive does not, in itself, set out to maintain or impact on biodiversity or ecological status. Its primary concern is public safety and providing good quality bathing water. However, close monitoring of water quality and attempts by governments to achieve good bathing water quality status have a positive impact on ecological status and help towards water bodies achieving Good Ecological Status as described in the Water Framework Directive. By reducing levels of contaminants and microbes in the water the directive helps to maintain safe bathing water for the general public but also safe contaminant levels for the marine ecosystem.

1.4.10 The Bathing Water Directive provides a platform for regular monitoring of coastal waters. Monitoring undertaken as part of this Directive will provide evidence to support the assessment of Descriptors 5, 8, 9 and 10.

#### **Shellfish Water Directive (2006/113/EC)**

1.4.11 Council Directive 2006/113/EC on the quality of required shellfish waters outlines the water quality of commercial shellfish species. The Shellfish Directive aims to ensure that waters in which commercial species are fished have good water quality and contaminant levels are within safe limits for human consumption. Monitoring contaminant levels and reducing them where possible helps towards achieving Good Chemical Status as outlined in the Water Framework Directive and helps to achieve a water body with good ecological potential or status. Although this does not strictly apply to Gibraltar as there are no official commercial shellfish fisheries in Gibraltar, a shellfish monitoring programme is in operation within BGTW as part of the wider coastal water monitoring programme. It should also be noted that methods used to obtain shellfish, such as raking the seabed, are illegal under the Nature Protection Act 1991. Notwithstanding, illegal shellfish fishing by Spanish vessels is known to occur in BGTW.

1.4.12 The need for clean waters for shellfish will help to monitor and address characteristics in Descriptors 5, 8 and 9.

#### **Waste Framework Directive (2008/98/EC)**

1.4.13 Gibraltar has a Waste Management Plan in operation to address waste collection and disposal in Gibraltar, including waste from shipping, with a view to preventing waste entering the environment through water or solid form. The framework set out in this Directive will help to address Descriptors 5, 7, 8, 9 and 10.

#### **Overarching conventions**

1.4.14 Gibraltar is also strongly committed to uphold the key objectives of applicable conventions that aim to protect wildlife and improve biodiversity. Some of these relate to maintaining and improving marine ecosystem biodiversity. These conventions include:

- Bonn Convention to conserve migratory species of wild animals (82/461/EEC) which aims to protect species that move between international borders;
- Bern Convention on the conservation of European wildlife and natural habitats (82/72/EEC);

- ACCOBAMS –Agreement on the conservation of cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area;
- Natura 2000 Network –A network of protected areas that falls under the Birds and Habitats Directives. The southern area of the Gibraltar coastal water is designated as a protected area under the Natura 2000 network; and
- The Rio de Janeiro Convention of Biological Diversity (Biodiversity Convention). This is a global initiative signed by UN member states. For Europe it was signed under Directive 93/626/EEC. This covers a wide range of biodiversity issues including alien invasive species, climate change, tourism and the introduction of the ecosystem approach to encourage sustainability and conservation of the wider ecosystem.
- Barcelona Convention (and subsequent Protocols) on the protection of the Mediterranean Sea against Pollution (1976).

1.4.15 The conventions and initiatives discussed above promote the maintenance and regeneration of biodiversity on both a European and international level. If followed the values outlined in these conventions will help to achieve Good Ecological Status and help to maintain and restore natural habitats and protect vulnerable species.

## 2. Initial Assessment of British Gibraltar Territorial Waters

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### 2.1 Introduction

2.1.1 This section provides the Initial Assessment of Gibraltar's marine waters in accordance with Article 8 of the Directive (see Box 2.1). The Initial Assessment is a reference point against which Member States are to determine the characteristics of GES and establish targets and indicators for measuring progress towards GES. The Initial Assessment will also be used to inform the work by Member States to establish and implement monitoring programmes for the ongoing assessment on environmental quality status.

2.1.2 Gibraltar's existing marine waters extend out to 3 nm to the East and South and along the median line to the West in the Bay of Gibraltar. BGTW have long been recognized as an important marine area due to its rich diversity in species and habitat. Sea cliffs, caves, reefs and sandy marine habitats all form part of the marine ecosystems found along and off the shores of Gibraltar. The abundance and richness of species is largely influenced by the strong currents and upwelling's that are so characteristic of the Straits of Gibraltar. Furthermore, the large migratory movements that take place through BGTW, due to its strategic location between the Mediterranean Sea and the Atlantic Ocean, also result in a multitude of pelagic and predatory fish along with cetaceans frequenting BGTW. Common cetaceans include Minke and Long-finned Pilot whales, striped and common dolphins, with the latter species breeding in the Bay of Gibraltar

#### Box 2.1 MSFD Article 8

In respect of each marine region or subregion, Member States shall make an initial assessment of their marine waters, taking account of existing data where available and comprise the following:

(a) an analysis of the essential features and characteristics, and current environmental status of those waters, based on the indicative lists of elements set out in Table 1 of Annex III, and covering the physical and chemical features, the habitat types, the biological features and the hydro-morphology;

(b) an analysis of the predominant pressures and impacts, including human activity, on the environmental status of those waters which:

- (i) is based on the indicative lists of elements set out in Table 2 of Annex III, and covers the qualitative and quantitative mix of the various pressures, as well as discernible trends;
- (ii) covers the main cumulative and synergetic effects; and
- (iii) takes account of the relevant assessments which have been made pursuant to existing Community legislation.

(c) an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment.

The analyses referred to in paragraph 1 shall take into account elements regarding coastal, transitional and territorial waters covered by relevant provisions of existing Community legislation, in particular *Directive 2000/60/EC*. They shall also take into account, or use as their basis, other relevant assessments such as those carried out jointly in the context of Regional Sea Conventions, so as to produce a comprehensive assessment of the status of the marine environment.

### 2.2 The Evidence Base

2.2.1 This report summarises and compiles the information from the underlying evidence base (see Box 2.2) to provide an overall view on the use and value of Gibraltar's marine waters, the

resulting pressures and the resulting environmental quality status as a baseline for work under the MSFD towards the GES of BGTW.

### Box 2.2 The evidence base for Gibraltar's MSFD Initial Assessment

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- Warr, S.J. (2012) *A general assessment of marine pollutants in Gibraltar coastal waters (southern Iberian Peninsula) Risks and future challenges*, submitted dissertation for MSc in Environmental Management, University of London.
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## 2.3 Regional coordination with EU member states

2.3.1 Gibraltar, through the United Kingdom is currently seeking more active participation and ratification of the Barcelona Convention and thus involvement in UNEP's Regional Mediterranean Action Plan. Coordination between the Ports of Gibraltar (U.K.) and Algeciras (Spain) takes place as and when required.



## 2.4 Preliminary analysis of the economic and social use of British Gibraltar Territorial Waters and the predominant pressures

### Marine users and uses and their economic and social importance

2.4.1 The Gibraltar River Basin Management Plan provides an assessment of the economic analysis of water use in Gibraltar. Water services include water abstraction, impoundment, storage, treatment and distribution as well as collection, treatment and discharge of wastewater. Water services, therefore, cover public and private water supply along with wastewater collection and treatment. The financial costs of providing water services are covered in Table 2.1.

**Table 2.1 Financial costs (operating and capital costs) of AquaGib in 2009/2010**

	Potable Water	Sea Water	Sewage Pumping	Totals
<b>Operating costs</b>	<b>£5,625,248</b>	<b>£1,771,739</b>	<b>£989,815</b>	<b>£8,386,802</b>
of which...				
Payroll	£2,736,322	£1,008,634	£573,617	<b>£4,318,573</b>
Energy and fuel costs	£1,370,395	£82,516	£57,978	<b>£1,510,889</b>
Purchases of materials etc.	£699,130	£202,799	£135,141	<b>£1,037,070</b>
Repairs and maintenance costs	£61,103	£27,045	£46,201	<b>£134,349</b>
Other operating costs	£758,298	£450,745	£176,878	<b>£1,385,921</b>
<b>Capital costs</b>	<b>£448,182</b>	<b>£317,692</b>	<b>£125,239</b>	<b>£891,113</b>

2.4.2 In addition to financial costs of water services, there are also the associated environmental and resources costs that need to be considered. Resource costs are typically related to the depletion of water sources although in Gibraltar's case the majority of the water is taken from the sea. While sea water desalination is likely to have some adverse environmental impacts, particularly associated with energy use and CO<sub>2</sub> discharges, resources costs attributed to water services in Gibraltar are likely to be negligible.

2.4.3 Different water services in Gibraltar potentially may give rise to some environmental costs. First of all there could be some potential adverse environmental effects associated with the discharge of untreated sewage (e.g. nutrients) which may damage the environment, affect the amenity of bathing waters, or cause additional costs of treating potable water as a result of pollution to the sea. As wastewater discharge to the sea is in an area of high dispersion it can be expected that the environmental costs associated with wastewater discharge in Gibraltar are significantly reduced.

2.4.4 The main adverse environmental impacts associated with sea water desalination are CO<sub>2</sub> emissions and other damage costs associated with additional energy use. Sea and brackish water

desalination is one of the most carbon intensive water supply options, with treatment of seawater claimed to be twice as energy intensive as treatment of brackish water. According to the UK Environment Agency scientific report on GHG emissions of water supply options, carbon emissions associated with desalination (using reverse osmosis and nano-filtration) were 2.2 to 3.4 tonnes of CO<sub>2</sub>e per Ml or 2.2 to 3.4 kg of CO<sub>2</sub>e per m<sup>3</sup> (for the schemes assessed). Overall, the carbon footprint of seawater desalination was estimated at 2.99 tonnes of CO<sub>2</sub>e per Ml (or 2.99 kg of CO<sub>2</sub>e per m<sup>3</sup>). This covers both installation and operational costs. The central estimate for the social costs of CO<sub>2</sub> is £52/t for 2010 with costs increasing over time

**Table 2.2 Estimated annual costs of carbon (2010 prices) for seawater desalination**

CO2 emitted (t) per year	Cost per tonne (£)	Total cost (£)
3,907	52	203,164

Apart from the financial costs of providing water services there are other activities in BGTW that have an important economic value such as maritime transport, telecommunications, marine leisure and recreation, including recreational fishing, defence (military activities) and coastal defence. These uses of the marine environment play a key role for the community of Gibraltar.

Gibraltar Port attracts around 10 per cent of all maritime traffic in the Straits and in 2011 handled 10,350 vessels. The Cruise Terminal, and Marina berthing facilities within the Port of Gibraltar are also a significant economic asset, on average the Port of Gibraltar and its peripheral commercial activities generate £4.5 - £5.5 million on a yearly basis (based on 2010 data). The commercial activity of the Port of Gibraltar supports a large and varied array of products and services that generate significant revenue for the private sector. Specific marine services that are provided within the Port area by the private sector include bunkering, crew changes, ship chandlery, stevedoring and conveyance of spare parts and other supplies.

### **Indirect users and non-users of the marine environment**

2.4.5 There are beneficiaries who derive value from the marine environment that are not considered to be direct users. These beneficiaries are categorised as indirect users and non-users. Indirect users are users who benefit from the ecosystem services provided by a resource, rather than the direct use of the resource itself. Non-users derive benefit simply from the knowledge that the natural environment is maintained. Examples of non-use values are listed below

- Citizens are likely to benefit from keeping open the option to make use of some aspects of the marine environment in the future, even though there is no current plan to make such use (option value);
- Citizens are likely to derive benefit from knowing that others can enjoy the services provided by the marine environment (altruistic value);
- Citizens may derive benefit simply from the satisfaction of knowing that ecosystems and the species they support (e.g. whales) continue to exist in good condition, now or in the future (existence values); and

- Society also derives benefits from the knowledge that marine ecosystems will be passed on to future generations in good condition (bequest value).

### **Predominant pressures resulting from marine uses**

2.4.6 The Bay of Gibraltar has become a prominent industrial and maritime hub resulting in a myriad of anthropogenic activities taking place such as industrial discharges, accidental oil spills, shipping operations, dredging and land reclamations. In addition, two main rivers empty into the Bay namely the rivers Palmones and Guadarranque which are themselves impacted by industrial and agricultural activity further upstream. It should be noted that the Bay of Gibraltar is divided by a median line distinguishing BGTW from Spanish waters.

2.4.7 A significant amount of research has been carried out on the impacts of marine pollution on the North section of the Bay which is where the main industrial installations in Spain are located. The latter include petrochemical installations such as a major oil refinery, a stainless steel manufacturing plant, paper mills, ironworks and thermal power stations.

2.4.8 The different marine uses of BGTW and the Bay of Gibraltar generally lead to a range of pressures on the marine environment, for example through pollution, or by disturbing habitats and species. Table 2.4 provides an overview of the main pressures identified by the Gibraltar River Basin Management Plan, under the Water Framework Directive, and other associated reports (Box 2.2). Although there are a number of activities that result in various pressures on the marine environment, maritime transport was considered to have the widest spatial extent on BGTW. In order to minimise the impacts of shipping from anchoring, a no anchoring zone is strictly monitored and enforced by the Gibraltar Port Authority. The extent of the aforementioned zone is shown in Figure 2.1.

**Figure 2.1 No anchoring zones in British Gibraltar Territorial Waters**



Source: Southern Waters of Gibraltar Management Scheme (2012)

**Table 2.3 Pressures within the coastal environment**

<b>Activity</b>	<b>Main Pressures (MSFD pressures category)<sup>13</sup></b>	<b>Spatial extent and intensity of activity</b>	<b>Outlook 2020/2030</b>
Maritime Transport	Litter, noise, non-indigenous species, physical damage, chemical pollution	Activity is widespread and intense throughout BGTW due to its close proximity to the Gibraltar Straits	A sustained gradual long-term growth is expected.
Telecommunications	No significant pressures identified.	A fibre optic cable from India runs through the Bay of Gibraltar to the North Mole in the Gibraltar harbour. Spain also has a cable that runs from La Alcaidesa to Ceuta on the eastern side of the Straits	Possibility of new underwater cables cannot be discarded in future.
Leisure and recreation (angling, water sports and bird watching)	Litter, non-indigenous species, removal of target species, physical damage, noise	Activity occurs throughout the whole of Gibraltar.	Growth in tourism is expected over the long term. Short term seasonal fluctuation occurs.
Defence - military	Litter, noise, non-indigenous species	The MOD regularly exercise throughout BGTW	Prediction is difficult due to the nature of the military. Activity is at least expected to remain at the same level although an Environmental Management Plan is currently in place in BGTW for all defence activities.
Maintenance dredging	Physical damage, noise, interference with hydrological conditions	The approaches to and within the Port of Gibraltar. Frequency is as and when required.	Level sustained and possibility of increased demand with any increase in shipping.
Anchoring	Physical damage, noise	Allocated areas within BGTW (see Figure 2.1)	Level sustained.
Point source discharges	Contamination by hazardous substances, nutrient and organic matter enrichment and microbial pathogens	See Table 2.5. Intensity may vary but is continuous.	Quality of discharge effluent should increase following construction of new wastewater treatment plant.
Diffuse discharges	Contamination by hazardous substances, nutrient and organic enrichment	See Table 2.5). Intensity is occasional, more frequent with heavy rainfall following prolonged period of dry weather.	Outlook is dependent on future climate change affecting rainfall.
Coastal defence	Interference with hydrological processes, physical loss	Approximately 40% of the coastline has been altered.	Any increase in coastal defences is ad-hoc and thus on a need-to basis.

<sup>13</sup> MSFD Annex III Table 2

Table 2.4 looks at specific pressures that may impact upon the status of the coastal waters of Gibraltar.

**Table 2.4 Pressures within the coastal environment.**

<b>Water Body</b>	<b>Details</b>	<b>Location</b>	<b>Type of pressure</b>
<b>Coastal Waters</b>	Desalination Plant	North Mole	Point source discharge
<b>Coastal Waters</b>	MoD Desalination Plant	Camp Bay	Point source discharge
<b>Coastal Waters</b>	Combined Sewer Overflows	Numerous locations although most are located within the Gibraltar Harbour	Point source discharge
<b>Coastal Waters</b>	Sewerage outfall	Europa Point	Point source discharge
<b>Coastal Waters</b>	Desalination Plant	Governor's Beach	Point source discharge
<b>Coastal Waters</b>	Dockyard discharge	South Mole	Point source discharge
<b>Coastal Waters</b>	Desalination Plant	Europa Point	Point source discharge
<b>Harbour &amp; Marina Bay</b>	Power station	Main Harbour	Point source discharge
<b>Coastal Waters</b>	Contamination from shipping	Outer Harbour, Gibraltar Bay	Diffuse discharge
<b>Harbour &amp; Marina Bay</b>	Contamination from shipping	Main Harbour	Diffuse discharge
<b>Coastal Waters</b>	Desalinisation Plant	North Mole	Abstraction
<b>Coastal Waters</b>	Reverse Osmosis Plant	Little Bay	Abstraction
<b>Coastal Waters</b>	Swimming Pool	Camp Bay	Abstraction
<b>Coastal Waters</b>	MoD Desalinisation Plant	Camp Bay	Abstraction
<b>Coastal Waters</b>	Deposition of dredgings	Harbour Moles and Airport	Morphological pressure
<b>Harbour &amp; Marina Bay</b>	Shoreline reinforcement	Main Harbour	Morphological pressure
<b>Harbour &amp; Marina Bay</b>	Construction / land claim	Main Harbour	Morphological pressure
<b>Coastal Waters</b>	Sewer overflow	Western Beach	Transboundary issue

### **Cumulative and synergistic effects resulting from pressures**

2.4.9 There is a need for further research to be undertaken in the methodologies for the assessment of the cumulative and synergistic effects of pressures from human activities. Where relevant cumulative or synergistic impacts on ecosystem characteristics have been identified, or are suspected, these are commented on in the sections describing the status of each characteristic in Section 3 of this report.

## 3. Current and Predicted Status of British Gibraltar Territorial Waters

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### 3.1 Introduction

3.1.1 This part of the report provides a summary of the current environmental status of BGTW, taking into account the indicative lists of physical, chemical and biological features and pressures and impacts in Annex III of the MSFD and the descriptors of GES in Annex I of the Directive. The assessments drawn together here vary widely in the nature of their evidence base and for some there has been a need to supplement the data available with expert judgement. For certain features there are no data currently available; where this is the case, it has been acknowledged and remedial action has been identified.

#### **Status of the physical features of BGTW.**

3.1.2 Gibraltar's marine waters extend out 3 nm to the East and South and along the median line to the West in the Bay of Gibraltar. A detailed description of the bathymetry and hydrography of BGTW is found in Section 3.7.

3.1.3 Sea temperatures do not vary much, with winter minimum temperatures recorded at 14°C and summer maximum temperatures recorded at 22°C.

3.1.4 Salinity is influenced by Atlantic and Mediterranean waters and also by the rivers Palmones and Guadarranque within the Bay which create localised salinity stratification. Under the WFD monitoring, salinity is measured on a monthly basis. Results show the range of salinity within Gibraltar's water to average 36.5 practical salinity units.

3.1.5 The degree of turbidity in BGTW is slight, with good visibility all year round. Under the WFD, Gibraltar's marine waters have been classified as 'clear'.

