



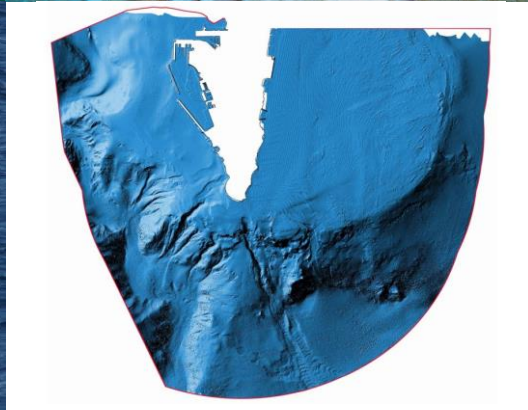
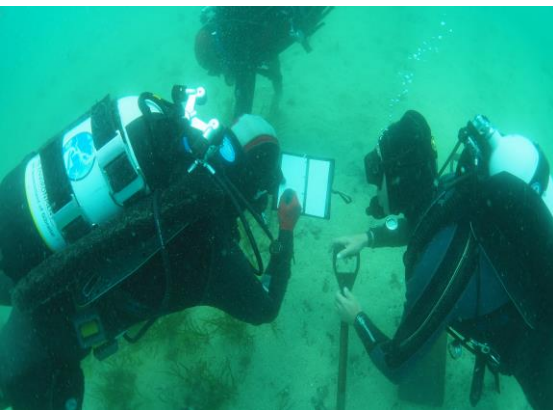
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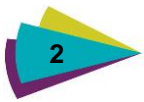
HM Government of Gibraltar

## Monitoring Programme for British Gibraltar Territorial Waters

Marine Strategy Framework Directive

July 2015





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**Cover photos:**

Front left to right:

1. Department of the Environment's Dive Team recording data on *Cymodocea nodosa* restoration programme.
2. Department of the Environment's underwater surveillance camera installed in the Marine Conservation Zone.
3. Cory's Shearwater in the Southern Waters of Gibraltar.
4. Department of the Environment Research and Protection vessel *Storm Petrel*.
5. Bathymetry of British Gibraltar Territorial Waters.
6. Protected reef within the Rosia Marine Conservation Zone.



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# 1. Introduction

The aim of this document is to set out Gibraltar's marine monitoring programme to support the targets and indicators as identified and set out within the Initial Assessment and Proposals for Good Environmental Status in British Gibraltar Territorial Waters (DoE, 2012).

This document thereby satisfies the requirements of Article 11 of the Marine Strategy Framework Directive (MSFD) (2008/56/EC), requiring Member States to establish and implement a coordinated monitoring programme for the ongoing assessment of water quality around Gibraltar's coastline. In order to establish the most comprehensive, robust and efficient monitoring regime, this programme will draw on existing monitoring schedules to determine which requirements are already being satisfied, and design the remainder of the programme around these elements.

## 1.1 Background to the Marine Strategy Framework Directive

The MSFD was developed in response to concerns that although the existing legislation protected the marine environment from some specific impacts, on the whole such legislation was fragmented and sectoral. In addition, due to the transboundary nature of some impacts, e.g. the international industries of commercial shipping or fisheries, and the movement of litter or other pollutants, it was noted that national responses needed to be supported by a wider, trans-Europe framework.

The MSFD came into force in July 2008, and has been transposed into national legislation by Gibraltar via the Marine Strategy Regulations (Gibraltar) (2011), and is being implemented in a coordinated way and in line with the strategies and processes required by the Directive.

Member States are required, under the MSFD, to put in place relevant measures to achieve Good Environmental Status (GES) in their marine waters by 2020. A definition of GES was provided within the Directive, and outlined in 11 high-level Descriptors (**Table 1.1**), which set out what Member States must achieve within their marine environment. For each of these Descriptors, the EC set out a series of detailed criteria and indicators to help Member States determine what each Descriptor would mean in practise and to help measure progress.

Table 1.1 High-level Descriptors of Good Environmental Status

High-level Descriptors of Good Environmental Status under Annex I of the Marine Strategy Framework Directive	
<b>Descriptor 1, Biodiversity</b>	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.
<b>Descriptor 2, Non-indigenous species</b>	Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.
<b>Descriptor 3, Commercial fish</b>	Populations of commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.
<b>Descriptor 4, Marine food-webs</b>	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.

### High-level Descriptors of Good Environmental Status under Annex I of the Marine Strategy Framework Directive

<b>Descriptor 5, Eutrophication</b>	Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.
<b>Descriptor 6, Sea-floor integrity</b>	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.
<b>Descriptor 7, Hydrographic conditions</b>	Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.
<b>Descriptor 8, Contaminants</b>	Concentrations of contaminants are at levels not giving rise to pollution effects.
<b>Descriptor 9, Contaminants in fish and other species</b>	Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.
<b>Descriptor 10, Litter</b>	Properties and quantities of marine litter do not cause harm to the coastal and marine environment.
<b>Descriptor 11, Underwater noise</b>	Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

The overall aims of the MSFD 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.”

Member States must apply an ecosystem-based approach to the management of human activities; in this context, this means ensuring the collective pressure of human activity is kept within levels compatible with the achievement of GES, ensuring that the capacity of the marine ecosystem to respond to anthropogenic changes is not compromised, whilst enabling ongoing sustainable use of the marine environment.

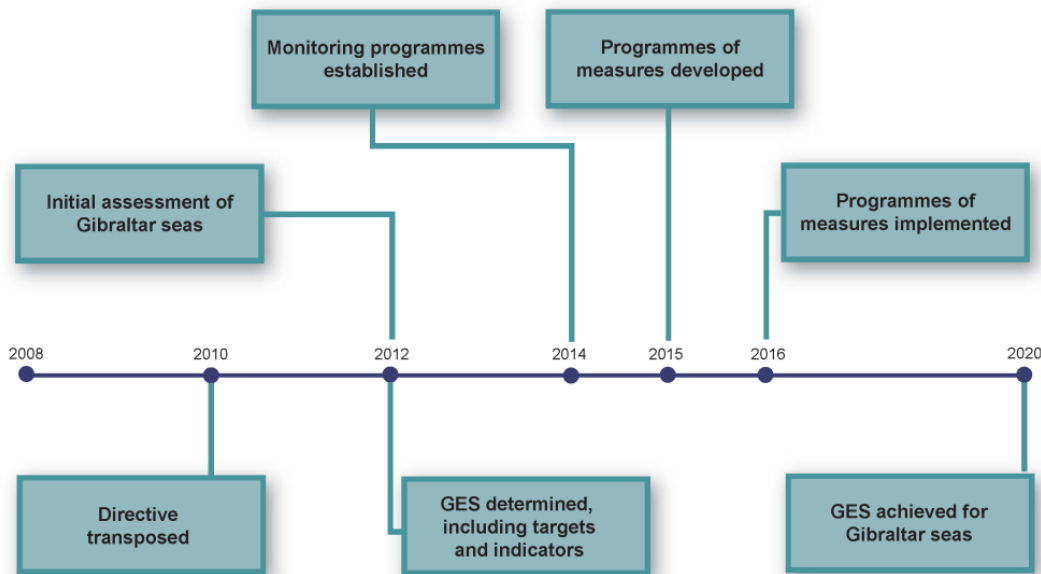
The aims of the Directive are to be delivered through the development of marine strategies, covering the elements and stages set out in **Figure 1.1**. The first stage of the process towards GES by 2020 was for Member States to undertake an initial assessment of the current status of their seas, and to determine specific characteristics for GES under each of the high-level descriptors. For Gibraltar’s waters, this first stage was completed and reported on in 2012 (DoE, 2012).