3.1.6 The northeast area of the Straits of Gibraltar is considered to be an area of upwelling. The upwelling, more evident in summer when thermal contrast is stronger, is easily observed in infrared satellite images. These oceanographic characteristics are influenced by the Atlantic surface water that enters the Mediterranean Sea through the Strait of Gibraltar, flowing with an estimated speed of about 1 ms<sup>-1</sup>.<sup>14</sup> In addition to the salinity gradient, one of the main mechanisms governing the upwelling is the predominant westerly winds. Another important mechanism is the unsteadiness of the Atlantic Jet front position, which fluctuates in a north-south direction in connection with changes in the position and shape of the anticyclonic gyre, namely the Azores High.

### 3.2 Habitat types (Descriptors 1, 4 and 6)

3.2.1 The status of habitat types links in with three descriptors: Descriptor 1, Descriptor 4, and Descriptor 6 (see Box 1.1).

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<sup>14</sup> Sarhan, T, *et al* (2000) Upwelling mechanisms in the northwestern Alboran Sea. *Journal of Marine Systems*, **23**, 317-331.

3.2.2 Under Annex III of the MSFD the characteristics of habitat types are as follows:

- The predominant seabed and water column habitat type(s) with a description of the characteristic physical and chemical features, such as depth, water temperature regime, currents and other water movements, salinity, structure and substrata composition of the seabed;
- identification and mapping of special habitat types, especially those recognised or identified under Community legislation (the Habitats Directive and the Birds Directive) or international conventions as being of special scientific or biodiversity interest; and
- habitats in areas which by virtue of their characteristics, location or strategic importance merit a particular reference. This may include areas subject to intense or specific pressures or areas which merit a specific protection regime.

### **Key Pressures**

3.2.3 Human activities in particular lead to physical and biological pressures on marine habitats. The main sources of pressure on benthic habitats arise from physical disturbance, contamination by hazardous substances, sand extraction, professional and amateur fishing, nautical sports, illegal dumping of waste, sea level rise and increase in storms due to climate change.

### **Current status and trends**

3.2.4 Although small, the coastline of Gibraltar supports numerous habitat types of conservation importance. The confluence of the Atlantic and Mediterranean Seas provides a unique set of conditions that have shaped the marine habitats of Gibraltar. The main habitats found within Gibraltar's marine waters include rocky shores, sandy sea beds, natural and artificial reefs and submerged and partially submerged sea caves.

3.2.5 *Intertidal habitats* - In Gibraltar and the Mediterranean generally, the intertidal zone is relatively narrow since the tidal range rarely exceeds 1 m, even during spring tides, and the average vertical tidal range is usually between 0.8 – 0.9 m. When considering the slight gradient of the shoreline, especially on beaches, the distance between high and low water mark is approximately 3 – 4 m. The narrow strip of intertidal habitat in Gibraltar is nonetheless extremely important for a wide variety of marine organisms. It includes the vertical harbour walls, natural rocky shorelines and sandy or pebble beaches, each containing a variety of marine life. Of these, the rocky shoreline is by far the richest in biodiversity although there are interesting species in other intertidal biotopes that also merit conservation. Approximately 60% of Gibraltar's littoral zone remains in a natural state. The rest is comprised of the harbour and port area, marinas, the airport and reclaimed areas.

3.2.6 *Rocky shoreline* – the larger part of Gibraltar's coastline consists of rocky or man-made hard surfaces, especially on the western side of the Rock. The majority of the Rock is limestone, although other substrates such as sandstone are present. Coupled with the differing physical factors, such as exposure and orientation, this has created varied habitats along the coast line with different species composition and diversity on opposite sides of Gibraltar's coastline. Artificial intertidal habitat primarily consisting of groynes and rock armour are also prevalent in the West side of Gibraltar. Some of these artificial reef habitats become well colonised by a



variety of sessile and motile intertidal species including European protected species such as *Patella ferruginea* and *Lithophaga lithophaga*.

*Sandy habitat* - The majority of benthic areas in Gibraltar are composed of sand. This is the most common habitat found within British Gibraltar's territorial waters, covering most of the eastern and western sides of the Rock.

3.2.7 *Sea caves* - Submerged and partly submerged sea caves are predominantly found along the southern half of BGTW, distributed along a stretch of approximately 4.5 km (see Figure 3.2).. The partly submerged caves provide ledges used as nesting sites by Mediterranean shags, pallid swifts, and, by wintering crag martins. The underwater sections of caves provide important habitat for a wide variety of sponges and tunicates that have and continue to be researched.

3.2.8 *Subtidal habitats* - In the sub-tidal zones, on both sides of the Rock the sea bed is primarily made up of soft sand/maërl /gravel substrate. On the west side the coastline drops away quickly to a depth of 400m+, this is where the harbour and docks are located. The east side coastline drops to 100m gradually over a 4km wide shelf which then steeply drops down to 400m+.

3.2.9 *Reefs* - BGTW are punctuated with natural and artificial reefs and outcrops, more so on the east side than the west (see Figure 3.1).. The reefs support a diversity of fish, mollusc, echinoderm and coral species. Typical fish species found are white seabream (*Diplodus sargus*), common two-banded seabream (*Diplodus vulgaris*), salema porgy (*Sarpa salpa*), black scorpionfish (*Scorpaena porcus*), moray eel (*Muraena helena*), conger eel (*Conger conger*), cardinal fish (*Apogon imberbis*), and dusky grouper (*Epinephelus marginatus*). Some of the more common and endangered molluscs and gastropods found are the common octopus (*Octopus vulgaris*), common cuttlefish (*Sepia officinalis*), noble pen shell (*Pinna nobilis*), date mussels (*Lithophaga lithophaga*), *Charonia lampas*, and various nudibranchs including *Babakina anadoni* and *Roboastra europaea*. Echinoderm species such as the endangered long-spined sea urchin (*Centrostephanus longispinus*) and corals (e.g. *Astroides calycularis*) are also notable species found in the reefs throughout BGTW. A comprehensive habitat and species surveillance monitoring programme is co-ordinated by the Department of the Environment and this is constantly providing new data on the marine species and habitats found in BGTW.

3.2.10 Although heavily impacted by historic coastal development and harbour reclamations, there are relics of sea-grass meadows believed to be *Zostera marina* and *Cymodocea nodosa* along the North of the Bay of Gibraltar.

3.2.11 The most significant rocky outcrop is Europa Reef. This lies approximately southwest of Europa Point and extends from the shoreline to over 300 m. The reef is an extension of one of a series of marine terraces. Europa foreshore remains above sea-level as a raised beach/intertidal habitat but the Europa Reef was submerged after the last ice-age. Closer inshore, the reef is generally fairly shallow: from 2 – 10 m deep although it extends to over 100m in the southern sections in an area known locally as 'the peaks'. Strong currents and rip tides continuously affect the area. The position of Europa Reef at the entrance to the Bay and the Strait has meant

that this area has become a magnet for marine life that converges on the reef for food and shelter. Europa Reef has therefore long been a popular area for ecological research and recreational activities such as sport fishing and scuba diving. There are numerous other reefs found in BGTW such as the Seven Sisters Reef found further North within the Rosia Marine Conservation Zone. This reef is particularly important in that the highest levels of marine invertebrate biodiversity have been recorded in this reef complex. Other notable reefs include Governor's Beach Reef, Sandy Bay Reef and Eastern Beach Reef along with the Two-Mile reef and numerous other rocky outcrops (e.g. Weaver's Pinnacle and Pete's Pinnacle) that are well known marine biodiversity hotspots.

**3.2.12 Artificial reefs** – During the 1970s work on the construction of an artificial reef network commenced in the Southern Waters of Gibraltar just off Camp Bay and Rosia Bay. The project is on-going and numerous vessels of a relatively large tonnage have been sunk in different areas within BGTW. A dramatic increase in biodiversity of mid-water and bottom-dwelling species has been recorded including an increase in the number of sessile organisms on the artificial reef structures themselves.

### **Predicted status in 2020/2030 given business-as-usual**

**3.2.13** Much of the intertidal zone has undergone significant change in the past and continues to change as new projects and other developments emerge. Much of the natural intertidal zone in the North West section of BGTW has been replaced by an artificial habitat of a substantially different character. Whereas natural intertidal zones often sloped into shallow waters, the boundaries of the artificial zones have been extended into deeper waters. The structure of the artificial boundary and the angle of its slope greatly influence the size and species composition of this habitat. Exposure to greater wave action will also influence species selection as the larger waves allow certain species to live higher in the inter-tidal zone and select for those that will resist the strong forces without being washed off the rocks. These factors have to be considered when establishing artificial littoral boundaries.

**3.2.14** The conservation status of the marine habitats is expected to remain stable or decrease between now and 2020. Pollution, fishing and physical damage are some of the main sources of pressure and this is predicted to remain the same or steadily decrease. However, careful management of the habitats should help result in a favourable future status. For the Habitats Directive interest features the current and future status is outlined below.

**3.2.15 Submerged or partially submerged sea caves** – the current and future status of submerged or partly submerged sea caves is deemed favourable if the relevant management measures continue to be implemented. This interest feature has therefore been assessed as stable.

**3.2.16 Reefs** – the current and future status of the reefs is deemed favourable if the relevant management measures continue to be implemented. This interest feature has therefore been assessed as stable.

### State of the evidence base and development needs

The assessment of intertidal and seabed habitats was largely based on a combination of information gathered from the reports in Box 2.2, and expert judgement, considering the relationship between habitats and pressures and drawing upon evidence from monitoring studies and research. The many uncertainties will be greatly reduced and the approach enhanced through more robust evidence on the distribution and intensity of pressures. The threshold values, against which habitats were judged in the above assessment were derived from assessments carried out in line with the related obligations of the Habitats Directive.

#### Box 3.1 Bibliography

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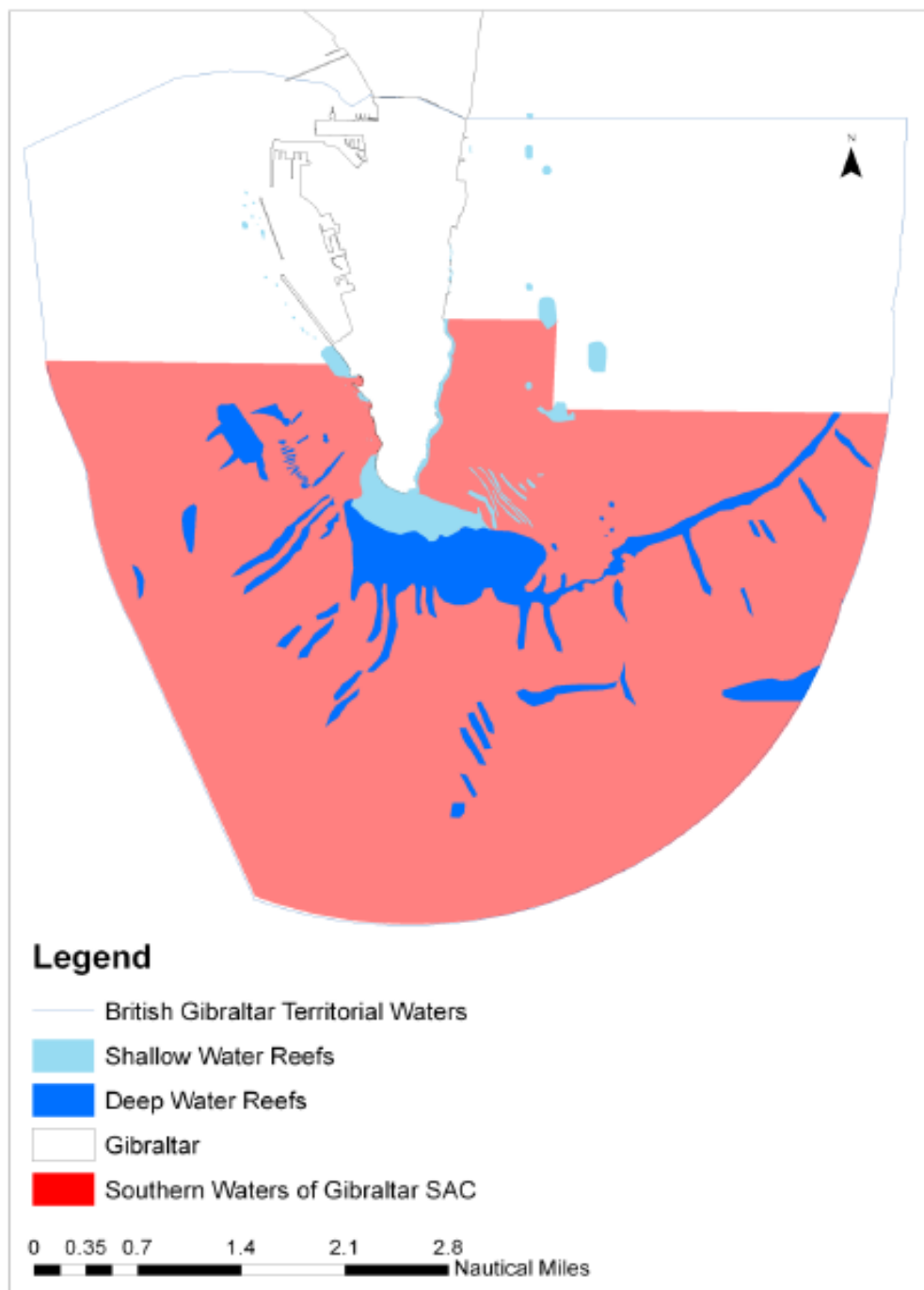
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**Figure 3.1 Spatial distribution of reefs in the Southern Waters of Gibraltar.**



Source: Southern Waters of Gibraltar Management Scheme (2012)

**Figure 3.2** Spatial distribution of submerged or partially submerged caves in the Southern Waters of Gibraltar.



Source: Southern Waters of Gibraltar Management Scheme (2012)

### 3.3 Biological features (Descriptors 1, 4 and 6)

3.3.1 BGTW are an important migratory route for avian, airborne invertebrate and marine species.

3.3.2 The hydrological regime within the Bay of Gibraltar is complex and this, coupled with nutrient rich water up-wellings, has led to a mixture of African, Atlantic and Mediterranean species co-existing in the Bay.

#### Benthic invertebrates

3.3.3 Under Annex III of the MSFD the characteristics for benthic invertebrates are described as follows:

- a description of the biological communities associated with the predominant seabed and water column habitats. This would include information on the phytoplankton and zooplankton communities, including the species and seasonal and geographical variability;
- information on angiosperms, macro-algae and invertebrate bottom fauna, including species composition, biomass and annual/seasonal variability; and
- a description of the population dynamics, natural and actual range and status of other species occurring in the marine region or sub-region which are the subject of Community legislation or international agreements.

#### Key pressures

3.3.4 The main pressures on the benthic invertebrate communities of Gibraltar are abrasion, collection, contamination by hazardous substances and illegal fishing activities.

#### Current status and trends

3.3.5 The rocky shorelines and off-shore reefs within BGTW provide ideal habitats for benthic marine invertebrates. The rocky littoral to the sub-littoral zone and rocky reefs reveal a rich biodiversity of benthic species; surveys and observations have recorded the presence of mussels, echinoderms, nudibranchs, hermit crabs, spider crabs, winkles, triton snails, top shells, limpets, barnacles, sea anemones, soft corals and sea fans.

3.3.6 Within BGTW and particularly within the Southern Waters of Gibraltar (a dual SAC and SPA) the Department of the Environment is monitoring the quality of coastal water as part of Gibraltar's obligations under the Water Framework Directive 2000/60/EC.

3.3.7 Surveys undertaken for the WFD found three main communities around the coast of Gibraltar:

- Well sorted or very shallow sands Characteristic species of this community present in the samples include the amphipods *Hippomedon massiliensis* and *Siphonoecetes dellavallei*, the decapod *Diogenes pugilator* and the polychaete *Prionospio malmgreni*.
- Transitional community between well sorted or very shallow sands and coastal detritic bottoms. Characteristic species of this community which have been found include the decapod *Diogenes pugilator* and the polychaete *Sigalion mathildae*.

- Transitional community between muddy sands in protected areas and shallow coastal terrigenous mud. Characteristic species found include the bivalves *Paphia aurea* and *Nucula sulcata*, the amphipod *Leptocheirus pectinatus* and the polychaetes *Paradoneis lyra* and *Heteromastus filiformis*.

3.3.8 In deeper, subtidal waters, historic conch raking off the East side of Gibraltar has had a considerable negative impact on its ecological diversity and abundance. The regular disturbance means there are poor epi-benthic communities and a lack of large slow growing bivalve and gastropod species. Commercial fishing is banned in BGTW by Gibraltar law but Spanish registered commercial fishing boats still partake in illegal fishing practices. .

3.3.9 Several benthic species found within BGTW are designated as protected under schedule IV of the Habitats Directive. These are discussed in detail below.

#### ***Patella ferruginea* - Ribbed Mediterranean limpet**

3.3.10 The coast of Gibraltar provides one of the largest single populations of this gastropod within the Iberian Peninsula which is endemic to the Mediterranean Sea. It is found adhered to rocks in the mid- to supralittoral zones, tends to avoid areas that are too exposed to wave action and favours areas of highly oxygenated water.

3.3.11 *P. ferruginea* is listed in Annex IV of the Habitats Directive and is found in numerous locations within BGTW.

3.3.12 Anthropogenic impacts (i.e. abrasion, collection, chemical and biological contamination) coupled with its low growth and reproductive rates, threaten *P. ferruginea* with extinction. Because it is so sensitive to changes in the environment, it is proposed as a bio-indicator of environmental quality.

3.3.13 The North Mole/airport runway is considered as a 'hotspot' for *P. ferruginea* possibly due to its restricted access which may have allowed the population in that area to reach a more balanced sex-ratio and act as a 'source' for new populations. There are other populations around the coast of Gibraltar including within the Southern Waters of Gibraltar SAC/SPA.

#### ***Pinna nobilis* & *Pinna rudis* – Fan mussels**

*Pinna nobilis* is also endemic to the Mediterranean Sea. It is a large bivalve (80 cm to 1 m) living solitarily in soft sandy and sometimes maërl /mud substrate between 3 and 40 m deep (although mostly deeper than 20 m). *P. nobilis* is listed in Annex IV of the Habitats Directive and is particularly found in the Southern Waters of Gibraltar (SAC/SPA). The mussels half bury themselves into the substrate anchored by their byssus threads. The upper half then stands out of the substrate and they filter feed. They are thought to avoid areas of high sediment transfer loads and seem to only be found on the west side in the Bay of Gibraltar. There exists a closely-related species of fan mussel in BGTW which is *Pinna rudis*. This species is also in regression and although not listed in Annex IV of the EU Directive 92/43/CEE, it is included in the subsequent Barcelona (Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean 1999 – Annexe II) and Bern Conventions (on the conservation of European wildlife and natural habitats 1998 – Annexe II).

3.3.14 On the southwest *P. rudis* is found near the warm hypersaline outfall just north of the Nuffield Pool complex. It is thought that the warm water is more productive, providing an ideal environment for a filter feeder.

3.3.15 Historic populations of *P. nobilis* were reported in sea grass meadows in the Bay of Gibraltar; however these meadows have all but disappeared and it is assumed that this is partly

to blame for the serious decline of *P. nobilis* seen in recent years. Other anthropogenic factors are also thought to contribute towards this decline (trawling, overfishing, and pollution); indeed they are found in the vicinity of shipwrecks and rocky outcrops, presumably because these areas are not trawled and so individuals in these areas are not removed.