The second stage is for Member States to establish Monitoring Programmes to measure progress towards GES, with the final stage being the implementation of management measures to achieve GES by 2020. Such management measures must be developed by 2015, and implemented by 2016.

Each stage of the MSFD must be reviewed every six years, and revised where necessary. The Monitoring Programmes presented here are for the first period from 2014 to 2020; where appropriate, following this period, they will be updated to take account of new knowledge and developments in the monitoring of the marine environment.



Figure 1.1 Key stages in the implementation of the MSFD



This report forms the second stage of the MSFD process; design of the Monitoring Programme, outlining how each of the Descriptors will be approached.

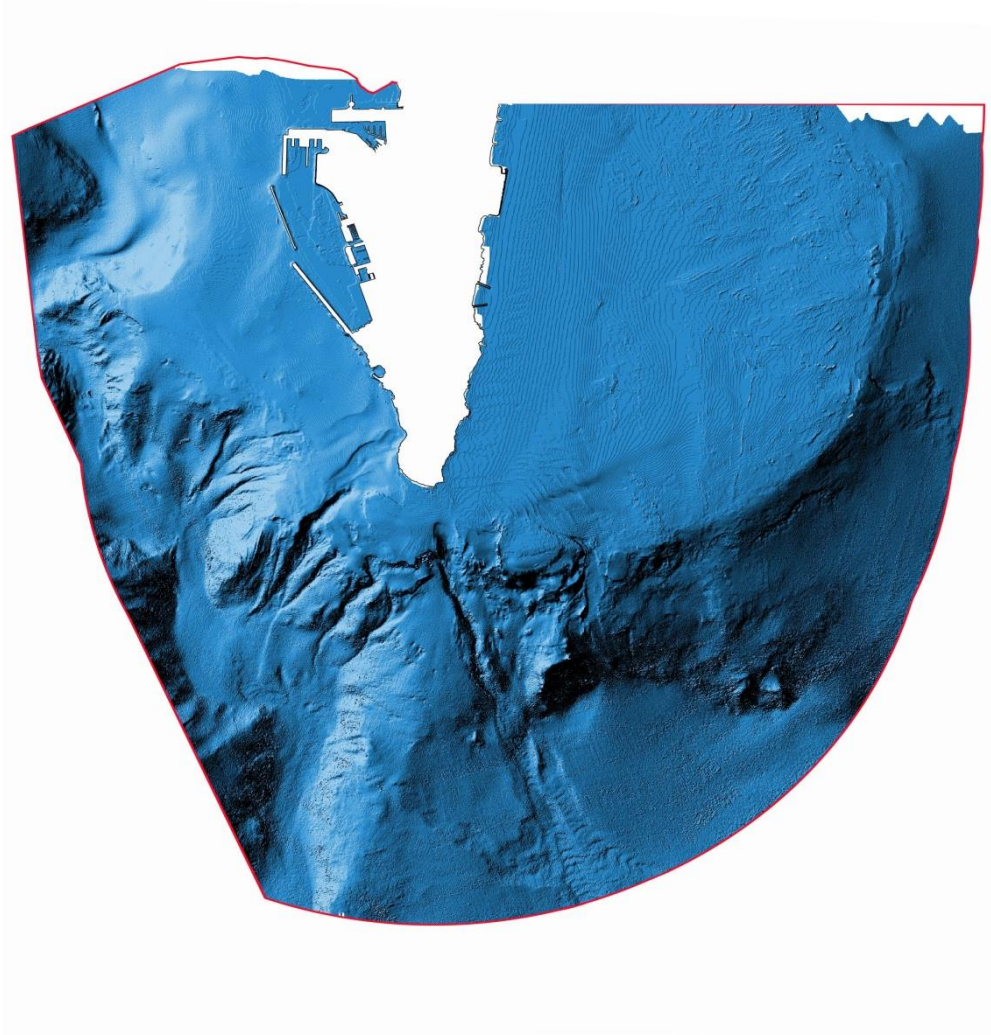
## 1.2 British Gibraltar Territorial Waters

The MSFD applies to the whole of the British Gibraltar Territorial Waters (BGTW) area (**Figure 1.2**), from the landward boundary of coastal waters as defined within the Water Framework Directive (WFD), i.e. mean high water springs (MHWS) to the outer limit of Gibraltar's median line in the Bay of Gibraltar. BGTW extends three nautical miles (nm) to the south, east and south west (being landlocked to the north). 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. The abundance and richness of species is largely influenced by the strong currents and upwellings that are so characteristic of the Straits of Gibraltar. BGTW is dominated by a highly active hydrodynamic regime, with cooler Atlantic waters meeting those of the warmer Mediterranean, with exchange taking place through the narrow Straits of Gibraltar. The Atlantic waters help enrich those of the Mediterranean, providing key nutrients to fuel marine productivity (AMEC, 2014). High levels of water exchange and rapid flow rates through the Straits (surface rates of approximately 1.5 m/s), mean that in general any observed pollutants are quickly dispersed.

Within BGTW, there is significant overlap between the waters covered by the MSFD and the WFD. To counter this, the MSFD explicitly recognises the overlap and makes it clear that in coastal waters, the MSFD is only intended to apply to those aspects of GES which are not already covered by WFD.



Figure 1.2 British Gibraltar Territorial Waters (BGTW)



## 1.3 The European and Regional Context

One of the key requirements of the MSFD is that Member States must take a coordinated approach to implementation, cooperating with other states within the appropriate marine region or sub-region, ensuring coherent and coordinated strategies. Following the MSFD's splitting of Europe's waters into four marine regions and associated sub-regions (**Table 1.2**), Gibraltar falls within the Mediterranean Sea region, and the Western Mediterranean Sea sub-region.