***Lithophaga lithophaga* – Date mussel**

3.3.16 The date mussel (*L. Lithophaga*) is listed in Annex IV of the Habitats Directive and is found in coastal regions of the Atlantic Ocean as well as the Mediterranean Sea. It bores 10-20 cm holes into limestone rocks and subsequently inhabits them. Due to its geology the Gibraltar region harbours a significant population of date mussels. It seems to prefer areas with strong currents and low sediment and is less common on the East side of Gibraltar where the currents are stronger. Studies have shown that *L. lithophaga* is present in most limestone and limestone-derived benthic substrates found in BGTW.

3.3.17 The tunnels and holes made by *L. lithophaga* in the rocks provide shelter in which other marine organisms can breed and feed, thus without the date mussel the diversity of communities on limestone rocks would be severely reduced.

3.3.18 The mussel is endangered and the main cause is thought to be its collection for human consumption; this is exacerbated by its slow growth rate which makes it unsuitable for commercial breeding (it takes 15 to 20 years to reach 5 - 6 cm). Harvesting of date mussels has been banned in most Mediterranean countries as it leads to the destruction of the limestone rocks in which it is found. This damages the ecosystem and, due to the mussel's slow growth rate, this effect is near impossible to rectify.

***Centrostephanus longispinus*- long-spined sea urchin**

3.3.19 *C. Longispinus* is considered a rare species and is listed in Annex IV of the Habitats Directive.

3.3.20 *C. longispinus* has a wide distribution throughout the western Mediterranean and is usually found in rocky or detritic/maërl habitats, in the depth range of 5 – 200 m, although most commonly at depths greater than 25 m, with the densest populations observed between 60 – 180 m.

3.3.21 Due to its long spines and its preference for deep water habitats, *C. longispinus* is not an ideal prey and is also not commonly harvested by man due to the inaccessible depths where it is more commonly found.

**Predicted status in 2020/2030 given business-as-usual**

3.3.22 The population of *P. ferruginea* is increasing. Although usually found on natural rocky shores, it has colonised artificial rocky shores that are served well by strong currents thus reducing the pollution encountered. Although this is positive there is no evidence to suggest that the substrate is more suitable than natural rocky coasts, but does suggest the species is adaptable. Ongoing monitoring is being carried out to determine optimal conditions for colonisation.

3.3.23 Apart from the other listed species which are considered rare and endangered, there is no clear information on the status of other invertebrates found in BGTW.



### State of the evidence and development needs

3.3.24 The data pertaining to benthic invertebrate species is drawn mainly from field work researching the presence and abundance of such species in BGTW. Research has been promulgated by the requirements of the Habitats Directive and the WFD amongst other EU Directives that have been transposed in Gibraltar.

3.3.25 More resources are required to police BGTW and curb illegal practices.

#### Box 3.2 Bibliography

Fa, D.A. and Finlayson, G. (2008) *Marine Surveillance – Diving and Intertidal Survey*, final report prepared by The Gibraltar Museum for The Ministry of Environment

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### Fish communities

3.3.26 Under Annex III of the MSFD the characteristics for fish are described as follows:

- information on the structure of fish populations, including the abundance, distribution and age/size structure of the populations.

#### Key pressures

3.3.27 The main pressures on the fish communities of Gibraltar are illegal commercial fishing, recreational fishing and pollution.

3.3.28 At present, where monitoring has been undertaken, Gibraltar's ecological status has been relatively positive. Assessments carried out as part of the WFD have generally shown good water quality. However, research into marine pollution in fish species including shellfish is ongoing. Elevated levels of heavy metals and hydrocarbon in some areas have the potential to bio-accumulate throughout the food chain. A fish and shellfish monitoring programme has therefore been launched by the Department of the Environment, the results of which will be used for future assessments of fish communities in BGTW.

3.3.29 The creation of artificial reefs is likely to have been beneficial to fish and other marine species, creating environments for smaller reef fish that then attract larger predatory species into BGTW. The artificial reef programme is still in operation and new reefs are currently being planned.

#### Current status and trends

3.3.30 There is very little information on the current status of fish communities in BGTW. A separate report looking at the management of marine living resources in BGTW has been produced by an independent Fishing Expert Working Group (Tydeman & Lutchman, 2013) and this report arrived at similar conclusions to the Initial Assessment in that the data available have been insufficient in providing clear trends.

3.3.31 The most common habitat found within BGTW are sandy habitats covering a large part of the eastern and western sides of BGTW. Characteristic fish species found over sandy habitats are shown in Table 3.1.

**Table 3.1 Main fish species found over or on sandy benthic habitat. Source: BAP, Gibraltar.**

Scientific name	Common name
<i>Echiichthys vipera</i>	Lesser Weaver
<i>Trachinus draco</i>	Greater Weaver
<i>Uranoscopus scaber</i>	Stargazer
<i>Engraulis encrasicolus</i>	European Anchovy
<i>Sardina pilchardus</i>	European Pilchard
<i>Chelon labrosus</i>	Thick-lipped Grey Mullet
<i>Pagellus acarne</i>	Bronze Bream
<i>Spondylusoma cantharus</i>	Black Bream
<i>lithognathus mormyrus</i>	Striped Sea Bream
<i>Raja clavata</i>	Thornback ray
<i>Torpedo marmorata</i>	Marbled electric ray
<i>Solea solea</i>	Common sole
<i>Sygnathus spp</i>	Pipefish

3.3.32 The currents and upwellings within the Strait and the Alboran Sea bring nutrients that stimulate the growth of plankton and thus attracting a variety of pelagic fish (Table 3.2).

**Table 3.2 Main pelagic fish found in the Strait of Gibraltar. Source: BAP, Gibraltar.**

Scientific name	Common name
<i>Trachinotus ovatus</i>	Pompano
<i>Trachurus mediterraneus</i>	Mediterranean horse mackerel
<i>Trachurus picturatus</i>	Blue jack mackerel
<i>Trachurus trachurus</i>	Atlantic horse mackerel
<i>Spicara flexuosa</i>	Picarel
<i>Spicara maena</i>	Blotched picarel
<i>Pomatomus saltatrix</i>	Bluefish
<i>Scomberesox saurus</i>	Atlantic saury
<i>Auxis rochei</i>	Bullet tuna
<i>Euthynnus alletteratus</i>	Little tunny
<i>Katsuwonus pelamis</i>	Skipjack tuna
<i>Sarda sarda</i>	Atlantic bonito

<i>Scomber japonicas</i>	Chub or Spanish mackerel
<i>Scomber scombrus</i>	Atlantic mackerel
<i>Thunnus alalunga</i>	Albacore
<i>Thunnus thynnus</i>	Northern bluefin tuna
<i>Thunnus albacores</i>	Yellowfin tuna
<i>Xiphias gladius</i>	Swordfish
<i>Mola mola</i>	Sunfish

3.3.33 Rocky outcrops found on the sandy sea bed also attract an array of marine life, including fish such as grouper, sea breams, scorpion fish, cardinal fish, conger and moray eels, rays, gobies, blennies and sunfish amongst many other species.

#### **Predicted status in 2020/2030 given business-as-usual**

3.3.34 As there are currently limited data on the populations of fish in BGTW, predicting the status in future years is difficult. Fish tagging programmes have been implemented in BGTW targeting species such as the European sea bass (*Dicentrarchus labrax*) although further monitoring is required to accurately assess fish stocks.

#### **State of the evidence and development needs**

3.3.35 There are limited data available on fish populations in BGTW. However the Government of Gibraltar is seeking to redress this situation by implementing a series of additional fisheries management measures in line with the requirements of the Marine Protection Regulations, as well as habitat enhancement measures. An overview of the fisheries management measures that are currently being implemented in BGTW is provided by Tydeman & Lutchman, 2013.

#### **Box 3.3 Bibliography**

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## Cetaceans and reptiles

3.3.36 Under Annex III of the MSFD the characteristics for cetaceans and reptiles are described as follows:

- a description of the population dynamics, natural and actual range and status of species of marine mammals and reptiles occurring in the marine region or sub region.

### Key pressures

3.3.37 Disturbance by and possible collision with sea users such as commercial ships and dolphin and whale tour operators. Habitat loss and degradation due to the reclamation of the Bay, and areas within the harbour. Pollution by industrial and commercial activities undertaken around the Bay area. Although fishing with nets is banned in BGTW, there is still a risk of entanglement and trapping since fishing nets are known to be used illegally in BGTW.

### Current status and trends

#### Ceteceans

3.3.38 Cetaceans are common throughout all of BGTW. Both Common Dolphin *Delphinus delphis* and Striped Dolphin *Stenella coerulaeoalba* have nurseries within the Bay (Shaw, 1998). The most common species that are recorded are listed in Table 3.3 below.

**Table 3.3 Main cetacean species seen in BGTW.**

Scientific name	Common name
<i>Delphinus delphis</i>	Common Dolphin
<i>Globicephala melas (melaena)</i>	Long-finned Pilot Whale
<i>Grampus griseus</i>	Risso's Dolphin
<i>Orcinus orca</i>	Killer Whale
<i>Stenella coeruleoalba</i>	Striped Dolphin
<i>Tursiops truncatus</i>	Bottle-nosed Dolphin
<i>Physeter macrocephalus</i>	Sperm Whale
<i>Ziphius cavirostris</i>	Cuvier's Beaked Whale
<i>Balaenoptera acutorostrata</i>	Northern Hemisphere Minke Whale
<i>Balaenoptera physalus</i>	Fin Whale
<i>Megaptera novaeangliae</i>	Humpback Whale

3.3.39 Many of these cetaceans migrate through BGTW throughout the year so defining numbers is difficult. The Department of the Environment together with the Gibraltar Port Authority implements a Dolphin and Whale Protocol that is imposed on all operators within BGTW. Species that are regularly found in BGTW include the common, striped and bottle nosed dolphins. Whales also frequent BGTW but are more commonly seen in the Strait of Gibraltar and on the eastern side of the Rock. Small resident populations of sperm whales, killer whales and long-finned pilot whales are found in the Strait of Gibraltar. The Department of the

Environment gathers data from numerous research entities operating within BGTW, and the wider region, in order to monitor the status of cetacean populations in BGTW.

Results of cetacean monitoring programmes are reported in line with the requirements of the Habitats Directive.

### ***Sea Turtles***

3.3.40 Green (*Chelonia mydas*), loggerhead (*Caretta caretta*) and leatherback turtles (*Dermochelys coriacea*) are recorded in BGTW, with the loggerhead turtle being the most frequently recorded species. These are predominantly migratory visitors. To date, no turtle nesting sites along the coast of Gibraltar have been reported.

### **Predicted status in 2020/2030 given business-as-usual**

3.3.41 The assessment undertaken for the Habitats Directive considers the current conservation status of the bottlenose dolphin populations that live in the Bay as ‘inadequate’, despite the habitat being considered as ‘favourable’. This is used as a proxy for the other cetacean species that frequent the Bay and the Straits, and indicates that a holistic approach to management of the key pressures is needed if populations and individuals are not to be further impacted by the key pressures.

All three species of sea turtle recorded in BGTW are listed as endangered, and as with the bottlenose and other dolphin species in BGTW, a conservation status of ‘inadequate’ has been designated for marine reptiles.

### **State of the evidence and development needs**

Foraging and breeding areas of cetaceans within BGTW and the Bay of Gibraltar generally require strict monitoring and enforcement, particularly in relation to fishing and maritime activities that could affect cetaceans and marine reptiles. Marine Conservation Zones have been designated within BGTW and this should assist in helping conserve important habitats used by both cetaceans and marine reptiles. Further research and regional co-operation is also required to help improve the conservation status of cetaceans and marine reptiles in BGTW and the wider region.

#### **Box 3.4 Bibliography**

Department of the Environment. Government of Gibraltar. 2012. *Southern Waters of Gibraltar Management Scheme. EU Natura 2000 Site. Dual SAC/SPA.*

Perez, C.E. 2006. *Biodiversity Action Plan, Gibraltar: Planning for Nature.* The Gibraltar Ornithological & Natural History Society. Gibraltar.

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### **Phytoplankton**

3.3.42 Under Annex III of the MSFD the characteristics for phytoplankton are described as follows:

- all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

### **Key Pressures**

3.3.43 High levels of nitrogen and phosphorus contamination, such as raw sewerage and fertilisers are some of the major pressures on phytoplankton populations. Increased nutrient load creates an environment where phytoplankton can grow and become superabundant. This leads to eutrophication and significantly degrades the biological communities in the affected areas.

3.3.44 Phytoplankton also uptakes heavy metal contamination found in the water column, this is then transferred through the food chain, accumulating in higher species.

3.3.45 Changes in water quality impact phytoplankton species composition and abundance and react quickly to any changes that occur. Due to their responsive nature, phytoplankton communities recover well when adverse conditions improve, so that the main implication of changes to phytoplankton communities is the impact on the wider ecosystem. Phytoplankton is the main food resource in most marine ecosystems and alterations to communities can have wide ranging and longer lasting effects on the species which feed on them.

### **Current Status and Trends**

3.3.46 Phytoplankton numbers and concentration in BGTW have been monitored as part of the wider Water Framework Directive monitoring programme. Phytoplankton is the main food resource for many marine food webs. It is important for both pelagic and benthic ecosystems, providing an abundant food resource for smaller fish and invertebrates which then support larger species. Phytoplankton is also an important indicator species which can provide a good deal of information on the health and status of a marine environment, particularly water quality in the area.

3.3.47 Regional currents and upwelling ensure regular nutrient input into BGTW waters thus preventing stagnation and detrimental nutrient depletion.

3.3.48 Diatoms are the most commonly recorded type of phytoplankton, with high levels of microflagellates also being present. Levels of chlorophyll *a* remain constant for much of the year, with very short lived blooms at most sites in February and higher levels of Chlorophyll *a* also being recorded in the summer months and November. However, the magnitude and timings of these blooms alter between the different sites monitored in BGTW. Winter and spring blooms are common in the Mediterranean as opposed to the spring/summer blooms seen in UK waters.

3.3.49 Recorded levels of chlorophyll *a* indicate a high ecological status at all sites sampled and it would suggest that the input of additional nutrients from sewage or other point sources is not adversely affecting phytoplankton communities in BGTW.

### **State of evidence and development needs**

3.3.50 Monthly monitoring since for chlorophyll *a*, dissolved oxygen, dissolved inorganic nitrogen, temperature, pH and suspended sediment has been undertaken as part of the Water Framework Directive. Quarterly sampling for heavy metal, hydrocarbon and pesticide contaminants has also been undertaken. Although it is difficult to interpret trends from the data collected to date, they have provided a good background to compare further years' data and assess trends.

3.3.51 The ecological status of phytoplankton communities in BGTW is considered to be high and so there is no action required to improve the ecological status of phytoplankton

communities in BGTW. Continued monitoring will identify any negative trends which may need to be acted upon.

#### **Box 3.5      References used**

Government of Gibraltar (2011) Water Framework Directive Annual Monitoring Report 2010-2011. Produced by AMEC for the Department of Environment Gibraltar

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## **Algae**

3.3.52 Under Annex III of the MSFD the characteristics for algae are described as follows:

- all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

### **Key Pressures**

3.3.53 A major concern with algae is the uptake of contaminants, in particular heavy metals. Algae, particularly brown algae are efficient in the uptake of heavy metals which can then accumulate in their tissues; these contaminants are then passed onto grazing invertebrates and fish.

3.3.54 The loss of coastal habitat due to the replacement of natural coastal areas with coastal defences and sea walls is likely to cause some shifts in algal communities. This will be both a short term pressure from habitat disturbance and potentially a long term pressure as different algal communities may thrive on anthropogenic structures.

3.3.55 Changes to algal community structure can have widespread and detrimental effects on invertebrate and grazing fish species that depend on algal habitats. Loss or changes to species composition caused by changes to substratum and coastal structures are a particular pressure.

### **Current status and trends**

3.3.56 Algae are a fundamental base element to many marine food chains, in a similar way to phytoplankton, they also provide habitat in otherwise exposed sandy and rocky areas. Algae are of particular importance in intertidal and subtidal areas, providing important grazing, sheltering and nursery habitats for invertebrate species.

3.3.57 Assessments of algal communities around Gibraltar have been carried out, including assessments on the use of algal communities as bioindicators of marine pollution (e.g. Green; 2001, Warr; 2004). A mix of Atlantic and Mediterranean type algal communities typical of intertidal rocky shores and shallow subtidal rocky reefs are found in BGTW. Notable species which have been found in BGTW include the increasingly rare *Cystoseira mediterranea* which is listed as an Annex II species under the SPAMI<sup>15</sup> Protocol. It is a furoid algae with a highly branched structure providing important habitats for numerous species of inter- and subtidal

<sup>15</sup> List of Specially Protected Areas of Mediterranean Importance

invertebrates. *C. mediterranea* depends on good water quality and can be used as a bioindicator to assess the levels of water quality in the coastal area.

#### **Predicted status in 2020/2030 given business-as-usual**

3.3.58 At present, there is no evidence to suggest that algal communities are unhealthy. The presence of the bioindicator *C. Mediterranea* in parts of the Southern Waters of Gibraltar suggests that water quality is typically good. Further monitoring on the presence and distribution of this and other algal species will provide valuable information on upwards or downwards trends in water quality.

3.3.59 An increase in coastal developments and addition of coastline through land reclamation could be a double edge sword. On one hand there is an initial destruction and disturbance of habitat, however, the structures that are built in replacement are likely to offer some suitable settling ground.

3.3.60 Increases in population, infrastructure and tourist facilities may increase pressure on coastal areas. The intertidal habitat needs to be managed to avoid habitat loss.

#### **State of the evidence and development needs**

3.3.61 There is a need to further expand the algae monitoring network into deeper areas within BGTW. This will help assess the impacts of key pressures in BGTW. Further research on intertidal algal communities is also required. These measures will help mitigate the potential impacts of replacing of natural coastal structures with anthropogenic ones that may cause shifts in algal community structure.

#### **Box 3.6            References used**

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#### **Seabirds**

3.3.62 Under Annex III of the MSFD the characteristics for seabirds are described as follows:

- a description of the population dynamics, natural and actual range and status of species of seabirds occurring in the marine region or sub region.

#### **Key pressures**

3.3.63 Disturbance to breeding sites and feeding areas from recreational craft, fishing boats, divers and maritime traffic are the main pressures. Oil spills in particular are the largest threat to seabirds, especially the Mediterranean shag, whose population in Gibraltar is one of the remaining few in the mainland Iberian Peninsula. Potential sources of oil spills include the oil refinery located in the Northern end of the Bay and the intense maritime traffic passing through BGTW either in transit or for refuelling purposes within the Bay. In order to prevent any potential discharges to the marine environment, the Port of Gibraltar in conjunction with the Gibraltar Maritime Administration operate a strict inspection and enforcement regime in line conformity with applicable EU legislation along with the Bunkering Code of Practice and the Port Rules. Fishing methods, such as purse seines, trammel and drift nets, deployed by Spanish



fishing vessels are also a key threat to the Mediterranean shag and the numerous other seabirds found in BGTW as outlined below.

### **Current status and trends**

3.3.64 British Gibraltar's Territorial Waters, particularly the Southern Waters of Gibraltar SAC/SPA, are an important feeding ground for migratory birds that continuously fly through the Straits of Gibraltar.

3.3.65 Each year an estimated c.300 million birds pass over the Strait of Gibraltar in each direction.

3.3.66 Some species, such as the Cory's shearwater, forage in the Southern Waters of Gibraltar SAC/SPA whilst breeding. Other species, such as Gannets, Black-headed Gulls and Sandwich Terns for example, rely on the nutrient-rich productive waters for feeding in winter months.

3.3.67 .

**3.3.68** Many of the seabirds that use BGTW are listed in the EU Birds Directive, these include:

- Cory's shearwater
- Black tern
- Gull-billed tern
- Audouin's gull
- Mediterranean gull
- Common scoter
- Mediterranean shag
- Cormorant
- Balearic shearwater
- Little tern
- Caspian tern
- Common tern
- Sandwich tern
- Yelkouan shearwater

The status of these and other seabird species in BGTW is reported as part of the Article 17 Reporting Process in line with the requirements of the Habitats Directive. In view that the Mediterranean Shag is the only seabird that breeds in Gibraltar (along with the Yellow-legged Gull which has a more widespread distribution), further particulars are provided below.

### ***Mediterranean shag***

3.3.69 Although the shag in general has a favourable status, the Mediterranean shag has a restricted global distribution. Gibraltar hosts one of the few remaining breeding colonies for the Mediterranean shag in the mainland Iberian Peninsula with a small population (5-10 pairs) using the sea caves on the East side of the Rock. As such under Gibraltar's Biodiversity Action Plan, a

Species Action Plan has been prepared for the Mediterranean shag. This plan incorporates clear steps that are being taken to enhance their survival.

3.3.70 The population has suffered declines in the past but is now considered stable.

#### **Predicted status in 2020/2030 given business-as-usual**

The population of Mediterranean Shag in Gibraltar is small, so any fatalities would have a major impact on the future success of the resident population.

#### **State of the evidence and development needs**

3.3.72 The Department of the Environment is provided with data collected by the Gibraltar Ornithological & Natural History Society (GONHS), which continuously assesses which Annex I or regularly occurring migratory bird species occur in BGTW. Ornithological research within GONHS is co-ordinated by the Strait of Gibraltar Bird Observatory. This is divided into monitoring and research with emphasis on the migration of passerines, seabirds and raptors and an annual passerine ringing programme. The GONHS has a database of records dating back to the 1960's and publishes an annual account of avian records in Gibraltar including the Southern Waters of Gibraltar (Gibraltar Bird Report). Additionally, records of note are published online [<http://www.gonhs.org/records.htm>].

3.3.71 The Southern Waters of Gibraltar have been designated as a dual SAC/SPA, affording the nesting site for the Mediterranean shag some protection. Ongoing monitoring is required, and this would benefit from enhancement of the nesting site and a reduction in human disturbance.

3.3.72 There needs to be improved monitoring of maritime traffic and fuel management and enforcement of laws with regards to net fishing.

#### **Box 3.7 References used**

Casier, R. (2011) *Marine Protected Areas in the Mediterranean Sea*, study awarded by EUROPARC Conference 2011 and made possible by Alfred Toepfer Stiftung F.V.S DoE, Gibraltar & Environmental Agency, Gibraltar (2008) *Climate Change: The Gibraltar Programme*

Department of the Environment. Government of Gibraltar. *Southern Waters of Gibraltar Management Scheme. EU Natura 2000 Site. Dual SAC/SPA.*

Halcrow (2007) *Eastside Environmental Statement*

Perez, C.E. (2006) *Biodiversity Action Plan, Gibraltar: Planning for Nature*, The Gibraltar Ornithological & Natural History Society, Gibraltar

Wildlife (Gibraltar) Ltd (2007) *Six-year report for the EC Habitats Directive 2000-2006: Gibraltar*, report for the Government of Gibraltar

## **3.4 Non-indigenous species (Descriptor 2)**

3.4.1 Under Annex III of the MSFD the characteristics for non-indigenous species is to be described as follows:

- an inventory of the temporal occurrence, abundance and spatial distribution of non-indigenous, exotic species or, where relevant, genetically distinct forms of native species, which are present in the marine region or subregion.

### **Current status and trends**

3.4.2 There is insufficient information currently available to properly assess the current status of non-indigenous species in the waters of Gibraltar.

3.4.3 A species is classed as non-indigenous when it is found in an area that is outside of its normal dispersion potential. For the marine environment this may come about by the introduction of species to new areas through attachment to boats (bio-fouling), through the expulsion of ballast water and introduction by man through aquaculture or unwanted pets. These species have the potential to out-compete indigenous species for habitat and prey. As such they are considered a threat to biodiversity and may be costly to manage.

3.4.4 The Strait of Gibraltar is the main shipping channel into and out of the Mediterranean from the Atlantic Ocean. As such the opportunity for non-indigenous species to arrive attached to ships or in ballast water is high.

3.4.5 As sea temperatures rise, it is anticipated that there will be an increase in the introduction and range expansion of non-indigenous species with unknown consequences for biodiversity, ecosystem functioning and living marine resources.

3.4.6 Localised gyres and currents mean the physical conditions in the West Mediterranean area are not suitable for the permanent settlement of all species that may end up there. A recent study (Zenetos *et al*, 2010) summarised the following numbers of non-indigenous species found in the Western Mediterranean sub-region, which includes Gibraltar:

- 4 pathogenic protozoa;
- 91 macrophytes;
- 49 polychaetes;
- 52 crustacea;
- 34 molluscs;
- 23 miscellaneous invertebrates (i.e. bryozoans, anemones, echinoderms); and
- 45 fish.

3.4.7 It is currently not clear how many of these are found in Gibraltar's territorial waters, and how many are a real threat to indigenous species. Intertidal ecology research has nevertheless shown that the marine algae *Asparagopsis armata* is prevalent in BGTW. Continued research in this field is therefore required as part of the Marine Surveillance Monitoring programme.

### **Predicted status in 2020/2030 given business-as-usual**

3.4.8 Given the lack of specific data on the population dynamics and ecology of non-indigenous marine species occurring in BGTW it is difficult to predict whether there will be an impact on the indigenous population.

3.4.9 Any increase in shipping through the Strait brings with it an increase in potential introduction of non-indigenous species through ballast dumping and hull biofouling. Transposition and enforcement of the requirements of the International Convention for the Control and Management of Ship's Ballast Water and Sediments Ballast Water should significantly help control ballast water discharges in BGTW.

## 3.4.10

**State of the evidence and development needs**

3.4.11 Currently non-native marine species are monitored by the Department of the Environment under the Marine Surveillance Monitoring Programme.

3.4.12 Monitoring and reporting of invasive species must be expanded as required under the Marine Strategy Regulations 2011.

3.4.13 The Government of Gibraltar is committed to cooperating with countries in the wider region and form part of the EU wide Invasive Species Alert System.

**Box 3.8      References used**

Government of Gibraltar. *Southern Waters of Gibraltar Management Scheme. EU Natura 2000 Site. Dual SAC/SPA.*

Zenetos, A. *et al* (2010) Alien species in the Mediterranean Sea by 2010. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part I. Spatial distribution. *Medit. Mar. Sci.*, **11(2)**, 381-493.

**3.5 Commercial fish stocks (Descriptor 3)**

3.5.1 Under Annex III of the MSFD the characteristics for commercial fish stocks are described as follows:

- populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

**Key Pressures**

3.5.2 The major pressures facing commercial fish are overfishing and the use of illegal fishing methods. Commercial fishing is illegally conducted by Spanish fishing vessels based in the ports of La Linea de la Concepcion and Algeciras (Spain), and it is therefore difficult for Gibraltar authorities to assess the levels of catch landed that originate from BGTW. This issue was specifically highlighted in the report produced by Tydeman & Lutchman (2013). The fishing gears used by commercial vessels can be particularly detrimental to reef habitats, coastal seabed communities and, larger pelagic species (e.g. tuna, sunfish, etc) including cetaceans and marine reptiles that frequent BGTW. There also exist other smaller-scale pressures such as recreational fishing and the illegal harvesting of intertidal bivalves.

**Current Status and trends**

3.5.3 An overview of the some of the main commercial species found in BGTW has already been provided in section 3.3. (biological descriptors). BGTW benefit from having an extensive reef habitat with good water exchange and easy access to deep waters. As a result it potentially holds an abundance of fish species that inhabit the coastal rocky reefs especially baitfish. These species provide food for larger predatory fish that enter the coastal waters from the deeper waters of the Strait of Gibraltar and the Bay.

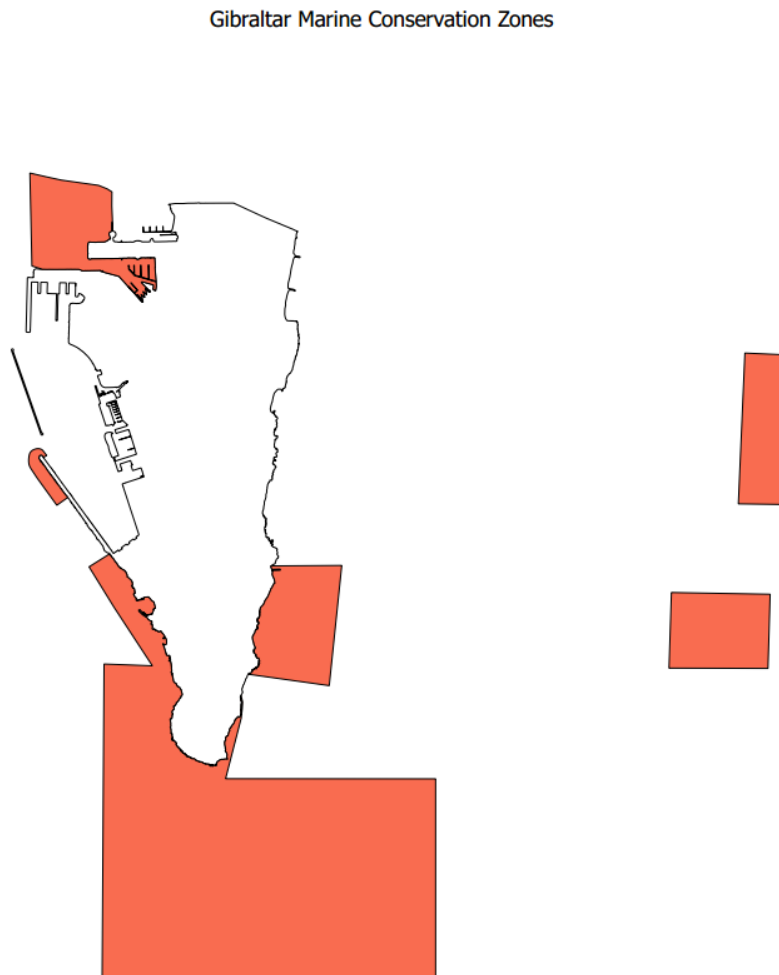
3.5.4 Gibraltar has no commercial fishing fleet and as a result has no fishing quota, although small scale subsistence (cottage) fishing does take place. Commercial fishing is prohibited using specific fishing methods under the Nature Protection Act 1991, however, this is not recognised by the Government of Spain, and fishing activities from Spanish Waters extend into BGTW. This becomes a source of friction when Spanish fishing vessels refuse to acknowledge the applicable British Gibraltarian legislation. Fish species targeted both within BGTW and in adjacent waters are a mixture of local stocks and regional and shared stocks. In some cases, highly migratory stocks also pass through Gibraltar's waters from the Atlantic through the Straits of Gibraltar and from the Mediterranean. The management of fishing activities within BGTW is critically dependent on accurate information about the state of the stocks, the fishing pressures on these stocks and other maritime activities or environmental pressures. In the case of the majority of the stocks, there is limited information on their state and the impact of the different activities on the fish stocks in BGTW. Both the Nature Protection Act 1991 and the Marine Protection Regulations subsequently adopt a precautionary approach and prohibit commercial fishing in BGTW using selected fishing methods.

3.5.5 Despite the small extent of BGTW, there are numerous important commercial species that are found therein. Tables 3.1 and 3.2 list the main coastal and pelagic species found in BGTW. Species of mackerel, tuna and swordfish are amongst the most commercially valuable fish found in BGTW.

3.5.6 As Gibraltar has no commercial fleet there are limited data on the stocks of commercial fish although programmes are being implemented by the Department of the Environment via the recreational fisheries sector to gather much needed fisheries data.

The Southern Waters of Gibraltar are designated as a dual SAC/SPA and has 3 marine conservation zones (MCZ) within it. The MCZs include areas where important reefs are situated and are likely to be important areas for fish communities. Different fisheries protection measures are in place within each of the MCZs outlined below.

**Figure 3.3. Location of MCZs in British Gibraltar Territorial Waters.**



Source: Southern Waters of Gibraltar Management Scheme (2012)

#### **Predicted status in 2020/2030 given business-as-usual**

3.5.7 If allowed to continue, proscribed fishing methods undertaken in BGTW by foreign fishing vessels will continue to have impact on fish stocks and habitats that support the fish communities in BGTW. Habitat damage further diminishes the ability of fish stocks to recover hence the artificial reef network in BGTW.

3.5.8 Without a form of acceptance or compromise from the Spanish authorities it is likely that the current status will at least remain as at present. If Gibraltar continues to enforce the

requirements of the Nature Protection Act 1991 then the future scenario is more optimistic and it is likely that improved fish stocks would be able to allow sustainable recreational and subsistence fishing, and possibly a degree of controlled commercial fishing.

3.5.9 Illegal harvesting of shellfish also takes place by Spanish rake fishermen both during and outside established shellfish harvesting seasons in Spain. When the Spanish fleet is not allowed to carry out these activities in Spanish waters they move into BGTW. This is likely to be a continued problem since all forms of raking are prohibited in BGTW under the Nature Protection Act 1991.

#### **State of the evidence and development needs**

3.5.10 There is limited baseline information available on the status of fish stocks in BGTW. An initial assessment into the current status has been carried out by Tydeman & Lutchman (2013) although further research and monitoring is required. However, it should also be noted that the populations of pelagic fish present in BGTW are likely to be heavily influenced by fishing effort in nearby waters and the Mediterranean in general.

3.5.11 Gibraltar has implemented no fishing areas in its own waters, however, this effort has also been largely undone by a refusal to accept no fishing zones by Spanish fishing fleets. Until a regional approach to fishing efforts and practices is achieved, it will be difficult to improve the current status and future assessment of fish stocks and coastal habitats in BGTW generally.

3.5.12 With regards recreational fisheries, Gibraltar is implementing the Marine Protection Regulations which impose conditions on this activity as well as recreational diving. It is envisaged that this legal instrument will help Gibraltar meet the requirements of Good Ecological Status provided that favourable developments take place in relation to illegal commercial fishing.

#### **Box 3.9      References used**

Gibraltar Ornithological & Natural History Society (1999) *Commercial Fishing and the Conservation of Marine Life in the Waters around Gibraltar*

Department of the Environment. Government of Gibraltar. *Southern Waters of Gibraltar Management Scheme. EU Natura 2000 Site. Dual SAC/SPA.*

Zenetos, A. *et al* (2010) Alien species in the Mediterranean Sea by 2010. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part I. Spatial distribution. *Medit. Mar. Sci.*, **11(2)**, 381-493

## **3.6 Eutrophication (Descriptor 5)**

3.6.1 Under Annex III of the MSFD the characteristics for eutrophication are described as follows:

- human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.

### Current Status and trends

3.6.2 Eutrophication is the enrichment of water by nutrients, particularly due to elevated levels of nitrogen and phosphorous. Enhanced enrichment causes accelerated growth in algae and plants causing an imbalance of organisms present and a reduction of water quality.

3.6.3 There are limited sources that would contribute to eutrophication in BGTW, with the only major source of additional nutrients being the point source and overflow of sewage. The River Basin Management Plan for Gibraltar assesses coastal waters as having 'good' levels of nutrients in coastal, harbour and, ground waters. However, the heavily modified water body of Gibraltar harbour is classed as 'probably at risk' from sewage overflows.

3.6.4 Sewage effluent is discharged at Europa Point, at the southern end of Gibraltar, into the coastal water body. Only screening of solids is provided as the coastal waters of Europa Point have extremely high water exchange and high rates of natural dispersion; contaminant levels are therefore unlikely to build up. The current risk of eutrophication is considered to be negligible.

3.6.5 Sewage effluent at Europa Point can be detrimental since it contains elevated levels of pollutants, as do all sewage discharges that have the potential to impact on marine species and habitats. Nevertheless sewage contains nitrogenous waste-based compounds that in dilution can improve the nutrient content of the waters, stimulating plant plankton growth. It can also hinder the development of marine organisms when the concentrations are excessive, but this does not occur at Europa Point where the strong currents ensure that the effluent is quickly dispersed into the Strait of Gibraltar. The shoreline receives a minimal quantity of nutrients in the immediate vicinity of the outfall, and tests carried out by the Environmental Agency on the water quality of the beaches show that the water quality complies with mandatory European standards. The use of salt water in the flushing and sewage systems already reduces the bacteriological content and activity of the effluent and is in effect already treating the sewage to some extent. The pumping stations, which ensure that gravity carries the effluent to the outfall, significantly reduce the solid waste to a mainly liquid form. However, the need to comply with the Urban Wastewater Treatment Directive requires that a new sewage treatment plant be built and plans are already in place for this development to be completed by 2015. Paradoxically, sewage treatment could have the effect of reducing the food available to the fish that feed near the site, particularly thick-lipped grey mullet *Chelon labrosus*, and so may have a negative effect on other species.

3.6.6 It is considered that there is good water exchange between BGTW and the wider environment, including open sea, with the exception of the waters in Gibraltar Harbour. It is however unlikely that there will be a build-up of nutrients or algal matter to sufficient levels to cause eutrophication. Hypoxia is also unlikely and monitored levels of dissolved oxygen in the coastal water body have been assessed as 'high' under the WFD and are predicted to remain 'high'.

3.6.7 Under the WFD monitoring programme there are three surveillance monitoring sites in the coastal water body and one location within the HMWB (harbour). Monitoring of nutrients (nitrates, nitrites, ammonia and phosphates) is undertaken monthly. The current status of dissolved inorganic nitrogen (DIN, calculated) is assessed as 'good' under the WFD and is predicted to remain 'good'.

3.6.8 It is likely that there will be some transboundary issues and features given the close proximity of Spanish waters, in particular the heavily industrialised North area of the Bay of Gibraltar. The location of a combined sewer overflow that services part of the neighbouring



Spanish town of La Linea de la Concepcion and discharges directly into BGTW in the Western Beach basin creates an additional pressure on coastal water quality.

3.6.9 Increased levels of sewage, regardless of their source, are likely to increase the risk of eutrophication.

**Predicted status in 2020/2030 given business-as-usual**

3.6.10 There are no problem areas in relation to eutrophication in Gibraltar at present, however increased pressures from human population growth and more frequent overflow events as a result of climate change may increase future levels of nutrients in BGTW.

3.6.11 Mechanisms already in place for reducing spillages from sewer overflows include de-silting of the gully and sewer network along with increased maintenance and upgrading of the sewer pumping station network. A maintenance contract, overseen by the Technical Services Department, specifies how many times a year de-silting of gullies should be undertaken.