Table 1.2 MSFD marine regions and associated sub-regions

Marine Region	Associated sub-region (where applicable)
<b>The Baltic Sea</b>	No sub-regions specified
<b>The North-East Atlantic Ocean</b>	The Greater North Sea (including the Kattegat and English Channel) The Celtic Seas The Bay of Biscay and Iberian Coast The Macronesian biogeographic region (waters around the Azores, Madeira and the Canary Islands)
<b>The Mediterranean Sea</b>	The Western Mediterranean Sea The Adriatic Sea The Ionian Sea and the Central Mediterranean Sea The Aegean-Levantine Sea
<b>The Black Sea</b>	No sub-regions specified

### European-level coordination

Coordination between countries under the MSFD jurisdiction is at both a European-wide level, for generic issues, and regionally for local, specific issues. At the European level, coordination is managed through a series of informal Working Groups led by the European Commission. These Working Groups include:

- ▶ The Working Group on Good Environmental Status;
- ▶ The Working Group on Economic and Social Analysis; and
- ▶ The Working Group on Data, Information and Knowledge Exchange.

In addition, there are European Union (EU) technical sub-groups on marine litter and on noise, with the remit to review monitoring methodologies, and develop proposals for new approaches.

### Regional-level coordination

Article 6 of the MSFD recommends Member States use existing regional cooperation structures to achieve coherence and coordination of their marine strategies, and build upon existing programmes and activities where relevant. For the Mediterranean Sea, the key forum is the Barcelona Convention, implemented through the United Nations Environment Programme (UNEP) Mediterranean Action Plan (MAP). Recent activities in relation to the MSFD, carried out at a regional level, include:

- ▶ 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'.
- ▶ 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.
- ▶ Gibraltar, through the United Kingdom is currently seeking extension of the Barcelona Convention and increased 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.

## 1.4 Legislation behind the Monitoring Programme

This document provides summaries of Gibraltar's Monitoring Programmes for BGTW, meeting the requirements of the second stage of the MSFD to implement a Monitoring Programme to measure progress towards achieving GES. This is in line with the following Articles of the Directive:

- ▶ **Article 5(2)(a)(iv)** notes that an essential element for the preparation of marine strategies is the "establishment and implementation, by 15 July 2014 except where otherwise specified in the relevant Community legislation, of a Monitoring Programme for ongoing assessment and regular updating of targets, in accordance with Article 11(1)".
- ▶ **Article 11(1)** then specifies that: "on the basis of the initial assessment made pursuant to Article 8(1), Member States shall establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of their marine waters on the basis of the indicative lists of elements set out in Annex III and the list set out in Annex V, and by reference to the environmental targets established pursuant to Article 10. Monitoring programmes shall be compatible within marine regions or subregions and shall build upon, and be compatible with, relevant provisions for assessment and monitoring laid down by Community legislation, including the Habitats and Birds Directives, or under international agreements."
- ▶ In addition, **Article 11(2)** provides that "Member States sharing a marine region or subregion shall draw up monitoring programmes in accordance with paragraph 1 and shall, in the interest of coherence and coordination, endeavour to ensure that: (a) monitoring methods are consistent across the marine region or subregion so as to facilitate comparability of monitoring results; (b) relevant transboundary impacts and transboundary features are taken into account."
- ▶ Also, **Annex V** sets out a list of needs for monitoring programmes:
  - ▶ Before the monitoring programmes are finalised and notified to the Commission, Member States must publish and consult the public on summaries of the programmes (**Article 19(2)(c)**). Then, Member States have to notify (report) their monitoring programmes to the European Commission by 15 October 2014 (**Article 11(3)**) and the European Commission has to assess these programmes within six months of receiving all those notifications (**Article 12**). An update of the monitoring programmes is required every six years, i.e. by 15 July 2020 at the latest (**Article 17 (2)AC(c)**). Finally, the Commission and the EEA must receive access and use rights in respect of data and information resulting from the monitoring programmes (**Article 19 (3)**).

The MSFD also required Member States to make summaries available for public consultation.

## 1.5 Development of the Monitoring Programme

The Government of Gibraltar is already committed to numerous measures which have, and will continue to, improve the state of Gibraltar's marine environment. As part of these measures, several monitoring regimes are already in place. In order to maximise efficiency and ensure compatibility between datasets, where it is appropriate to do so, existing monitoring protocols will be incorporated into the MSFD Monitoring Programme. The following subsections set out key Directives which this Monitoring Programme shall draw on, as appropriate.

In addition to existing monitoring regimes, this report also draws on guidance produced by Zampoukas *et al.* (2012), which highlighted issues to be considered when designing a Monitoring Programme to satisfy the requirements of the MSFD. This report states that for each of the Descriptors, several characteristics should be monitored, allowing an overall assessment of compliance with the MSFD Indicators. It is also noted that while numerous ongoing monitoring regimes exist, the coordination of these efforts are still in their infancy, and that the coordination through the MSFD will be a step towards more cost-effective and efficient monitoring.

Of particular note within the Zampoukas *et al.* (2012) report is the acknowledgement that Descriptors 10 and 11 (Litter and Noise) are comparatively 'new' Descriptors, therefore they are not covered by existing strategies. Guidance has been produced for these Descriptors as a result, and will be referred to within this Programme.

A public consultation was held between August 2015 and February 2016 on this monitoring programme, were no comments were received.

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

The Water Framework Directive (WFD) came into force in 2000, with its main purpose being to establish a framework for the protection on inland, transitional and coastal waters as well as groundwater. It was designed to create a Europe-wide way of measuring and monitoring water bodies with a specific aim of assessing water quality. Within the WFD 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
- ▶ ensure progressive reduction of groundwater pollution.

The Directive requires Member States to establish river basin districts and a River Basin Management Plan (RBMP) for each of these districts which must set out ways to achieve 'good status' by 2015. Gibraltar's own objectives are to be met by 2027, the end of the third management cycle under the WFD (a six-yearly cycle, as with the MSFD). As part of Gibraltar's WFD RBMP programme, surveillance monitoring is undertaken at three sample sites in the coastal water body, and operational monitoring at one site within a heavily-modified water body namely Gibraltar Harbour. The location of these sites is presented in **Figure 1.3**.