3.6.12 In respect to the sewer network, de-silting occurs as and when required to improve capacity. It is the responsibility of the Technical Services Department of the Government to maintain the sewer network in good working condition. Improvements are also planned for the network as part of the Wellington Front Flood Alleviation scheme. These improvements are designed to reduce flooding but as a by-product will also improve the capacity of the sewers and therefore reduce the frequency of sewer overflows into the Gibraltar Harbour.

3.6.13 Impacts of climate change are likely to affect sewage discharges, particularly overflow events. Overall, annual rainfall levels are due to decline in the Mediterranean, however increased storminess and greater rainfall intensity have the potential to increase the volume of sewage disposed and the quality/chemical reactions of the sewage. Population growth within Gibraltar in the future will also result in increased levels of sewage.

3.6.14 Continued monthly monitoring at coastal sites will monitor levels of nutrients and negotiations with Spanish authorities will continue to attempt to resolve the impact of Spanish sewerage on the Western Beach basin.

3.6.15 Any potential for eutrophication in 2020/2030 is predicted to decrease due to the design and build of a new Sewage Treatment Plant. Completion is expected in 2015.

**State of the evidence base and development needs**

3.6.16 Considering its size, there is a relatively high number of coastal water monitoring sites in BGTW and water quality results obtained are classified using applicable EU water quality standards (see Gibraltar River Basin District Management Plan for an overview of the classification of coastal waters). There is high confidence that indicators of excessive nutrient levels and eutrophication would be detected and that the assessment for eutrophication is accurate.

3.6.17 A secondary sewage treatment plant has been designed and this will help further improve the quality of sewage discharged into the coastal waters and reduce any amounts of excess nutrients or contaminants entering coastal waters in BGTW. The design of the works will address potential climate change effects and future population levels. The potential effect of climate change on this point source pressure is therefore considered to be very low.

3.6.18 The use of sustainable drainage systems, where appropriate, on new developments could help to prevent further capacity problems in the sewer network, by controlling surface water discharges at source. Such systems can provide multiple environmental benefits not only on

water quantity but on aesthetic quality and biodiversity. For example green roofs can be used to control rainwater falling on building roofs, but also contribute toward habitat creation and energy reduction by providing building insulation. The Gibraltar Development Plan contains a myriad of sustainable development policies including measures that will help combat flooding events that can potentially result in increased pollution levels. In addition, the Environmental Agency is responsible for ensuring new developments comply with Building Regulations and Approved Code of Practice, which includes appropriate control for the discharge of sewage, oils and lubricants.

#### **Box 3.10      References used**

Government of Gibraltar (2011) Water Framework Directive Annual Monitoring Report 2010-2011. Produced by AMEC for the Department of Environment Gibraltar

Government of Gibraltar (2011) *River Basin Management Plan*, report produced by AMEC for the Department of Environment, Gibraltar

Government of Gibraltar (2011) Waste management action plan.

Perez, C.E. (2006). *Biodiversity Action Plan, Gibraltar: Planning for Nature*. The Gibraltar Ornithological & Natural History Society. Gibraltar.

War, S.J. 2012. A general assessment of marine pollutants in Gibraltar coastal waters (southern Iberian Peninsula) Risks and future changes. MSc dissertation thesis. University of London.

## **3.7 Hydrographic conditions (Descriptor 7)**

3.7.1 Under Annex III of the MSFD the characteristics for hydrographic conditions are described as follows:

- permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.

### **Current Status and Trends**

#### ***Natural environment***

3.7.2 Gibraltar forms the eastern edge of the Bay of Gibraltar. The Bay is 8km wide and extends 10km into the mainland. It is one of the deepest bays in Europe (over 400m) and is conditioned by the hydrodynamic movements of the Straits of Gibraltar. Estimates suggest that there is a net surface inflow of Atlantic water through the Straits approximating 53,000 km<sup>3</sup>. This is compensated by the export of 50,500 km<sup>3</sup> of highly saline deep water emanating from the Mediterranean. These mass movements of saline water through the Straits are believed to play a key role in controlling the biogeochemistry of the Mediterranean and even the circulation and climate of the Atlantic Ocean.

3.7.3 The bathymetry surrounding Gibraltar is varied. On the West coast there is a narrow shelf area and steep continental slope with deep water (>200m) within a mile of the shoreline. In the centre of Gibraltar Bay the water depth reaches around 400m. To the South, the coastal slope separating Gibraltar from Morocco declines to around 900m within 10 miles of the coast. BGTW extend up to 3 nautical miles from the southern and eastern shores and up to the median line in the Bay of Gibraltar, and therefore there are limited deep sea environments in BGTW.

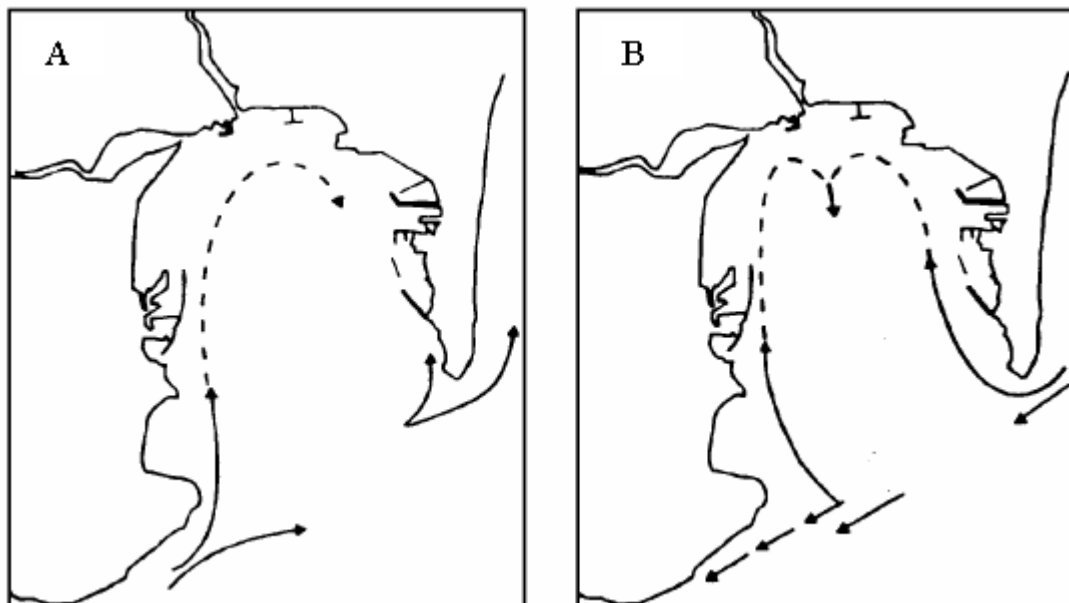
3.7.4 To the East there are shallow coastal habitats predominantly characterised by sandy/soft substrates and reef. This extends out for several km up to the continental slope where both maerl and rock are found along the outer edges of BGTW.

3.7.5 Salinity levels within BGTW (1 mile out) generally lie within the Euhaline range (30 to <40 ppt). Due to the high variability of depth, with areas of deep and shallow water, mean depth would equate more closely to the intermediate type. The coastal water type therefore can be considered as Mediterranean euhaline intermediate.

3.7.6 The natural intertidal zone is a mix of rocky shore, manmade structures and sandy beaches, with most of the shore being rocky shore. However, due to the lack of tidal movement in the Mediterranean (approximately 1 m vertical movement), the intertidal zone is relatively narrow and somewhat compressed.

3.7.7 Within the stable bi-directional currents moving into and out of the Straits of Gibraltar lie smaller-scale superficial currents that operate within the Bay of Gibraltar itself. Prevailing currents tend to be either easterly or westerly in line with dominant wind patterns observed in the Straits area. The exact direction of the current ultimately depends on the state of the tidal cycle although winds can amplify, cancel and even reverse tidal currents within the Bay.

**Figure 3.4 Main current flows in the Bay of Gibraltar during (a) tidal flux and (b) tidal reflux.**  
Source: Fa 1998. Modified from Caminas, 1987.



3.7.8 The Alboran Sea, situated immediately East of Gibraltar, exhibits strong Atlantic affinities with the incoming influx of water. The incoming Atlantic waters form a permanent clockwise gyre in the Alboran Sea, which is separated from the rest of the western Mediterranean by a well-marked hydrographic front.

3.7.9 There are no rivers in Gibraltar. Two major rivers enter the Bay in Spanish waters, the Rivers Palmones and Guadarranque, creating localised salinity gradients within the Bay.

### ***Key Pressures***

3.7.10 Gibraltar has an overall size of 6.8 km<sup>2</sup> and a coastline of 12km and a high population density of 4,959 people per km<sup>2</sup>. As such, it has a high proportion of coastal development, much of which is residential and light industrial. The western coast is heavily developed with a large amount of the coast dedicated to harbour facilities and marinas. There are also heavily developed residential and tourist areas along this coast. The East side is less densely developed with mainly residential, tourist, leisure developments and bathing beaches along the coast.

3.7.11 Gibraltar Harbour has a large seawall enclosing a body of water and reclaimed land. There are also large, manmade moles creating an irregular shoreline within the harbour water body. The East side is still largely composed of a natural rocky shoreline with the exception of the new reclamation found within the North-east part of BGTW. Developments that extend into the coastal zone can alter hydrodynamic and sedimentary processes in the coastal waters. Activities likely to cause an impact on coastal processes are:

- Dredging altering sedimentation, water circulation and tidal flows;
- Coastal development such as harbours, sea defences and shoreline developments altering patterns of water movement and as a consequence patterns of erosion and deposition;
- Reclamation of land;
- Discharge of water into coastal areas from industrial and sewage processes; and
- Seawalls and rock armour that prevent waves dissipating energy through erosion and breaking, and reflect energy back to sea. This can cause greater turbulence in adjacent sand and mud and/or reduce sediment supply to adjacent habitats.

3.7.12 Gibraltar Harbour consists of a large seawall restricting the flow between Gibraltar Bay and the inner harbour waters.

3.7.13 As part of the pressure and impact analysis, provisional HMWBs can be identified. If a water body is at risk or probably at risk of failing to meet good ecological status as a result of morphological pressures, it is provisionally identified as a HMWB. The Gibraltar Harbour coastal area and area between the harbour and the airport have been provisionally designated as a HMWB in the Gibraltar River Basin District Management Plan.

3.7.14 The restricted flow and exchange between the open sea and the harbour area due to the large sea wall and restricted access cause considerable hydrodynamic and sedimentation impacts. It is also likely to trap contaminants in the harbour basin and increase contamination levels.

3.7.15 In other regions of Gibraltar coastal development is unlikely to have major impacts on hydrographic conditions, although manmade protrusions into the intertidal area along the coast (such as beach defences and jetties) are likely to have small scale localised impacts on coastal processes.

3.7.16 Dredging around the harbour channel is likely to alter sedimentation and hydrodynamic processes around the harbour coastal water and HMWB area.

3.7.17 Dredging is an invasive procedure that causes direct and indirect losses of sediment due to removal and alterations in sediment transport regimes. It also directly impacts on faunal

habitats through habitat loss and alteration. There is also the potential for dredging to re-suspend contaminants trapped in sediments and create significant sediment plumes which result in smothering of adjacent benthic habitats. However, in the longer term, removal of contaminated sediment can prove beneficial to faunal habitats. Additionally, the development of beach groynes, especially if made from limestone, provides opportunities for new communities to develop.

3.7.18 As Gibraltar is highly restricted by size and already has a high population density it is likely that creating reclaimed land in the coastal area will continue as a result of economic development. This will increase pressures on hydrodynamic and sediment processes in both the Gibraltar Harbour HMWB and coastal water body.

### *Environmental impact from alterations to hydrodynamic regimes*

3.7.19 Much of Gibraltar's near shore benthic habitat is sandy substrate, however, there are areas of coastal rocky reef, artificial reef and maerl beds which are particularly high in biodiversity and are important biological habitats.

3.7.20 Due to the proximity of the deep waters of the Strait and the mixing of Mediterranean and Atlantic waters there are also important pelagic fish communities found in the waters surrounding Gibraltar. These include highly important species (both from a commercial and conservational perspective) as previously outlined as part of the fisheries descriptor.

3.7.21 In the current status, coastal developments are shore based with some projects extending into the intertidal and near shore area. These structures are unlikely to alter or impact on the large scale currents acting within Bay of Gibraltar and beyond.

3.7.22 However, these coastal developments do alter the natural shape of the coastline and are likely to have localised impacts on tidal movements along the shoreline, potentially impacting on sediment transportation and erosion in the intertidal/near shore zone.

3.7.23 Within the modified water body of the harbour the intertidal zone and marine life has been greatly compromised by the reclamation of land around the moles. Water exchange has been restricted by the sealing of a channel that allowed water exchange between open water in Bay of Gibraltar and the harbour. The present currents are sometimes insufficient to allow sufficient hydrodynamic movement in the harbour. Coupled with the low tidal range, this can potentially result in a degree of stagnation of the harbour waters at certain times of the year which is then likely to affect marine life within this Harbour.

3.7.24 It is also likely that the lack of water movement within the harbour area will result in sedimentation which will then have to be regularly dredged to maintain the necessary depth. Sedimentation, most likely with a degree of contamination, will also negatively impact marine fauna in the harbour area. It is likely that poor water exchange will contain and increase the levels of contamination in the harbour area and reduce levels of biodiversity within the water body.

3.7.25 Dredging activities around the harbour are also likely to increase suspended sediment levels and smothering of the surrounding environment, although smothering outside of the harbour will be reduced due to the good levels of water exchange.

3.7.26 Saltwater intakes for Gibraltar's reverse osmosis are also located within the harbour although the outfalls are located in the coastal water body. Reverse osmosis plants can result in localised salinity and temperature gradients which will impact on the zonation patterns of local biological communities, reducing biodiversity.

3.7.27 Similarly, the sewage outfall at Europa Point is likely to have impacts on the local biological and physio-chemical condition by creating localised plumes of warmer and low salinity water with higher nutrient levels. The impacts from this will be minimised following construction of the new secondary sewage treatment plant in addition to the high degree of hydrodynamic movement that is characteristic of Europa Point.

#### **Predicted Status by 2020/2030**

3.7.28 The existing marine planning, licensing and consent process will ensure that developments are assessed, and potential impacts on hydromorphological conditions are appropriately managed and monitored, in line with the requirements of the EU Environmental Impact Assessment Directive and the EU Habitats and Birds Directives.

3.7.29 It is important to understand how changes in hydrographical conditions as a result of human developments interact with the potential shifts in hydrographic conditions due to changing climate and increased levels of atmospheric CO<sub>2</sub>. For example, temperatures in the North Atlantic have risen by around 1°C since 1910 and similar rises in Mediterranean waters may have impacts on water mixing and hydrodynamic processes as predicted by the Intergovernmental Panel on Climate Change.

3.7.30 Gibraltar has an increasing population and is trying to attract both industry and tourism. Given its limited space for expansion it is likely that the need for more reclaimed land is going to be greater over the next decade. Hydrological impacts will need to be carefully assessed both individually and cumulatively to determine the impacts and extent of any changes to sediment transport or hydrological regimes.

#### **State of evidence base and development needs**

3.7.31 Much of the evidence has come from monitoring carried out under the WFD, focusing on water bodies. Several other studies into pollution and the biodiversity action plan have looked at hydrological regimes and conditions around the coast.

3.7.32 Halcrow (2007) conducted an extensive EIA process for the Eastside development. This included surveying hydrodynamic and sedimentation regimes. The level of surveying provided a great deal of useful information but was restricted in scope to the development area. Similar information for the entire coastline area is currently being obtained and this will be useful in providing further information on localised currents, and sediment transport regimes. This information will be beneficial to inform any required impact assessments of future coastal developments.

3.7.33 Information of this nature is important when assessing the wider environment and attempting to consider widescale and cumulative impacts.

3.7.34 The Gibraltar Port Authority undertakes regular depth studies to review the impacts of and needs for dredging within the Harbour. Consultation with the Department of the Environment will ensure that any required dredging operations do not impact on sensitive or protected habitats outside the Harbour.

**Box 3.11      References used**

Casier, R. (2011) *Marine Protected Areas in the Mediterranean Sea*, study awarded by EUROPARC Conference 2011 and made possible by Alfred Toepfer Stiftung F.V.S DoE, Gibraltar & Environmental Agency, Gibraltar (2008) *Climate Change: The Gibraltar Programme*

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## 3.8 Contaminants (Descriptor 8 and 9)

3.8.1 Under Annex III of the MSFD the characteristics for contaminants are described as follows:

- concentrations of contaminants are at levels not giving rise to pollution effects; and
- contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.

### Hazardous substances

#### Current Status and Trends

3.8.2 Sediment and water quality monitoring in Gibraltar is undertaken as part of the River Basin Management Plan. Recent results from sediment analyses show that the levels of contamination vary between sites, with the Harbour area showing signs of elevated contaminant levels.

3.8.3 Under the WFD monitoring programme there are three surveillance monitoring sites in the coastal water body and one location within the HMWB (harbour). Monitoring of priority substances and specific pollutants in the water column occurs on a quarterly basis and in sediments on a monthly basis.

3.8.4 The state of the Coastal Water body and Heavily Modified Water Body (HMWB) of Gibraltar Harbour were assessed as part of the River Basin Management Plan in 2011. The coastal water body was classified as attaining ‘Good Ecological and Chemical Status’.

3.8.5 The HMWB was assessed as having Good Ecological Potential but a Chemical Status Fail was reported due to elevated levels of di- and tri-butyl tin (DBT and TBT). Heavy metals (including DBT and TBT) are harmful to marine organisms and accumulate throughout the food chain. Higher trophic species accumulate greater levels of contaminants and this can affect the quality of fish and shellfish for human consumption. The regular consumption of contaminated food can lead to poisoning in humans.

3.8.6 DBT and TBT were commonly used in anti-fouling paint to protect ships hulls from colonising organisms. The use of both was banned in 2008 due to their environmentally harmful effects but levels still remain high in many harbour areas due to the long lived nature of the contaminant which is a biocide. Ships painted before 2008 are likely to still have DBT/TBT containing paint on their hulls and as such are likely to continue to release pollutants into the marine environment.

3.8.7 Levels of TBT and DBT in both the water column and sediment were elevated within the harbour particularly the *Harbour South* sampling site. The harbour contains an operational shipyard and dockyard, which was formerly the Royal Navy dockyard, built at the end of the 19<sup>th</sup> century before being acquired by successive private companies. The dockyard was in operation when TBT was used as an anti-fouling paint on vessels.

3.8.8 Gibraltar has a low amount of industry, with virtually no heavy industry. There are therefore relatively few sources of land based hazardous waste that are likely to enter the coastal area except through the sewerage system or marine pathways.

### **Biological effects of heavy metal contamination**

3.8.9 As part of Gibraltar's water quality assessment the condition of phytoplankton and macro-benthic invertebrates were monitored in order to assess the ecological quality of Gibraltarian water bodies. Both water bodies were assessed as having Good Ecological Status (or potential).

3.8.10 The main biological effect identified as part of monitoring is the elevated levels of TBT seen in Gibraltar Harbour waters causing it to fail the Chemical Status criterion. TBT is ingested by benthic fauna and accumulates in species that predate on them, it also causes growth abnormalities and hermaphroditic deformities in some benthic invertebrate species exposed to high levels.