Monitoring under the WFD has been ongoing since 2009, providing a large dataset which this Monitoring Programme will draw upon. Both monthly and quarterly monitoring is undertaken, as follows:

- ▶ Monthly monitoring. Samples are collected and analysed for physico-chemical parameters and specific pollutants, e.g. nutrients, chlorophyll-*a*, suspended solids, and un-ionised ammonia.
- ▶ Quarterly monitoring. Samples are collected and analysed for priority substances (e.g. heavy metals, polyaromatic hydrocarbons (PAHs), tributyl tin, chromium VI, etc.) and phytoplankton.
- ▶ Sediment samples are collected on a yearly basis and analysed for priority substances.

There is regular reporting on the WFD sampling results, which is subsequently captured in the River Basin Management Plan. The second 'cycle' of RBMPs is currently ongoing, with the report in preparation.

Along with the physical and chemical parameters monitored, Gibraltar also monitors benthic invertebrate diversity within BGTW. Fa and Finlayson (2011) carried out a comprehensive benthic invertebrate study using WFD sampling locations with the aim of establishing Ecological Quality Objectives and Standards (EcoQs) for Gibraltar's waters. This study determined a number of biological indices from the data collected which are being used to monitor long-term trends in water quality.

The MSFD Monitoring Programme will draw on this comprehensive, long-term monitoring regime, in particular with regards to **Descriptors 1, 4, 5, 6, 8 and 9**.



Figure 1.3 Water Framework Directive sampling stations within BGTW



Information from the Government of Gibraltar, 2016

Environmental Impact Assessment Directive (2014/52/EU)

The Environmental Impact Assessment (EIA) Directive has been in force since 1985, with the latest amendments introduced in 2014, with the requirement to be transposed by Member States on or before the 16<sup>th</sup> May 2017. The main principle of the EIA Directive is to ensure that projects likely to have significant effects on the environment are subjected to an environmental assessment, prior to their approval or authorisation. Consultation is ongoing throughout the process with the appropriate regulator, their advisors, stakeholders and members of the public. This is a key feature of the environmental assessment process.

### Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC)

These two Directives have complimentary over-arching aims to maintain and improve the status of natural habitats and species. Such measures are clearly contributory to achieving and maintaining GES. The focus of the Directives is as follows:

- ▶ The Habitats Directive: The Directive promotes the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Directive's Annexes at a favourable conservation status. Robust protection measures should be introduced for those habitats and species of European importance. Member states are required to take account of economic, social and cultural requirements, as well as local and regional characteristics.
- ▶ The Birds Directive: The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe, setting broad objectives for a wide range of activities.

Under both Directives, an interconnecting network of designated sites are created, known as Natura 2000 sites. These consist of both Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Birds Directive.

Potential impacts on designated sites need to be screened for an Appropriate Assessment under the Habitats Directive, with particular focus on any potential adverse effects on the qualifying features of SACs and SPAs. The screening assessment focuses on the conservation objectives of each qualifying feature, as noted within the citation for the site, and the maintenance of site integrity. Where it is determined that there may be a 'likely significant effect' (LSE) on a qualifying feature, this triggers the requirement for an Appropriate Assessment (AA) to be completed by the relevant competent authority and where necessary additional mitigation measures may be enforced.

Due to the interconnected nature of a number of Descriptors, monitoring and studies undertaken in relation to the Habitats and Birds Directives will be relevant for **Descriptors 1, 2, 4 and 6**. Both Directives and the legal requirements therein are transposed locally in Gibraltar under the Nature Protection Act 1991.

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

The revised Bathing Water Directive (2006/7/EC) came into force in March 2006 and replaces the previous Bathing Water Directive (76/1160/EEC) which is transposed into Gibraltar law by the Environment (Quality of Bathing Water) Regulations 2009. The over-arching aim of the Directive is the protection of public health, however, it also offers the opportunity to improve management practises in bathing waters and to standardise the information offered to bathing water users across Europe. Under the Directive, designated bathing waters are classified as excellent, good, sufficient or poor, based on analysis and assessment of two contaminants (*Escherichia coli* and *Intestinal enterococci*), based on the recognition that the presence of these pollutants are the primary threat to public health.

There are seven designated Bathing Waters around Gibraltar's coastline. Work undertaken in relation to the Bathing Water Directive will be relevant for **Descriptors 5, 8 and 10**.



## Local Legislation / Plans

There are a number of local schemes and programmes which are ongoing around Gibraltar's coastline, which the MSFD Monitoring Programme can draw upon.

### Nature Protection Act (1991)

The overriding aim of the Nature Protection Act (NPA) (1991) is to provide for the protection of habitats, wild birds, animals and plants in Gibraltar. The NPA 1991 also allows for the designation of protected areas and the implementation of conservation measures.

In 2014, two new regulations were published under the Act that specifically dealt with the protection of the marine environment. These are the Marine Protection Regulations (2014) and the Tuna Preservation Regulations (2014)<sup>1</sup>. These instruments create a licensing regime for different activities that take place within Gibraltar's marine environment, including fishing, recreational diving, anchoring and dolphin/whale watching tour operators. Under these Regulations, there is a requirement to provide details of catches to the Department of the Environment. The Regulations have also allowed for the creation of a number of marine protected sites to be established within BGTW. Five Marine Conservation Zones (MCZs) have been created to date as part of the Marine Protection Regulations (see below) and these are being regularly surveyed by the Department of the Environment. This information will be used as part of the MSFD Monitoring Programme to provide information relevant for **Descriptors 1, 3, 4 and 6**.

### Southern Waters of Gibraltar Management Scheme

This Management Scheme was drawn up as a framework to enable the Relevant Authorities to carry out their responsibilities and functions in line with the requirements of the Nature Protection Act 1991, the Marine Strategy Regulations 2011 and the Marine Protection Regulations 2012. These legislative provisions aim to protect both the habitats and species for which the Southern Waters of Gibraltar European Marine Site was designated, but extend to the whole of British Gibraltar Territorial Waters. The Management Scheme is concerned with promoting the sustainable use of a living, working environment. It does not aim to stop people using the Southern Waters of Gibraltar or prevent leisure activities or commercial development in the area. Instead, it brings together all existing management measures in place and provides the mechanism by which these can be delivered so that they do not damage the habitats or species for which the site has been designated. Data collected as part of the Surveillance Monitoring Programme will be used to provide information for all Descriptors.

### Biodiversity Action Plan

Gibraltar's Biodiversity Action Plan (BAP) was published by the Gibraltar Ornithological and Natural History Society (GONHS). This plan describes the status of key habitats and species as well as highlighting observed threats and proposed mitigation measures for key habitats and species, in both terrestrial and marine environments. Information obtained through work carried out under the Biodiversity Action Plan will be relevant for **Descriptors 1, 4 and 6**.