3.8.11 Although there are areas of elevated contaminant levels within BGTW, the wider marine area has been assessed as having both Good Ecological and Good Chemical Status. Predicted biological effects of hazardous substances are therefore considered to be minimal although research in this field is still being carried out. It is worth noting that studies carried out on cetaceans in the Bay and Straits of Gibraltar, specifically *Delphinidae*, have shown that the levels of some contaminants are higher than neighbouring Atlantic populations. It is believed that the elevated concentration of contaminants in tissue samples are attributed to industrial activities in the Bay and the intense shipping activity that is characteristic of the Straits of Gibraltar.

3.8.12 With respect to GES Descriptor 9, monitoring of fish and other seafood for human consumption is based on the requirements laid out in Commission Regulation 1881/2006. Analytical tests of fish and seafood for retail in Gibraltar are carried out by the Environmental Agency. These surveys indicate that contaminant levels in fish and seafood rarely exceed



maximum levels specified in the legislation. However some consumers e.g. children and pregnant women are advised to avoid eating certain species such as tuna, marlin and swordfish due to their elevated mercury content.

3.8.13 Due to the size of BGTW there is limited scope for commercial fishing. Gibraltar predominantly imports its fish and fish tissue samples are regularly sent to the UK for testing by the Environmental Agency.

#### **Predicted Status in 2020/2030 given business as usual**

3.8.14 The effective implementation of the Urban Waste Water Treatment Directive, the WFD, the Integrated Pollution Prevention and Control Directive, and the European Community Regulation on chemicals and their safe use (REACH) (EC 1907/2006) is likely to ensure progress towards Good Chemical Status (for priority and priority hazardous substances) and contribute to Good Ecological Status (for other pollutants) for some problem areas up to 2020, with further improvements likely up to 2030. However, there are likely to be some areas where the measures taken to control inputs of contaminants may not be sufficient to minimise impacts due to the presence of persistent contaminants in sediments where it will not be practicable to take remedial measures. In addition, the discharge of hazardous substances outside of BGTW within the Bay of Gibraltar could also affect the future chemical status of BGTW.

3.8.15 Under the WFD, future monitoring in coastal waters will potentially encompass a wider range of substances. WFD environmental quality standards adopted in Directive 2008/105/EC provide an enhanced level of environmental protection and these are being applied in BGTW.

#### **State of the evidence base and development needs**

3.8.16 The evidence is based on water quality monitoring and sediment contaminant monitoring in line with the WFD in order to assess the quality of coastal waters in terms of chemical and ecological status. The monitoring has been conducted in both Gibraltar Harbour and the surrounding coastal area comprising BGTW. Bacterial levels of coastal water are also regularly monitored in line with the requirements of the revised Bathing Water Directive so as to adequately assess the quality of water in bathing areas.

Further contaminant analyses on fish and other marine organisms would be beneficial and are being incorporated into existing monitoring programmes to further assess the risks of contamination in specific marine organisms and the likelihood of bioaccumulation from long term contaminants such as heavy metals and organotins.

### **Oil contamination**

#### **Current Status and Trends**

3.8.17 Oil pollution is often a major environmental consideration in areas with high levels of human coastal activity. Areas with high levels of vessel activity are particularly at risk from oil pollution from day to day activities. Vessels use various forms of oil based substances from fuel and hydrodynamic fluids to cleaning products, all of which have the potential to enter the coastal waters. It is a regular occurrence for vessels to emit some form of minor oil discharge in ballast or waste water whilst in transit.

3.8.18 Within the Port of Gibraltar bunkering and associated shipping activities are some of the most frequent activities. Bunkering activities also take place in the opposite side of the Bay of Gibraltar in Spanish Territorial Waters. Most bunkering activities that take place in BGTW are

via ship-to-ship transfer and the Gibraltar Port Authority operates a strict bunkering code of practice and enforcement programme to ensure that there are no accidental discharges to the marine environment. Amongst the precautionary measures implemented, each Bunkering Operator and the Gibraltar Port Authority maintain equipment and personnel on 24 hour standby in the unlikely event that a 'Tier 1' incident occurs (small spill size which varies depending on circumstances but could be up to 500 litres). In addition, an ad-hoc inspection programme is in place to ensure that the bunkering code of practice is adhered to. To date, there has been no major oil spills reported in BGTW as a result of bunkering operations, however, small spills are reported several times a year on opposite sides of the Bay as a result of the intense maritime activity.

3.8.19 An oil refinery and other large industrial facilities are located in the northern part of the Bay in Spain. These installations all have discharges into the marine environment and are very likely to be causing an impact on water quality in the Bay of Gibraltar. Results obtained through the WFD monitoring programme will continue to help assess the impact of all known contaminant sources within and outside of BGTW.

### **Biological effects of oil pollution**

3.8.20 Oil contamination is one of the major forms of worldwide coastal pollution causing both long and short term impacts on marine fauna and flora.

3.8.21 Short term impacts include the smothering and physical impairment of flora and fauna and the toxic effects caused by absorption or ingestion of oil. Longer term impacts occur when contamination, whilst not acutely toxic, impact on mortality and biological community structure and also the chemical and physical alteration of habitats due to the incorporation of oil contaminants.

3.8.22 Different types of oil based substances have different impacts, lighter oils tend to be more toxic but more easily dispersed than heavier oils which are less toxic but longer lived. Smothering is more indicative of a heavy or crude oil spill.

3.8.23 Surface slicks do not tend to remain intact for long periods as wind and wave actions tend to break slicks up and disperse pollutants. However, whilst it is in the form of a slick it can cause considerable damage to seabirds using the area by oiling their feathers and reducing their ability to feed and fly effectively.

3.8.24 Shoreline communities tend to be the most heavily impacted by oil slicks near coastal areas as the oil washes up on shore and does not break down as easily. It also becomes heavily incorporated into coastal sediments. Coastal areas tend to have the highest biodiversity and, this can lead to high levels of mortality at all trophic levels due to smothering and toxicity.

3.8.25 Once oil disperses into the environment it becomes less dangerous from a short-term stance, it is less toxic and less likely to oil bird feathers. Once it has dispersed, toxins then begin to accumulate in the water and sediments over a wider area and can raise background contaminant levels. This may then impact a larger number of species as they accumulate the toxins within themselves through long term ingestion and exposure.

3.8.26 In Gibraltar the main risk to the biological community is from fuel oil spills. These are likely to be small and surface based. With the spill response facilities in place, the spills are likely to be short lived and therefore the main dangers to the environment are likely to be to birds and surface dwelling organisms.

3.8.27 Contaminant analysis shows that in some areas hydrocarbon contaminants are elevated in coastal sediments. This could potentially have long term impacts on the structure of benthic communities.

#### **Predicted Status by 2020/2030 given business as usual**

3.8.28 Gibraltar is becoming an increasingly important refuelling station for ships passing between the Atlantic and the Mediterranean. Due to the size of Gibraltar harbour and the number of vessels seeking bunkering services much of the activity takes place in the form of ship-to-ship transfer in line with the strict conditions imposed by local authorities.

3.8.29 There are inherent risks to the environment from any form of refuelling activities whether based on land or sea. In order to maintain the current level, it is important that the risk of minor oil spills from bunkering exercises is continuously assessed and the required measures implemented.

3.8.30 Due to the amount of vessel traffic in and around Gibraltar and the accumulating nature of contaminants, it will be difficult to maintain current levels of contamination, particularly in the heavily modified water bodies where water exchange is restricted.

3.8.31 The Gibraltar Port Authority has an Oil Spill Response Plan and is an Associate Member of Oil Spill Response Ltd which is based in Southampton. Oil spill response procedures are therefore in place to quickly deal with any minor oil spills should they occur within or outside BGTW in High Seas.

3.8.32 Run-off from roads and hard surfaced areas are also a likely input of oil contamination into the marine waters. This is currently being controlled using trapped gullies intercepting most fuel, oil and heavier contaminants running off from all main roads. The likelihood of oil contaminants from road run-off reaching the sea is predicted to fall in the future with the installation of additional oil interceptors in both major and minor storm drains.

3.8.33 Given the likelihood and known risks of transboundary pollution, Gibraltar will find it difficult to maintain or improve background levels without the cooperation of neighbouring countries.

#### **State of the evidence and development needs**

3.8.34 Sediment and water quality monitoring and analysis have been undertaken at numerous sites in BGTW providing baseline information on specific contaminant levels.

3.8.35 Continued monitoring and a reduction in the level of contaminants entering the marine environment will be required to maintain or improve on current levels. Regional cooperation and exchange of information is also critical to the success of improving the status of BGTW.

3.8.36 Continued surveillance and reporting of any minor oil spills within and outside of BGTW should continue so as to identify additional measures that could be implemented and help safeguard marine habitats and species.

### **Radio-nucleotides**

#### **Current Status and Trends**

3.8.37 Environmental radiation is a concern because of its wide ranging and negative impacts on both the environment and humans. Major incidents are an obvious source of radioactive pollution; however, less obvious is the accumulation of smaller levels of radioactive material through the marine food chain.

3.8.38 Radioactive pollution tends to be long lived and some elements take hundreds of years to become neutral. Therefore, there is a high potential for levels of radioactive substances to accumulate through the marine food chain into the higher life forms such as fish and seabirds. Some of these species then become food for human consumption.

3.8.39 There are no major sources of radioactive pollution in Gibraltar or BGTW. Continued monitoring is undertaken by the Environmental Agency on desalinated potable drinking water in line with Directive 98/83/EC (Drinking Water Directive). Additional monitoring is carried out on coastal water and sediments and levels recorded to date have been found to be below EU safe limits for all elements tested.

#### **Biological Effects of Radio-nucleotides**

3.8.40 Radio-nucleotides are long lived contaminants and as such there is the potential for bio-accumulation to occur, even at low levels of contamination.

3.8.41 Radio-active particles naturally occur in the Earth's crust and natural background levels of radiation are often recorded and not environmentally damaging. Additional contamination from anthropogenic sources can add to the background levels of radiation, these can have more detrimental impacts if present in high concentrations. Fallout from various sources such as Pacific Island weapons testing, Chernobyl and Fukushima can be found in low levels across the globe, spread by atmospheric conditions.

3.8.42 Radioactive particles can enter the food chain through contaminated sediment which is ingested by benthic organisms. These are in turn eaten by higher trophic species. Low levels of radioactive particles in base organisms can accumulate in higher species through predation. This may culminate in species for human consumption having relatively high levels of radiation, which is then passed on to human consumers.

3.8.43 The accumulation of high levels of radiation has the potential to impact species on a cellular level, increasing the risk of cancers and growth defects and increasing mortality. Widespread contamination is likely to spread through a food web and have significant impacts on biological communities.

3.8.44 Due to various nuclear episodes and activities, low levels of contamination are globally widespread. The levels of radiation in Gibraltar are lower than many other European coastal countries and it is unlikely that the biological communities around Gibraltar are particularly affected.

#### **Predicted Status by 2020/2030 given business as usual**

3.8.45 It is anticipated that the levels of radioactive contamination will remain the same and not significantly increase. Gibraltar itself has no sources of radioactive pollution and has a limited capacity to prevent radioactive pollution from other areas.

3.8.46 Gibraltar will continue to monitor the levels of radio-active contamination in its waters.

#### **State of the evidence and development needs**

3.8.47 Water sampling for radio-nucleotides is conducted in two areas from around Gibraltar. An increased sediment and coastal water sampling strategy may prove beneficial to improve spatial coverage. However, with no evidence of elevated radiation levels, additional monitoring is not deemed necessary.

## **Microbial Contamination**

### **Current Status and Trends**

3.8.48 Key monitoring priorities for microbial contamination include monitoring the concentrations of total coliforms, faecal coliforms and e-coli. These microbes tend to be present in areas where there is untreated sewage input causing poor water quality. These contaminants can cause illness through coastal users being exposed to poor quality bathing water and also have the potential to contaminate food resources.

3.8.49 Gibraltar has six main bathing areas and these are all monitored in accordance to EC Directives 76/160/EC and 2006/7/EC. Five of the beaches have quality results for total coliforms, e-coli and faecal streptococcus that are consistently below the mandatory EC standards and only occasionally failing the EC Guideline values.

3.8.50 The Western Beach bathing area failed the minimum EC mandatory levels for total coliforms and e-coli and UK guidelines for faecal streptococcus through most of January to May and October to December 2012. These poor quality results are attributed to input of untreated sewage from an overflow located in mainland Spain.

3.8.51 The coastal waters around Gibraltar have ample hydrodynamic exchange with the wider Mediterranean and microbial contamination is therefore quickly dispersed in most areas with the exception of the Gibraltar harbour, Northern marina and Western Beach basins. During periods of prolonged heavy rain, overflows may occur on the main sewer network which can result in rainwater, surface/road run-off and sewage discharging at various points along the coast and within the Harbour and Marina Bay. Individually these sources may not cause a significant pressure on the environment, but collectively the diffuse pressure could be significant.

### **Biological Effects of microbial contamination**

3.8.52 The major concern over the microbial quality of bathing water is public health. Bathing in water contaminated by coliforms and faecal matter can cause serious illnesses in humans and it is a priority concern within the EU and UK. Mandatory and guideline levels for microbial contaminants are stipulated by the EU in the Bathing Water Directives (Directives 76/160/EC & 2006/7/EC). For public safety reasons, designated bathing waters must be regularly tested and have sufficient quality levels to be announced as safe for bathers. The Gibraltar Bathing Waters Programme is spearheaded by the Environmental Agency and the results collected to date are available from [http://www.environmental-agency.gi/environmental\\_monitoring.htm](http://www.environmental-agency.gi/environmental_monitoring.htm).

3.8.53 The release of high levels of bacteria into the water has the potential to impact on fish and shellfish species in affected areas. Bacteria such as e-coli are consumed by fish and shellfish along with the organic matter from raw sewage; these bacteria are then consumed by humans causing illness.

3.8.54 As well as the impact on human populations, exposure to bacteria can increase infection and mortality in exposed fish and shellfish species.

### **Predicted Status by 2020/2030 given business as usual**

3.8.55 The number of instances where water quality has failed to meet the EU Guideline level has increased year on year since 2009. Prior to this beaches consistently met both mandatory and guideline levels. Without investigation it is a concern that levels will continue to worsen. During 2011 and 2012 the number of instances where Western Beach did not meet mandatory guidelines also increased.

3.8.56 In addition to the known discharges of sewage effluent within BGTW, it is likely that significant levels of pollution are entering BGTW from adjacent Spanish waters on both western and eastern sides of BGTW. The sewage outflow near Western Beach is evidence of this along with the infrequent closures of bathing areas in La Linea (Spain) as a result of the numerous storm overflows and a sewage outflow located immediately North of BGTW. There are concerns that transboundary microbial pollution originating from Spain may continue to impact BGTW in the foreseeable future. It is likely that Spanish sources are the cause of the increases referred to in 3.8.55.

3.8.57 Negotiations have taken place with local authorities in Spain with regards to the untreated sewage outfall at Western Beach but the issue is currently unresolved.

3.8.58 As the population of Gibraltar and number of tourist visitors grows, increasing pressure is likely to be placed on sewerage and treatment facilities which have the potential to increase the levels of contaminants in the coastal area.

3.8.59 Increased rainfall intensity due to climate change has the potential to increase the amount of untreated sewage entering the coastal zone through overflowing.

#### **State of the evidence and development needs**

3.8.60 Investigations are being carried out to determine the reasons for the observed deterioration in water quality since 2009. It is known that Western Beach is continually having problems with untreated sewage from Spain, but given that other beaches, particularly on the eastside are increasingly failing the Guideline levels, further investigations are currently being carried out by both the Department of the Environment and the Environmental Agency.

3.8.61 Monitoring of bathing water quality has good spatial coverage and is carried out regularly in compliance with the Bathing Water Directives. There is a good historical data set for bathing water quality, all of which is reported to the Commission.

3.8.62 The fact that elevated levels may have transboundary sources will require regional cooperation to ensure that the objectives of the MSFD and other water quality directives are met. Continuous improvements of the sewer network and the development of the new secondary sewage treatment plant will ensure that there are no untreated sewage effluents being discharged into BGTW.

#### **Box 3.12      References used**

Gibraltar Port Authority <http://www.gibraltarport.com/>, (accessed 20/12/12)

Government of Gibraltar (2011) *Gibraltar Waste Management Plan*, prepared by the Environmental Agency Gibraltar in conjunction with the Department of the Environment

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## 3.9 Litter (Descriptor 10)

3.9.1 Under Annex III of the MSFD the characteristics for marine litter are described as follows:

- properties and quantities of marine litter do not cause harm to the coastal and marine environment.

### Current Status and Trends

3.9.2 The UK MSFD Initial Assessment describes marine litter as follows: any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment can be defined as marine litter.

3.9.3 Much of the litter that enters the marine environment consists of long lived materials, such as plastic, that degrade slowly, if at all. If the input of litter into the environment is constant, a gradual build-up of litter will occur.

3.9.4 Litter enters the marine environment from various sources: ships, fishing and offshore industries are a common source of litter, as too is litter left by beach users in the coastal area.

3.9.5 Gibraltar faces potential problems with litter and waste; the restricted size of Gibraltar limits the amount of space that can be set aside for waste disposal facilities. Many of the facilities found in other countries are not possible in Gibraltar due to its limited size, and because of economies of scale. The high population density and the large number of visitors to Gibraltar each year also exacerbate litter and waste disposal problems.

3.9.6 There is also a major issue due to the volume of products that are imported into Gibraltar. These items, both domestic and industrial, inevitably result in a large volume of packing materials that subsequently need to be disposed, adding additional pressures on the waste facilities.

3.9.7 Europa foreshore, located in the Southern Waters of Gibraltar has been used by anglers for many years. This has led to a problem of littering on occasions, and there has been an observed impact on the intertidal community.

3.9.8 The Governor's Cottage and Hole in the Wall areas of the Southern District are described as having high levels of litter (of various types) deposited on and near the cliffs in these areas. This is likely to increase levels of marine pollution in these areas as some of the debris is likely to eventually end up in the sea.

3.9.9 Gibraltar has an important tourist industry, its beaches are an essential element of that industry. As noted in the UK MSFD Initial Assessment, tourism and beach users are one of the main sources of marine litter and it is likely to be an important source of marine litter in Gibraltar.

3.9.10 The full extent of marine litter in BGTW is currently being investigated with the majority of information collected to date being restricted to the Gibraltar harbour, main beaches and near shore coastal areas. Formal investigations and monitoring implemented (see 3.9.18) in line with the requirements of the MSFD, will help assess the issue of marine litter in all its forms, i.e. flotsam, jetsam and intertidal litter.

### **Key Pressures**

3.9.11 Litter places a physical risk to marine life through entanglement and ingestion. In particular, marine mammals, birds and turtles are at risk. If there is a particularly high level of litter, there can be smothering effects on marine habitats associated with marine litter.

3.9.12 There is also concern that levels of harmful contaminants may start to enter the food chain. As plastics begin to physically wear and degrade, it is possible that particles will become small enough to be readily ingested by important food web species. The concern is that these plastic contaminants may accumulate through the food web and impact higher trophic species and the quality of commercial fish species.

3.9.13 The main sources of marine litter in the Mediterranean are cited as being from:

- Illegal disposal;
- tourist facilities;
- run-off from waste installations/facilities;
- run-off from rivers;
- pleasure crafts;
- direct disposal from urbanised areas; and
- ships.

3.9.14 Gibraltar does not have any litter input from river run-off or direct disposal; however, all the other sources are likely to contribute to marine litter in BGTW. It should also be noted that litter from adjacent waters and beyond is known to migrate into BGTW. Increasing levels of shipping, tourists using the beaches and coastal developments in the Bay of Gibraltar generally are likely to be the greatest sources of marine litter in BGTW.

3.9.15 Litter in the beach area is a particular problem because not only does the litter damage intertidal and coastal habitats, it also has economic implications from a tourism perspective.

3.9.16 Although an efficient cleansing programme is in operation throughout the coastline of BGTW, regular cleanup and awareness raising events are additionally carried out by non-governmental organisations (NGOs) that regularly participate in the global '*Clean up the World Campaign*'. Examples of past campaigns can be found on <http://www.esg-gib.net/clean-up-the-world/>. In addition, the Gibraltar Government's Litter Committee ensures that all reports of both marine and coastal litter are highlighted and the necessary remedial actions taken.

### **Development needs**

3.9.17 There is a comprehensive Waste Management Plan in place in Gibraltar which details how the numerous waste streams generated are managed. This plan includes waste streams emanating from shipping and any other activities that could pose a risk to the marine environment.



3.9.18 Surveys and continued monitoring undertaken by the Department of the Environment, Gibraltar Port Authority, Environmental Agency, Gibraltar Tourist Board and NGOs will help to quantify and characterise marine litter in BGTW. This information will be used to establish future trends in marine litter as the knowledge base expands.

**Box 3.13      References used**

Government of Gibraltar. *Southern Waters of Gibraltar Management Scheme. EU Natura 2000 Site. Dual SAC/SPA.*  
 Government of Gibraltar (2011) *Gibraltar Waste Management Plan*, prepared by the Environmental Agency Gibraltar in conjunction with the Department of the Environment  
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## 3.10 Underwater noise (Descriptor 11)

3.10.1 Under Annex III of the MSFD the characteristics for underwater noise are described as follows:

- introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

### Current Status and trends

3.10.2 There is currently not enough evidence to provide a comprehensive assessment of the trends in underwater noise in BGTW. Gibraltar and the wider bay area are busy shipping ports located near to a major shipping lane so ambient noise levels are likely to be constantly elevated.

3.10.3 Seismic surveys are not uncommon around the Strait of Gibraltar and these create some of the loudest anthropogenic sounds. With its unusual bathymetry, the spread and transmission of seismic waves around BGTW bay area are likely to be highly complex.

3.10.4 Ships, particularly oil tankers and cruise ships create a large amount of mechanical noise through engine noise and propeller cavitation. Due to the number of ships passing and calling in at Gibraltar and Algeciras (Spain) Ports, this noise is likely to be fairly constant and loud, particularly in the shallow areas of the Bay.

3.10.5 Increases in ambient noise levels are thought to be occurring globally, primarily as a result of increases in maritime transportation. This is currently the subject of debate within the International Maritime Organization.

### Key Pressures

3.10.6 Underwater noise is a growing concern and still relatively little is known about its impacts on marine ecosystems. Considerable research has been conducted into the impacts of noise on marine mammals, however, results have been mixed and there is a great deal of difference between sites and species.

3.10.7 Gibraltar is used by various types of vessels but large vessels such as cruise liners, cargo ships and tankers are common. Due to their size and propulsion power these types of vessel create loud continuous sounds. These sounds tend to be in a low frequency bracket (>500 Hz) but have relatively large broadband source levels of 180-190 dB re 1µPa. These frequencies and amplitudes have the potential to interfere with biological signals used by some large whales.

These vessels produce higher frequency noises (~10kHz) from cavitation bubbles created by propeller movement.

3.10.8 Smaller leisure vessels are also common around Gibraltar. These tend to emit higher frequency sounds, typically above 1 kHz in a range of 160-170 dB re 1µPa, however, cavitation noise from these smaller vessels can be as high as 10 kHz.

3.10.9 The major concern from a biological perspective is the cumulative impacts of a large number of vessels and the frequency range of the sounds being emitted.

3.10.10 Continuous noise may degrade the sound habitat, masking biologically relevant signals such as echolocation clicks, making it harder or impossible to find a mate, locate food or detect predators. Impulsive sounds can lead to a variety of behavioural reactions such as avoidance of feeding or breeding areas or may result in physiological effects such as temporary or permanent damage to hearing organs, and at very high levels, even death. There is a scarcity of quantitative data on the actual impacts of marine noise on species and populations in BGTW, and the thresholds at which noise is considered to have a 'significant' impact on organisms. From a conservation perspective, estimating the effects of noise disturbance on populations is critical, and there are first attempts to develop population consequences of acoustic disturbance models, at least for marine mammals.

3.10.11 The bathymetry and sheltered areas of the Bay of Gibraltar, along with the easy access to deep offshore waters, provides a good habitat for numerous species of cetacean. The Bay itself is important for populations of striped (*Stenella coeruleoalba*), bottlenose (*Tursiops truncatus*) and common dolphin (*Delphinus delphis*); nearby waters also support numerous larger species moving between the Mediterranean and Atlantic.

3.10.12 Marine mammals such as dolphins are particularly sensitive to loud underwater sounds and it is unknown at what level continuous noise begins to interfere with their ability to function efficiently. There is also concern that high levels of noise, particularly pulsing noise, in the narrow area of the Straits may act as a barrier to cetaceans moving between the Atlantic and Mediterranean.

3.10.13 There are also concerns over disruptive effects of sound on fish. If sound causes fish to avoid specific areas this can have negative implications on spawning and feeding behaviours, as well as impacting the predator species that are dependent on these fish. Fish are more likely to show adverse reactions to pulsing sounds such as seismic rather than continuous mechanical sounds such as ship noise. It is likely that they will become habituated to continuous noise, however, this could still mask 'vocal' signals in sound-dependent species.

3.10.14 Overall, further monitoring and investigation is necessary to fully understand the effects of noise at an individual and population level, the risks and significance of noise inputs to the environment, and appropriate options for mitigation. Underwater noise is known to be an issue for most marine mammals, many marine fish, and perhaps some shellfish as sound is important for communication, detecting predators and long-range navigation.

#### **State of the evidence and development needs**

More regular noise monitoring campaigns is the only way to more accurately assess the levels of noise within BGTW. Further research into the species in BGTW that are sensitive to elevated sound levels is also required to enable more comprehensive assessments of the ecological status of BGTW regarding underwater noise. In order to facilitate the collection of underwater noise

data, the Department of the Environment has included a systematic noise monitoring campaign within the wider coastal water monitoring programme.

**Box 3.14      References used**

Perez, C.E. (2006) *Biodiversity Action Plan, Gibraltar: Planning for Nature*, The Gibraltar Ornithological & Natural History Society, Gibraltar

OSPAR (2009) *Assessing the environmental impacts of underwater noise*, Biodiversity Series.

## 4. Proposals for GES characteristics and targets and indicators

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### 4.1 Introduction

4.1.1 This section sets out the proposed characteristics of Good Environmental Status (GES) and associated targets and indicators for each of the Descriptors and describes how these proposals have been developed and why they are being put forward.

4.1.2 Proposals for Descriptors 1 (biodiversity), 4 (food webs) and 6 (sea-floor integrity) are set out first and are dealt with together in one sub-section due to the significant degree of overlap between them. The proposals for these Descriptors are the most complex to describe due to their wide coverage.

4.1.3 The following sub-sections set out the proposals for Descriptors 2 (non- indigenous species), 3 (commercial fish), 5 (eutrophication), 7 (hydrographical conditions), 8 (contaminants), 9 (contaminants in seafood), 10 (litter) and 11 (noise) in the following format:

- background;
- summary of current status from Initial Assessment;
- proposed GES characteristics and associated targets and indicators – in tabular format;
- approach to setting GES targets;
- implications of the proposed targets; and
- key gaps and development needs.

### 4.2 Biodiversity (Descriptors 1,4 and 6)

4.2.1 MSFD Descriptor 1: Biological Diversity is maintained – the quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

4.2.2 MSFD Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of those species and the retention of their full reproductive capacity.

4.2.3 MSFD Descriptor 6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems in particular are not adversely affected.

#### Background

4.2.4 Descriptor 1: This Descriptor has a very broad biological and geographical scope. To achieve GES a multi-species and multi-habitat approach will be needed, together with a robust assessment of human pressures (and impacts) upon each of these components. Most activities in

the marine environment affect biodiversity in some way, and achieving GES in the other Descriptors will ultimately help achieve GES for this Descriptor.

4.2.5 Descriptor 4: A properly functioning marine food web is crucial to the overall health of the marine ecosystem. This Descriptor is intended to cover the functional aspects of marine food webs, particularly rate and directions of energy transfer, and levels of productivity. Currently, there is not enough known about energy transfer between trophic levels and species interaction to meaningfully cover these within the targets for this Descriptor. In the medium term a pragmatic approach is proposed, which focuses on the abundance, distribution and productivity of key species and trophic groups within the food web. This means there is significant overlap with Descriptor 1.

4.2.6 Descriptor 6: This Descriptor is intended to ensure that human pressures on the seabed do not hinder the ecosystem components from retaining their natural diversity, productivity and dynamic ecological processes. The seabed and associated benthic habitats underpin much of the biodiversity within the seas. Scientific research continues to emphasise the importance of benthic fauna to coastal ecosystems, detrital decomposition, nutrient cycling and energy flow to higher trophic levels, supporting both primary and secondary production. Human pressures are known to reduce the diversity of benthic communities. There is significant overlap between this and Descriptor 1.

4.2.7 The draft determination of GES for these Descriptors is very high-level and we have aimed to ensure consistency with existing legislative commitments and the level of ambition set out in the Natural Environment White Paper, the England Biodiversity Strategy and relevant commitments in the Devolved Administrations.

## **Proposed characteristics of GES**

### ***Descriptor 1 (biodiversity)***

4.2.8 The proposed characteristics of GES for this Descriptor are as follows:

- Biodiversity<sup>16</sup> loss is halted and where possible restored, with key ecosystems maintained or recovered;
- The abundance, distribution and condition of species and habitats in BGTW reflects, or is consistent with, prevailing environmental conditions, taking into account sustainable use of the marine environment;
- The extent and natural range of habitats and species is not being significantly reduced (nor likely to be so in the foreseeable future) and the specific structures and functions necessary for their long-term maintenance exist and are likely to exist for the foreseeable future;
- Habitats and species defined as rare or threatened under existing national or international agreements are conserved effectively through appropriate national mechanisms; and

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<sup>16</sup> According to the Convention on Biological Diversity (CBD), biodiversity is defined as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”.

- Impacts of human activities do not lead to significant degradation of marine habitats or adversely affect species at the population or key functional group level.

#### ***Descriptor 4 (food webs)***

4.2.9 The proposed characteristics of GES for this Descriptor are as follows:

- Populations of key species groups within the food web occur at levels that ensure the long-term sustainability of the marine ecosystem of which they are part with an age and size structure for these and other key species towards sustainable populations.

#### ***Descriptor 6 (sea-floor integrity)***

4.2.10 The proposed characteristics of GES for this Descriptor are as follows:

- The sea-floor habitats (physically and structurally) are both productive and sufficiently extensive to carry out natural functionality, including the necessary ecological processes (e.g. cycling carbon and nutrients) and to provide ecological goods and services (e.g. food security and climate regulation);
- The sea-floor habitats are capable of supporting a healthy and sustainable ecosystem for the long term; and
- Those sea-floor habitats most susceptible to the significant detrimental impacts of human activity are protected to ensure their extent and functioning is maintained.

### **Approach to setting GES targets for Descriptors 1, 4 and 6**

4.2.11 The approach has been organised according to six ecosystem components: three species components (fish, birds, marine mammals), and two habitats groups (pelagic habitats, benthic habitats). The proposals outlined here may need to be reviewed in the light of further information about approaches being put forward by other neighbouring countries.

4.2.12 No species targets have been proposed for Descriptor 6 (sea-floor integrity) as the approach to setting targets for this Descriptor focuses on sea-floor habitats and their associated species (see the section on habitats targets below).

4.2.13 Existing targets have been used wherever suitable (e.g. from the Habitats Directive, Barcelona Convention) and the proposals have been based as far as possible around existing indicators and monitoring programmes.

4.2.14 For marine mammals the targets are all based on existing commitments under the Habitats Directive, which covers all marine mammal species. They aim to ensure that marine mammal distribution is not significantly affected by human activities and that their abundance is not decreasing as a result of human activities, using baselines consistent with those used for the Habitats Directive. For birds, targets are based on bird population distribution and abundance data collected as part of the surveillance monitoring programmes under the Habitats and Birds Directives. In order for GES to be achieved, species are required to meet their individual indicator thresholds. Bird abundance and distribution can be affected by a range of factors, both natural (e.g. climate change and changes in prey distribution) and human related, so it is considered consistent with GES that some species may decline within BGTW. There are indeed data that reflect a decrease in specific wintering seabird species (*Larus fuscus* and *Larus*

*ridibundus*) that may be attributed to climatic change, as these species are wintering further North.

4.2.15 It is acknowledged that any potential declines in bird's species abundance and distribution within BGTW caused by human activity are not consistent with GES and follow-up action will be taken for any species that do not meet individual thresholds.

4.2.16 For fish including commercial fish species, there are few targets in existing legislation which are suitable as indicators of fish biodiversity. Also there is a lack of available data on fish species frequenting BGTW. For this reason most of the GES targets developed for fish are new. Targets for fish abundance and distribution aim to ensure that the distribution and abundance of sensitive fish species are not significantly impacted by human activities and require a statistically significant proportion of sensitive fish species to be meeting targets for recovery. Fish species may decline for a number of reasons, both natural and due to pressures from human activities and these targets explicitly acknowledge that long-term declines in some fish species may be consistent with the achievement of GES. However, it is acknowledged that continual declines that are caused by human activity are not consistent with GES and follow-up action will be taken for any species which are consistently missing their individual indicator thresholds to try to establish the cause, leading to management measures where appropriate.

4.2.17 For benthic habitats existing targets under the Habitats Directive and the Water Framework Directive (WFD) have been used wherever possible. The proposed baselines for benthic habitats are reference conditions which equate to minimal disturbance from human activity. Targets are set as a deviation from that baseline, recognising that achieving GES is consistent with sustainable use of the marine environment.

4.2.18 For pelagic habitats, the proposed targets and indicators all focus on plankton, which plays a crucial role in the pelagic food-web and the whole marine ecosystem. Changes in plankton are driven by climate but are also affected by human pressures, particularly eutrophication and fishing. The proposed targets and indicators are designed to identify changes in plankton caused by human pressures.

## **Implications of the targets - Species**

### ***Proposed targets for Marine Mammals***

4.2.19 The distribution of cetaceans is not contracting as result of human activities:

- in all of the indicators monitored there is no statistically significant<sup>17</sup> contraction in the distribution of marine mammals caused by human activities.

4.2.20 Cetacean populations are in good condition:

- mortality of cetaceans due to fishing by-catch is sufficiently low so as not to inhibit population targets being met.

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<sup>17</sup> The way in which statistical significance of an event is determined will vary according to the species in question because indicators for different species are based on differing types of data. It is also essential that a pragmatic approach is taken because of the mobile nature of marine mammal populations and the inherent variability in monitoring abundance and distribution.

4.2.21 Cetacean productivity is not significantly affected by human activities. There should also be no decline in cetacean reproduction caused by human activities.

***Proposed targets for seabirds***

4.2.22 Seabird species distribution and abundance are not impacted by human activity:

- Migratory bird species utilising the marine environment in BGTW during passage are not the best indicators of GES. Targets are therefore focused on wintering and resident species

4.2.24 Seabird populations should therefore be maintained in good condition by allowing:

- Continued recruitment from donor populations in the area.
- Ensuring adequate fish stocks in BGTW.
- Ensuring the risks of mortality in seabirds due to bycatch, oil spills and other key pressures are sufficiently low so as not to affect seabird population ecology .
- Ensuring the breeding population of Mediterranean Shag is not adversely impacted due to fishing by-catch or netting.

***Proposed targets for fish (including commercial fish species)***

4.2.25 Fish species distribution, population size and community composition are not significantly impacted by human activities:

- the geographic and depth distribution of sensitive fish should meet individual indicator targets in a statistically significant proportion of species monitored;
- the population abundance density and population biomass density of sensitive fish species should meet individual indicator targets for recovery in a statistically significant proportion of species monitored; and
- the size-composition of fish communities should reflect a healthy status and not be significantly impacted by human activity.

**Implications of the targets - Habitats**

4.2.26 There are measures already in place which are expected to reduce the pressures on benthic habitats and support the achievement of the targets for seafloor habitats. These include measures required under the Habitats Directive, the Water Framework Directive, and the Gibraltar Biodiversity Action Plan.

4.2.27 For those rock and sediment habitats that are covered by the Habitats Directive it has been assumed that measures taken under the Directive will be sufficient to achieve GES. For pelagic habitats the targets under the Water Framework Directive have been used as sufficient to achieve GES.

4.2.28 The BOPA index measures the ratio of abundance of opportunistic polychaetes to amphipods. It is generally a good indicator of the overall health of the benthic community and the extent of which it is being compromised by pollution. Monitoring this ratio will aid in



identifying degraded areas and targeting on them to achieve GES. Currently all areas monitored are of GES status, however, monitoring is needed to ensure this stays consistent.

4.2.29 *Corbula gibba* and *Eunice vittata*, amongst other indicator species, are both tolerant of disturbed sediments and tend to be found in areas where there has been seabed disturbance. Monitoring the presence and distribution of these benthic invertebrate species will continue to help in determining whether significant hydrological disturbances have taken place in BGTW.

### **Gaps and development needs**

4.2.30 There is a greater need for more baseline information on certain species, namely fish as it is difficult to set targets on a poorly-known fish populations.

4.2.31 Over the longer term there will be a need to understand the energy flows within the food web and the structure of food webs (size and abundance), development of detailed baseline information for assessing the quality/condition of benthic habitats as well as habitats resilience towards pressures exerted upon them (thresholds for loss and damage).

## 4.3 Non-indigenous Species (Descriptor 2)

### Background

4.3.1 It is widely accepted that one of the greatest threats to biodiversity across the globe is posed by non-indigenous species (NIS) which become invasive, known under the Convention on Biological Diversity as invasive alien species (IAS). Globalisation and a growth in trade and tourism have greatly increased the movement of species to new habitats where they may become invasive. It has been estimated that damage caused by terrestrial and marine invasive species worldwide amounts to almost five percent of the world economy.

4.3.2 Invasive NIS may alter ecosystem processes, decrease native species abundance and richness via competition, predation, hybridization and indirect effects<sup>18</sup>, change community structure<sup>19</sup> and alter genetic diversity.

4.3.3 The main anthropogenic activity that contributes to the introduction of NIS in Gibraltar waters is maritime transport. Boats and ships may transport NIS either in ballast water or as biofouling (i.e. attaching to hulls, anchor chains and other parts of the vessel). The aquarium trade has also been responsible for some serious introductions such as *Caulerpa taxifolia* which incidentally is making its way to the Straits of Gibraltar.