### Environmental Action and Management Plan

Gibraltar's Environmental Action and Management Plan (EAMP) is the roadmap for the implementation of Gibraltar's Environmental Charter, which itself sets out a series of commitments to meet Gibraltar's intention to create a sustainable, rich, diverse and healthy environment. The EAMP establishes general policy goals, identifies specific action points, sets out tentative timeframes for these measures, and develops measures of success. The information gathered as part of the measures outlined in the EAMP will be relevant for **Descriptors 1, 4, 6 and 10**.

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<sup>1</sup> <https://www.gibraltar.gov.gi/new/marine-protection-%E2%80%93-permits>. Accessed February 2015.

## Additional conventions

In addition to the above, Gibraltar is also committed to uphold the key objectives of certain conventions which aim to protect wildlife and improve biodiversity. These include the following:

- ▶ Bonn Convention to conserve migratory species of wild animals (82/461/EEC), which aims to protect species which move between international borders;
- ▶ Bern Convention on the conservation of European wildlife and natural habitats (82/72/EEC);
- ▶ Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic area (ACCOBAMS);
- ▶ The Rio de Janeiro Convention of Biological Diversity (Biodiversity Convention), a global initiative signed by UN member states, covered in Europe by Directive 93/626/EEC, and covering an array of biodiversity issues including invasive species, climate change, tourism and the introduction of the ecosystem approach; and
- ▶ The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean adopted in 1995, protecting the region against pollution.

## 1.6 Structure of the Monitoring Programme

Each of the high-level MSFD Descriptors (or appropriately-assigned groups of Descriptors) have been given a dedicated chapter within this report. For each Descriptor, the Gibraltar-specific characteristics of GES, as proposed within the Initial Assessment report (DoE, 2012) have been included with the determined Indicators, along with a review of existing monitoring regimes and how these will supply the necessary information to assess these. Where gaps within the current monitoring regimes are identified, new, additional monitoring regimes will be designed in order to satisfy the whole suite of monitoring needs. Wherever possible, the Monitoring Programme will allow for the collection of quantitative, rather than qualitative data, so as to produce measurable results.

## 1.7 Monitoring Costs

Monitoring programmes used to assess compliance with the MSFD are generally funded directly by HM Government of Gibraltar, or by government agencies, that are indirectly funded by Government. Some elements are run by non-governmental organisations (NGOs) (e.g. seabird monitoring carried out by the Gibraltar Ornithological and Natural History Society (GONHS) or cetacean monitoring carried out by the Helping Hand Trust) and information collected by marine industries and developers (e.g. in environmental impact assessments) can also be relevant for several descriptors.

In developing the proposed monitoring programmes, wherever possible, we have relied on existing monitoring programmes established to meet existing obligations. In these cases, no additional monitoring cost has been identified. As the majority of these are long-term monitoring regimes, it has been assumed that they will continue for the foreseeable future.

For other descriptors, further work is underway to identify options for cost effective monitoring programmes. This covers non-indigenous species, fisheries, some benthic habitats, litter and ambient noise. In all cases, the monitoring programmes proposed are the minimum required to meet the Gibraltar's monitoring obligations and in most cases it will be a case of business as usual. The programmes will also be regularly reviewed to achieve efficiencies, and the resources targeted at areas where there is most risk of not achieving GES.

## 2. Monitoring Programme Summaries

The following chapters provide summaries of the Monitoring Programmes designed to meet the requirements of each of the 11 Descriptors. The aim of these strategies is to demonstrate how the programmes will monitor progress against Gibraltar's MSFD targets and indicators.

For each Descriptor, the following information has been provided:

- ▶ Part 1: Targets, Indicators and Monitoring Programme:
  - ▶ Includes a description of each MSFD criterion and the associated targets and indicators as well as a summary of the proposed Monitoring Requirements. Information has been drawn from H.M. Government of Gibraltar's Initial Assessment and Proposals for Good Environmental Status in British Gibraltar Territorial Waters (DoE, 2012).
- ▶ Part 2: Meeting Requirements:
  - ▶ Discusses how the Monitoring Programme can be used to evaluate whether targets have been met, how MSFD requirements will be met, and how the effectiveness of measures will be monitored.
- ▶ Part 3: Gaps and Issues:
  - ▶ Describes existing data-gaps, and how these may be addressed, along with key issues which have arisen or may arise in the design of the Monitoring Programme.
- ▶ Part 4: International Considerations:
  - ▶ Describes any regional or international cooperation and coordination which may be required, and consideration of any additional international legislation which needs to be considered.

It should be noted that due to the significant level of overlap between Descriptors 1 (biodiversity), 4 (food webs) and 6 (sea floor integrity), and Descriptors 8 (concentration of contaminants) and 9 (contaminants in marine species), these Descriptors have been combined to form two separate groups within this Monitoring Programme (Chapters 3 and 8). This includes the current status of each element within BGTW and the four parts of the Programme as outlined above.

All Monitoring Programmes described within this report should be considered adaptive in nature, i.e. should concentrations of a key contaminant be shown to be regularly below target or detection levels, the frequency of such analysis may be reduced. Conversely, should monitoring identify particular issues, sampling frequency or survey coverage may be increased or adapted to reflect this.

Throughout the Monitoring Programme, where 'significant change' is referred to, this has been based on EIA and Appropriate Assessment (AA) terminology, referring to the significance of impacts arising from developments or activities.

Finally, although a summary of the current status of each of the Descriptors has been provided, for more detailed information this document should be read in conjunction with the Initial Assessment report (DoE, 2012), which has been used as the primary source for each of the 'Current Status' sections which follow.

### 3. Descriptors 1, 4 and 6: Biodiversity, Marine Food-webs and Sea-floor Integrity

Due to the high level of interconnectivity between these three Descriptors and in order to prevent repetition within this document, biodiversity, marine food-webs and sea-floor integrity have been addressed together. This reflects the fact that the current status and the proposed Monitoring Programme will be broadly the same for all elements. The three Descriptors have a very broad biological and geographical scope, with most human activity in the marine environment having the potential to affect biodiversity, food-webs and the integrity of the sea-floor. Therefore, to achieve GES will require a multi-species and multi-habitat approach. At the same time, achieving GES in the other Descriptors will ultimately assist in achieving GES for these Descriptors.