4.3.4 Climate change, although outside of the MSFD considerations, may create conditions which are more suitable for NIS to survive and establish themselves in BGTW.

### Proposed characteristics of GES

4.3.5 Due to the lack of information on current abundance, distribution and impacts of IAS, the targets proposed for this Descriptor are operational targets, focused on:

- Taking measures to reduce the risk of introduction and spread of NIS (by managing key pathways and vectors more effectively), and;
- Putting in place management plans for dealing with key high risk species should they arrive in BGTW.

4.3.6 The proposed characteristics of GES for this Descriptor are as follows:

- the risk from pathways and vectors which facilitate the introduction and spread of NIS as a result of human activities is managed in such a way as to significantly reduce the risk of introducing new species which may have adverse impacts. Achievement of this will be based on an assessment of high risk areas and known pathways/vectors aiding the spread of such species; and
- species specific action plans are developed for key high risk marine non-indigenous species by 2020.

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<sup>18</sup> Gaertner *et al.*, (2008) Understanding biodiversity consequences of habitat change, *Journal of Applied Ecology* **45**, 883-893

<sup>19</sup> Hejda *et al.*, (2009) Impact of invasive plants on the species richness, diversity and composition of invaded communities, *Journal of Ecology*, **97** 393-403

### **Implications of the proposed targets**

4.3.7 Some measures are already in place to manage the key pathways and vectors of introduction of NIS such as controls on shipping and discharge of ballast water, as well as legislation (Nature Protection Act 1991) to ban the deliberate release of NIS into the wild. However, additional measures are likely to be necessary to achieve the targets proposed for this Descriptor, but at this stage it is difficult to say what these might be. Many measures to reduce the risk of introductions of NIS, for example, need to be implemented at an international scale through the International Maritime Organization (e.g. additional management of hull cleansing or ballast water for large vessels).

4.3.8 Further analysis of the key pathways and vectors of introduction of marine NIS is currently being carried out in order to establish which, if any, additional management measures are necessary.

### **Gaps and development needs**

4.3.9 It has not been possible to explicitly cover all elements of Descriptor 2, mainly due to the lack of data and full understanding of NIS in respect to abundance, distribution, introduction (vectors and timing) and ability to survive in new environments.

4.3.10 In the short term consideration will be given to the pathways and vectors of introduction. Some additional monitoring, or changes to existing monitoring may be required, particularly with the risk based pathways management approach and the surveillance indicator which have been proposed.

4.3.11 Over the longer term there is a need to develop detailed baseline information regarding the abundance of NIS. Continual engagement within MAP regions will be necessary to ensure a regional approach is taken with regards monitoring and preventing the movement of NIS in the Straits of Gibraltar and BGTW. The Government of Gibraltar is committed to cooperating with countries in the wider region and forming part of the EU wide Invasive Species Alert System.

## 4.4 Eutrophication (Descriptor 5)

### Background

4.4.1 Eutrophication is one of the major threats to the health of estuarine, coastal and shelf sea ecosystems around the world. It occurs when waters are enriched by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water.

4.4.2 Anthropogenic eutrophication can occur in certain conditions when inputs of nitrogen and phosphorus (nutrients) from point sources (e.g. sewage effluents and industrial processes) and diffuse sources (e.g. agricultural run-off and transport emissions) enter the coastal and marine environment.

### Proposed characteristics of GES

4.4.3 There are very few potential eutrophication problem areas in BGTW at present. The sewage outlet at Europa point causes some eutrophication to the area immediately surrounding the outlet, however this only extends to a few metres from the outlet. Otherwise the currents present at Europa point provide a very high dilution rate thus reducing any potential eutrophication problems. A combination of both river inputs and other sewer discharges exist in the wider Bay area and these are known to be potential transboundary causes of eutrophication. The Gibraltar coastal water monitoring programme is providing an insight into eutrophication episodes in the wider Bay area.

4.4.4 The proposed targets are all based on existing WFD targets and how these are used to assess eutrophication. They have therefore already been coordinated regionally and we have high confidence that similar targets will possibly be adopted by other Member States. A risk-based approach is being proposed for the establishment of targets. Where problems do not exist then the target is to maintain non-problem area status.

4.4.5 The proposed characteristics of GES for this Descriptor are as follows:

- Nutrient concentrations do not lead to an undesirable disturbance<sup>20</sup> to the balance of organisms present in the water or to the quality of the water concerned resulting from accelerated growth of algae;
- The direct effects of nutrient enrichment associated with algal growth do not constitute or contribute to an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned ; and
- Indirect effects of nutrient enrichment associated with growth of macroalgae, sea grasses, and reductions of oxygen concentrations do not constitute an undesirable

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<sup>20</sup> An undesirable disturbance is demonstrated when adverse effects resulting from nutrient enrichment and accelerated growth of algae occur leading to losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.

disturbance to the balance of organisms present in the water and to the quality of the water concerned.

4.4.6 The proposed indicators for this Descriptor as follows:

- There should be no or little increase in *Abra alba* abundance. It is known to be an indicator of eutrophic conditions. Monitoring any increases in population density or abundance will indicate a shift towards eutrophic conditions; and
- There should be no or little increase in populations of *Aponuphis bilineata*, *Eunice vittata*, *Glycera convulta*, *Lumbric latreilli* and *Scolecopsis ciliata*. These species are tolerant of high levels of organic matter typically associated with sewage outfalls and population increases are likely to indicate elevated nutrient levels.

### Gaps and development needs

4.4.7 Targets have not been proposed for two of the Commission Indicators outlined in the Commission Decision on GES. For the Commission Indicator on nutrient ratios, no specific target has been put forward given the area specific variability of nutrient ratios in BGTW. This information will, however, still be collected and interpreted under the Commission Indicator for nutrient concentrations and used in diagnosing eutrophication.

4.4.8 Some additional monitoring or changes to existing monitoring activities may be needed, especially in the light of the need to adopt a risk based approach.

## 4.5 Hydrographic conditions (Descriptor 7)

### Background

4.5.1 The MSFD requires that any permanent alteration of prevailing hydrographical conditions resulting from human activities does not have an adverse effect on coastal and marine ecosystems. This Descriptor is, therefore, intended to manage the potential hydrographical impacts (including cumulative and in-combination environmental effects) arising from large scale projects such as land reclamation, dredging, sea defence and other significant marine activities or infrastructures.

4.5.2 Development in the coastal and marine zone can be broadly categorised into urban (e.g. housing), infrastructure (e.g. ports, harbours, navigation channels, commercial vessel anchoring), tourism & leisure (e.g. marinas), and resources (e.g. aggregate extraction). Developments in these areas can, if poorly managed, alter hydrographical conditions, resulting in significant local scale impacts on both the coastal and marine environments.

4.5.3 Although there is the potential for developments to cause impacts due to changes in hydrographical conditions, impacts arising from marine and coastal development are currently managed through a consenting process. All significant developments are assessed, and their potential impacts monitored, in line with the requirements of the Environmental Impact Assessment Directive, and the assessment processes under the Habitats and Birds Directives.

### Proposed characteristics of GES

4.5.4 The characteristics of GES for this Descriptor are as follows:

- The nature and scale of any permanent changes to the prevailing hydrographical conditions (including but not limited to salinity, temperature, pH and

hydrodynamics) resulting from anthropogenic activities (individual and cumulative), having taken into account climatic or long-term cyclical processes in the marine environment, do not lead to significant long term impacts on those biological components considered under Descriptors 1, 4, and 6.

#### 4.5.5 Proposed indicators for Descriptor 7 – Benthic Invertebrates:

- There should be no increase in the abundance or density of *Corbula gibba* or *Eunice vittata*. These species are known to indicate disturbed sediment and often colonise shortly after dredging or damage from anchoring.

### Approach to setting GES targets

4.5.6 The proposed target reflects the fact that GES will be achieved under the current licensing and consenting regime. It would require all new developments to continue to comply with the existing regulatory regime, and guidance should be followed to ensure that regulatory assessments are undertaken in a way that ensures the appropriate consideration of any potential cumulative and in-combination environmental effects at the most appropriate spatial scales so that GES is not compromised.

4.5.7 *Corbula gibba* and *Eunice vittata* are both tolerant of disturbed sediments and tend to be found in areas where there has been seabed disturbance. They therefore indicate whether areas of the seabed have recently been disturbed by physical activity. Monitoring presence and distribution of these species will indicate whether significant hydrological disturbance has taken place.

### Gaps and development needs

4.5.8 In the longer term there will be a need to develop more detailed baseline information on prevailing environmental conditions.

## 4.6 Concentration of contaminants (Descriptor 8)

### Background

4.6.1 This Descriptor is intended to ensure the presence of contaminants in the marine environment and their biological effects are kept within acceptable limits, so as to ensure that there are no significant impacts on, or risk to, the marine environment. These contaminants include synthetic compounds (e.g. pesticides, antifoulants, etc.), non-synthetic compounds (e.g. heavy metals, hydrocarbons, etc.), and other substances considered pollutants whether solid, liquid or gas.

4.6.2 Hazardous substances can enter the marine environment through natural sources and as a result of anthropogenic activities, either as direct inputs or via rivers and the atmosphere. Pollution itself is considered to be the introduction of substances which have, or are likely to have, deleterious effects on the marine environment and its uses. This includes effects that result in loss of biodiversity, are hazardous to human health, impair water quality, and reduce our ability to use the sea.

4.6.3 There is already a robust legislative framework in place for controlling pollution from contaminants, including appropriate consenting and monitoring programmes. There is good

knowledge of contaminant levels in the marine environment, particularly in coastal and inshore areas, as a result of the WFD, which requires the monitoring of specific contaminants and compliance with specific concentration limits to prevent pollution. The current programme is, however, limited in terms of robust biological effects measurements.

### Proposed characteristics of GES

4.6.4 The characteristics of GES for this Descriptor are as follows:

- Concentrations of contaminants in water, sediment, or biota are kept within agreed<sup>21</sup> levels and these concentrations are not increasing;
- Concentrations of substances identified within relevant legislation and international obligations are below the concentrations at which adverse effects are likely to occur (e.g. are less than Ecological Quality Standards applied within the Water Framework Directive);
- For oil/chemical spills - As a wide range of oils and chemicals may be spilled, targets will be incident-specific and will need to be derived at the time. For spilled chemical compounds relevant assessment criteria (e.g. established EQS and EACs) will be used to help establish significance of impact and appropriate response;
- Abundance and distribution of benthic invertebrate species known to indicate contaminant levels should remain constant or, where possible reduced to naturally occurring concentrations; and
- BOPA species index should remain stable and continue to indicate good ecological status.

### Approach to setting GES targets

4.6.5 The targets proposed for contaminants are based on existing WFD targets.

4.6.6 There is a high-level of regional coordination on the approach to assessment of contaminants and we have high confidence that other countries in the MAP region will follow a similar approach to setting targets.

4.6.7 The use of benthic species such as *Corbula gibba* and *Cirriformia tentaculata* which are known to be tolerant of industrial contamination will help to identify key areas of contamination. The monitoring of these species relative abundance and distribution will provide important information on contamination levels, affected areas, the type of pollution and whether the areas affected by pollution are increasing or decreasing. From this information, key objectives can be made in order to gain GES.

4.6.8 The BOPA index assesses the number of opportunistic polychaete species against the number of amphipod species to provide a ratio that can be compared with that expected of a healthy benthic community. By monitoring the BOPA value it would provide information indicating any shifts in population structure to one more or less associated with contaminated sediment structures. The BOPA value has previously been used in the WFD to show GES.

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<sup>21</sup> Under the WFD.

**Gaps and development needs**

4.6.9 There are no major gaps or development needs, but it will be necessary to keep in step with on-going work on the development of environmental quality standards for new chemicals and to participate in inter-calibration exercises carried out in the MAP and the EC.

**4.7 Contaminants in fish and other seafood (Descriptor 9)****Background**

4.7.1 This Descriptor is intended to ensure contaminants, specifically organic chemicals and trace metals found in fish and shellfish destined for human consumption do not exceed thresholds laid out in Community legislation or other agreements.

4.7.2 Contaminants present in fish and other seafood destined for human consumption may arise for a number of reasons, from both anthropogenic sources (e.g. industry, sewage discharges, agriculture, aquaculture, etc.) and natural sources (e.g. natural geological factors including geothermal activity).

**Proposed characteristics of GES**

4.7.3 As Gibraltar does not have any commercial fisheries in its waters, it is difficult to determine any proposed characteristics of GES for this descriptor – most, if not all, the fish and shellfish sold in Gibraltar is imported. However Gibraltar does undertake a certain amount of testing on fish and other seafood for human consumption based on the requirements laid out in Commission Regulation 1881/2006. Analytical tests of fish and seafood for retail in Gibraltar are tested by the Environmental Agency.

**Gaps and development needs**

4.7.4 No targets have been specifically proposed for this Descriptor due to the fact that Gibraltar does not have any commercial fisheries.



## 4.8 Litter (Descriptor 10)

### Background

4.8.1 Significant amounts of litter appear in the Mediterranean seas and its beaches. It is unsightly and can cause harm to marine wildlife through entanglement, ingestion and smothering of the seabed. However there are currently no agreed assessment tools to quantify how impacts on individual species might translate to population level effects. Litter also has economic impacts due to the clean-up costs to local communities and potential impacts on tourism. It can also pose a hazard to seafarers by fouling ship propellers. Plastics are the main type of litter found both on beaches and offshore, including increasing quantities of microscopic pieces of plastics resulting from degradation of larger plastic products in the sea. These may act as a vector for transferring toxic chemicals to the food chain. There is, therefore, widespread recognition that current and future measures to reduce marine and coastal litter will bring ecological, economic and social benefits.

4.8.2 Any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment can be defined as marine litter. Most marine litter consists of material that degrades slowly, if at all, so a continuous input of large quantities of these items results in a gradual build-up in the marine and coastal environment.

### Proposed characteristics of GES

4.8.3 The draft characteristics of GES for the Descriptor are as follows:

- The amount of litter, and its degradation products<sup>22</sup>, on coastlines and in the marine environment is reducing over time and levels do not pose a significant risk to the coastal and marine environment, either as a result of direct mortality such as through entanglement, or by way of indirect impacts such as reduced fecundity or bioaccumulation of contaminants within food chains.

### Approach to setting GES targets for NIS

4.8.4 Due to our limited understanding of the current levels, properties, and impacts of marine litter we are unable to propose quantitative targets indicating the point at which GES would be achieved i.e. a litter threshold. Trend based targets, instead, have been proposed.

4.8.5 There is also a requirement within this Descriptor to measure ‘trends in the amount, distribution and, where possible, composition of microparticles (including microplastics)’. Expert opinion has indicated that our understanding of the nature of microparticles in the marine environment and their propensity to cause harm is too underdeveloped to establish a meaningful target or indicator at this point in time. Further work will be carried out to improve our understanding of the issue with a view to setting targets and indicators in the future should this prove necessary.

Discussions at an EU level indicate that some Member States are likely to adopt a similar approach to target setting. Coordination with other Member States within the relevant Mediterranean working groups between is required to further elaborate future targets.

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<sup>22</sup> Degradation products of litter include small plastic particles and micro plastic particles.

### Gaps and development needs

4.8.6 It is difficult to determine targets when there is a lack of baseline information. As this is redressed, more clear targets will be proposed to achieve GES.

4.8.7 Over the short term there is a need for additional socioeconomic analysis in support of the final Impact Assessment, in particular with respect to the costs and effectiveness of different management measures e.g. beach cleaning, waste facilities, behavioural change, etc.

4.8.8 Over the longer term there is a pressing need to develop our understanding of the types and amounts of marine litter in the marine environment and how these relate to GES, in particular with respect to ecosystem harm. There is also a need to develop appropriately sensitive and fit for purpose indicators of impact.

4.8.9 Finally, further work will be needed on identifying appropriate and cost effective management measures and ensuring an integrated approach is developed to tackling marine and terrestrial sources of litter.

## 4.9 Underwater noise (Descriptor 11)

### Background

4.9.1 According to the Commission Decision 2010(5956) on the criteria and methodological standards on good environmental status of marine waters, this Descriptor is currently intended to address the impacts of noise on the marine environment and does not currently cover the impacts of any other forms of energy. The Descriptor is divided into two Commission indicators, impulsive sound<sup>23</sup> caused primarily by activities such as oil and gas, seismic activity and pile driving for wind farms, and ambient sound<sup>24</sup> caused primarily by shipping.

4.9.2 Anthropogenic inputs of sound can potentially affect marine organisms in a variety of ways. Continuous noise may degrade the marine habitat, masking biologically relevant signals such as echolocation clicks, making it harder or impossible to find a mate, locate food or detect predators. Impulsive sounds can lead to a variety of behavioural reactions such as avoidance of feeding or breeding areas, or may result in physiological effects such as temporary or permanent damage to hearing organs, and at very high levels, even death.

4.9.3 It is fair enough to state that the major input of underwater noise in BGTW is from shipping. Regular noise monitoring campaigns are the only way to more accurately assess the levels of noise within BGTW.. Further research into the species in BGTW that are sensitive to elevated sound levels is also required to enable more comprehensive assessments of the ecological status of BGTW regarding underwater noise. In order to facilitate the collection of underwater noise data, the Department of the Environment has included a systematic noise monitoring campaign within the wider coastal water monitoring programme

4.9.4 There remain significant gaps in our understanding of levels of noise in the marine environment, its impacts on species and populations, and the thresholds at which noise is considered to be having a 'significant' impact on organisms.

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<sup>23</sup> Impulsive sounds are loud, low and mid-frequency sounds which tend to be caused by activities such as pile driving.

<sup>24</sup> Ambient sounds are continuous low frequency sounds.

### **Proposed characteristics of GES**

4.9.5 Due to the high level of uncertainty about the effects of noise and the lack of comprehensive baseline data in Gibraltar, it has not been possible to recommend a specific target for either impulsive sounds or ambient sounds which are equivalent to GES. Instead, a generic target has been suggested.

4.9.6 The draft characteristics of GES for this Descriptor are as follows:

- Any loud, low and mid-frequency impulsive sounds introduced into the marine environment through anthropogenic activities are managed to the extent that no significant long term adverse effects are incurred at the population level or specifically to vulnerable/threatened species and key functional groups; and
- Continuous low frequency sound inputs do not pose a significant risk to marine life at the population level.

### **Gaps and development needs**

4.9.7 Under the preferred option, targets have not been specifically proposed for the Commission Indicator relating to trends in ambient noise levels as outlined in the Commission Decision on GES. Instead a surveillance indicator has been proposed to ensure further monitoring data are collected with a view to developing an appropriate target in the near future.

4.9.8 In the short term there will be a need for some additional socioeconomic analysis to support the final Impact Assessment, in particular with respect to potential costs associated with implementing the proposed targets.

4.9.9 There is a need to develop and implement the proposed noise registry and a continuing need to develop the quantitative elements of the targets in order to better understand the relationship between the distribution in time and space of impulsive sounds and the implications for achieving GES and promote this approach at an EU level.

4.9.10 Over the longer term there will be a need to develop a more comprehensive ambient noise monitoring programme. Coordinating with other Mediterranean Member States will help improve the effectiveness and extent of noise monitoring in the marine environment.

4.9.11 Further research is also needed to understand the levels of noise, both ambient and impulsive, which result in harm at a population level and significant behavioural effects.