#### 3.1 Current Status

A properly-functioning food-web is critical to the overall health and biodiversity of the ecosystem. There is a need for an improved understanding of food-webs within BGTW, particularly with regards to functional aspects, including productivity levels and the rate and direction of energy transfer. Given the need for additional data it is currently difficult to apply meaningful targets for this Descriptor which needs to focus on the abundance, distribution and productivity of key species and trophic groups. Furthermore, these food-webs and associated biodiversity are underpinned by healthy and functioning sea-floor habitats, making it essential that this component of the ecosystem is maintained.

For each of the inter-connected Descriptors, the overall aim of the MSFD with regards to the biological environment is that any loss of biodiversity is halted, restored where possible, and that key ecosystems are maintained or recovered. The abundance, distribution and condition of the species and habitats present within BGTW is a reflection of prevailing environmental conditions. Monitoring the health of such species and habitats is important for reviewing the long-term health of the overall ecosystem and ensuring that anthropogenic activities do not lead to significant degradation at any level.

#### Habitats

Although small in scale, BGTW supports a range of benthic habitats, including rocky shores, sandy seabeds, shallow and deep-water (200 m+) reefs, artificial reefs, maerl beds and submerged and partially-submerged sea caves, all of which support a range of marine communities.

The intertidal zone in Gibraltar, as in the Mediterranean Sea in general, is relatively narrow due to a tidal range which rarely exceeds 1 m, with the exception of spring tides. However, this narrow strip of habitat is still important in supporting a variety of marine organisms including the protected Mediterranean ribbed limpet (*Patella ferruginea*), and includes vertical harbour structures, rocky shores, and sandy or pebble beaches. A large proportion of Gibraltar's coastline remains in a natural state on the eastside although the western side (i.e. within the Bay of Gibraltar) is mainly composed of artificial structures such as the harbour and port areas, marinas, the airport and reclaimed land.

Rock armouring and beach stabilisation measures have created a range of rocky shore habitats with a variety of crevices and surfaces for colonisation. These have become well colonised by a variety of sessile and motile species including European protected species such as *Patella ferruginea* and *Lithophaga lithophaga*.

In the southern half of BGTW, submerged and partially-submerged sea caves are found in a stretch of approximately 4.5 km of coastline, providing habitat for a number of seabird species which utilise the ledges as nesting sites. These include Mediterranean shags (*Phalacrocorax aristotelis desmarestii*), pallid swifts

(*Apus pallidus*) and wintering crag martins (*Ptyonoprogne rupestris*). In addition, submerged areas support a wide variety of marine life, particularly sponges and tunicates.

Subtidal rocky reef areas within BGTW, both natural and artificial, provide habitat for a wide array of fish species, thereby supporting a wider marine food web, which includes larger fish species (e.g. Bluefin Tuna), seabirds and marine mammals and reptiles. These areas support not only common marine species, but also a range of rare and endangered species, including the long-spined sea urchin (*Centrostephanus longispinus*), the noble pen shell (*Pinna nobilis*) and the rough pen shell (*Pinna rudis*). The most significant rocky outcrop is Europa Reef, lying south west of Europa Point and extending over 300 m from the shoreline. Water depths across the reef vary from 2-10 m closer inshore, to over 100 m in the southern areas further offshore. Other rocky reef features include the Seven Sister Reef, Weaver's Pinnacle and Pete's Pinnacle. All of these sites are well-known marine biodiversity hotspots within the region.

A programme of developing artificial reefs in BGTW commenced in the 1970s 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.

## Species

The variety of inter- and subtidal habitats present within BGTW provides support to an equally varied range of marine organisms. These are discussed in the following sub-sections; however, it is noted that in general the Mediterranean has seen a fall in the levels of its top predators (Tydeman and Lutchman, 2013), with some shark species showing rates of decline of 96-99%. Cetaceans, pinnipeds, turtles and large bony fish have also shown similar declines. This decline has been linked to the apparent increase in the number of squid and jellyfish species present around Gibraltar.

### Benthic species

At a benthic level, surveys and observations have recorded a diverse variety of marine flora, mussels, echinoderms, nudibranchs, hermit crabs, spider crabs, winkles, tritons, top shells, limpets, barnacles, sea anemones, soft corals and sea fans.

Benthic invertebrate surveys undertaken specifically for ecological classification purposes, in line with the requirement of the WFD, have identified three main communities around the coast of Gibraltar:

- ▶ Well-sorted or very shallow sands, with characteristic species present in samples including amphipods *Hippomedon massiliensis* and *Siphonoecetes dellavallei*, the decapod *Diogenes pugilator* and the polychaete *Prionospio malmgreni*;
- ▶ Transitional community, between well-sorted or very shallow sand and coastal detritic seabeds, with characteristic species including the decapod *Diogenes pugilator* and the polychaete *Sigalion mathildae*; and
- ▶ Transitional community, between muddy sands in protected areas and shallow coastal terrigenous mud, with characteristic species including the bivalves *Paphia aurea* and *Nucula sulcata*, the amphipod *Leptocheirus pectinatus* and the polychaetes *Paradoneis lyra* and *Heteromastus filiformis*.

There are also a number of benthic species present in BGTW which are strictly protected under the Habitats Directive, and include:

- ▶ Ribbed Mediterranean limpet (*Patella ferruginea*);
- ▶ Fan mussels (*Pinna nobilis* and *Pinna rudis*);
- ▶ Date mussel (*Lithophaga lithophaga*); and
- ▶ Long-spined sea urchin (*Centrostephanus longispinus*).

## Fish

Until recently, there was limited information on the status of fish communities in BGTW. A separate report looking at the management of marine living resources in BGTW was produced by an independent Fishing Expert Working Group (Tydeman and Lutchman, 2013) and this report arrived at similar conclusions to the Initial Assessment of BGTW in that the data available had been insufficient in providing clear trends. However, following the publication of the Marine Protection Regulations, the amount of information on fish species and abundance that has been provided to the Department of the Environment has increased significantly. 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*). Other common species found in sandy habitats are listed in **Table 3.1**. Moreover, the currents and upwellings within the Strait and the Alboran Sea bring nutrients that stimulate the growth of plankton thus attracting a variety of pelagic fish (**Table 3.2**).

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>Spondyliosoma 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

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



Scientific name	Common name
<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

A comprehensive fish and mollusc identification guide was produced in January 2015 in order to assist the implementation of the Marine Protection Regulations. Coincidentally, this has also assisted the Department's efforts to collect data on fish species richness and abundance in BGTW. Other notable initiatives include the launch of a fish tagging programme, focusing on white bream, common seabass and bluefin tuna initially. In time, this will provide more useful and accurate data to monitor selected fish stocks.

### Seabirds

One of the more unique seabird species found within BGTW is the subspecies of the Mediterranean shag (*Phalacrocorax aristotelis desmarestii*), with the Gibraltar population being one of the few remaining populations in the Iberian Peninsula. BGTW are also important feeding grounds for a vast number of migratory birds passing through the Straits, with an approximate 300 million birds passing through each year in each direction hence the reason why the Southern Waters, along with the wider Straits of Gibraltar, have been identified as an Important Bird Area (IBA). Cory's shearwaters (*Calonectris borealis*) regularly forage in the Southern Waters of Gibraltar SPA/SAC during its breeding season, with other species, such as gannets (*Sula bassana*) and sandwich terns (*Thalasseus sandvicensis*), utilising the nutrient-rich waters during the winter season. Many of the seabirds which are recorded within BGTW are listed under the EU Birds Directive and are therefore afforded high levels of conservation protection.

In general, however, seabird diversity is relatively low within the Mediterranean, with only 15 species recorded in the area (Tydeman and Lutchman, 2013). Seven of these species are noted as being vulnerable to mortality from bycatch and Cory's shearwater is one of those species that is most affected. **Table 3.3** lists those seabird species present within BGTW which are also listed within the EU Birds Directive.

Table 3.3 Seabird species present within BGTW listed in the EU Birds Directive.

Scientific name	Common name
<i>Calonectris borealis</i>	Cory's shearwater
<i>Chlidonias niger</i>	Black tern
<i>Gelochelidon nilotica</i>	Gull-billed tern
<i>Ichthyaetus audouinii</i>	Audouin's gull
<i>Ichthyaetus melanocephalus</i>	Mediterranean gull
<i>Melanitta nigra</i>	Common scoter
<i>Phalacrocorax aristotelis desmarestii</i>	Mediterranean shag
<i>Phalacrocoracidae</i>	Cormorant
<i>Puffinus mauretanicus</i>	Balearic shearwater



Scientific name	Common name
<i>Sternula albifrons</i>	Little tern
<i>Hydroprogne caspia</i>	Caspian tern
<i>Sterna hirundo</i>	Common tern
<i>Thalasseus sandvicensis</i>	Sandwich tern
<i>Puffinus yelkouan</i>	Yelkouan shearwater

### Marine Mammals

A number of marine mammal species have been recorded within BGTW, with common dolphin (*Delphinus delphis*) and striped dolphin (*Stenella coeruleoalba*) having nurseries within the Bay of Gibraltar. Many species migrate through BGTW and therefore defining exact populations is not easy. Due to their conservation status and general appeal, numerous projects have been undertaken into marine mammal populations around Gibraltar, including work undertaken by the Helping Hand Trust, the Gibraltar Ornithological and Natural History Society and the Foundation for Information and Research on Marine Mammals (FIRMM). These entities have been recording sightings of whales and dolphins in the Straits of Gibraltar since the 1980s. Their work has included photographic ID studies, mapping of temperature and plankton in connection with marine mammal sightings, recording sightings to analyse cetacean diversity and abundance as well as studying nutrient fluxes in the environment. The main marine mammal species recorded within BGTW are presented in **Table 3.4**.

Table 3.4 Main marine mammal species present within BGTW.

Scientific name	Common name
<i>Delphinus delphis</i>	Common dolphin
<i>Globicephala melas</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>	Bottlenose dolphin
<i>Physeter microcephalus</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

Under the new Marine Protection Regulations (2014), all whale and dolphin tour operators must hold a valid licence and must report sightings to the Department of the Environment.

## Marine Reptiles

Three species of sea turtle are recorded within BGTW – green (*Chelonia mydas*), loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) – with the latter being the most frequently-observed. However, these are predominantly visitors to the area, and to date, no evidence of nesting has been observed along Gibraltar's coastline.

## Protected Sites

There are two Natura 2000 network sites in Gibraltar; the Southern Waters of Gibraltar SAC/SPA is the only marine site<sup>2</sup>. The area is 100% marine, ranging from the intertidal area to over 700 m in depth. The Southern Waters of Gibraltar site is shown on **Figure 3.1**, along with the following Marine Conservation Zones (MCZs) designated within BGTW.

There are five MCZs within BGTW:

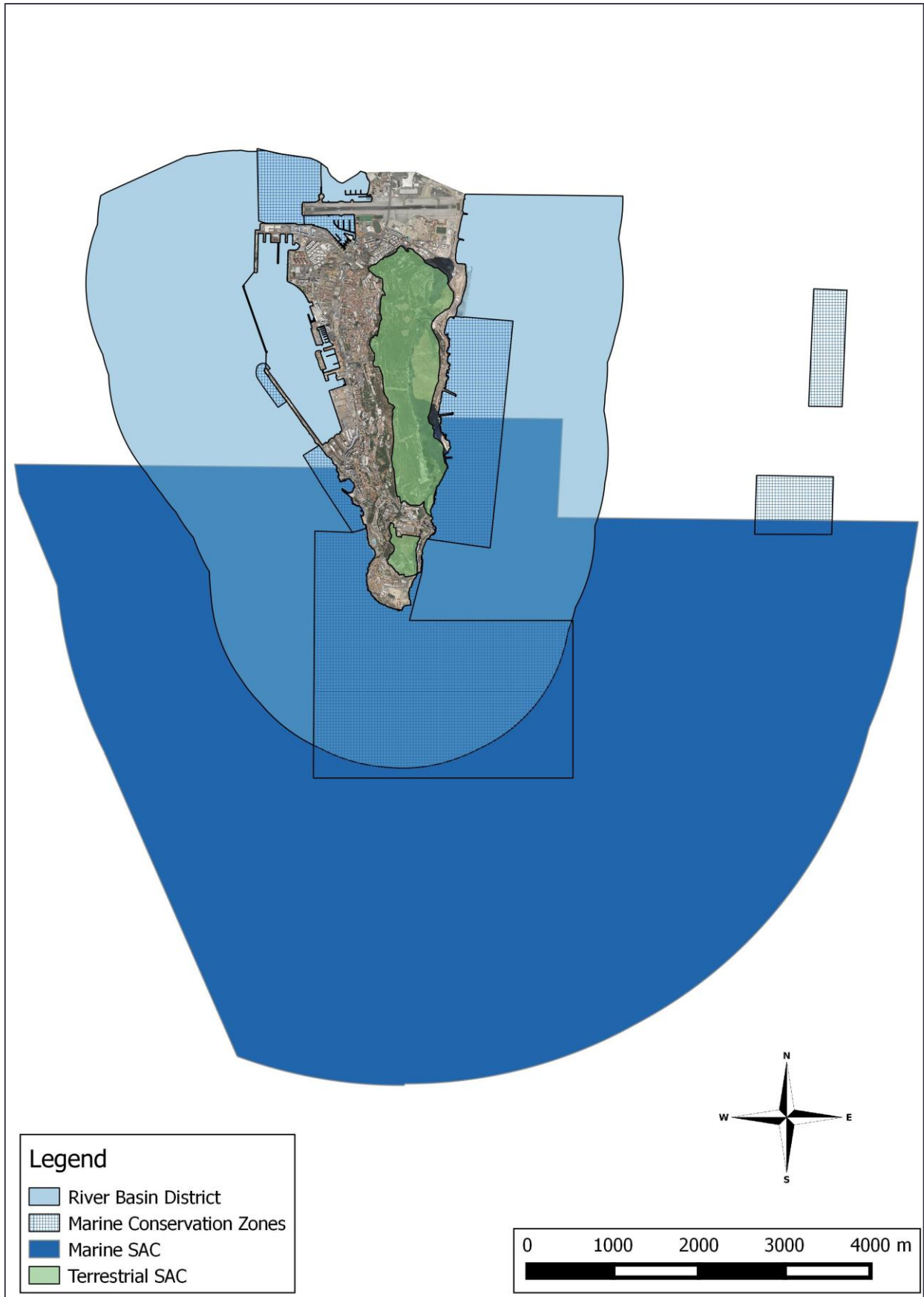
- ▶ North West MCZ
- ▶ South Mole MCZ
- ▶ Rosia MCZ
- ▶ Southern MCZ
- ▶ Eastern MCZ

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.

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<sup>2</sup> Natura 2000 form for Southern Waters of Gibraltar SAC / SPA, available online at: <http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UKGIB0002.pdf>. Accessed January 2015.

Figure 3.1 Protected sites within BGTW



Information from the Government of Gibraltar, 2016

## 3.2 Key Pressures

### Habitats

Anthropogenic activities have the potential to exert physical, chemical and biological pressures on marine habitats. The main sources of pressure on marine habitats include:

- ▶ Physical disturbance, e.g. through construction activities;
- ▶ Contamination by hazardous substances, including oil spills;
- ▶ Fishing;
- ▶ Recreational activities;
- ▶ Illegal dumping of waste material;
- ▶ Sea-level rise;
- ▶ Anchor / mooring damage from all vessel types; and
- ▶ Increase in storms due to climate change.

### Species

The main pressures on the marine communities within BGTW include:

- ▶ Collection of intertidal bivalve species;
- ▶ Pollution;
- ▶ Collision risk to marine mammals and bird features;
- ▶ Disturbance to seabird feeding and nesting sites;
- ▶ Bycatch; and
- ▶ Illegal fishing activities.

## 3.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

**Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 1: Biodiversity, Descriptor 4: Food webs and Descriptor 6: Sea-floor integrity**

#### Overall summary

The proposed Monitoring Programme for biodiversity, marine food-webs and sea-floor integrity combines a range of existing monitoring regimes. The biodiversity of BGTW in particular is studied under a number of regimes, primarily focused on preserving and enhancing the qualifying features of the protected sites in the area. The Programme is also able to draw upon the results of long term monitoring under the WFD, and on new data to be collected under the Tuna Protection Regulations and Marine Protection Regulations. As an over-arching element, the existing planning and licencing legislation will be used to identify any developments with the potential to adversely affect the biodiversity, sea-floor integrity or food webs within BGTW, and enforce mitigation measures as appropriate.

#### MSFD Criterion 1.1: Species distribution

Target: In all of the indicators monitored there is no statistically significant contraction in the distribution of marine mammals caused by human activities.

**Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 1: Biodiversity, Descriptor 4: Food webs and Descriptor 6: Sea-floor integrity**

	<p>Target: The geographic and depth distribution of sensitive fish should meet individual indicator targets in a statistically significant proportion of species monitored.</p> <p>Target: Ensuring the breeding population of Mediterranean Shag is not adversely impacted due to fishing by-catch.</p> <p>Indicator: 1.1.1 Distributional range.</p> <p>Indicator: 1.1.2 Distributional pattern within the distributional range, where appropriate.</p> <p>Indicator: 1.1.3 Area covered by the species (for sessile / benthic species).</p>
<b>MSFD Criterion 1.4: Habitat distribution</b>	<p>Target: No deterioration in qualifying features of designated sites, including a reduction of extent.</p> <p>Indicator: 1.4.1 Distributional range.</p> <p>Indicator: 1.4.2 Distributional pattern.</p>
<b>MSFD Criterion 1.5: Habitat extent</b>	<p>Target: No deterioration in qualifying features of designated sites, including a reduction of extent.</p> <p>Indicator: 1.5.1 Habitat area.</p>
<b>MSFD Criterion 1.6: Habitat condition</b>	<p>Target: No deterioration in qualifying features of designated sites, including a reduction of extent.</p> <p>Indicator: 1.6.1 Condition of the typical species and communities.</p> <p>Indicator: 1.6.2 Relative abundance and/or biomass, as appropriate.</p> <p>Indicator: 1.6.3 Physical, hydrological and chemical conditions.</p>
<b>MSFD Criterion 1.7: Ecosystem structure</b>	<p>Target: Mortality of cetaceans is sufficiently low so as not to inhibit population targets being met.</p> <p>Target: Continued recruitment of seabirds from donor populations in the area.</p> <p>Target: Ensuring adequate fish stocks in BGTW, including key seabird prey species.</p> <p>Target: Ensuring the risk of mortality in seabirds due to by-catch, oil spills and other key pressures are sufficiently low so as not to affect seabird population ecology.</p> <p>Target: 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.</p> <p>Target: The size-composition of fish communities should reflect a healthy status and not be significantly impacted by human activity.</p> <p>Indicator: 1.7.1 Composition and relative proportions of ecosystem components (habitats and species).</p>
<b>MSFD Criterion 4.1: Productivity</b>	<p>Target: No specific target was set for this criterion; however, through successful delivery of other, species-specific criteria, productivity levels within the marine ecosystem should remain at healthy levels. This will be supported by the successful delivery of other Descriptors and associated criteria, e.g. those in relation to eutrophication and nutrient levels.</p> <p>Indicator: 4.1.1 Performance of key predator species using their production per unit biomass.</p>
<b>MSFD Criterion 4.2: Proportion of selected species at the top of food webs</b>	<p>Target: No specific target was set for this criterion; however, through successful delivery of other, species-specific criteria, the proportion of species within each trophic level of the food-web within BGTW should remain healthy.</p> <p>Indicator: 4.2.1 Large fish (by weight).</p>

## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 1: Biodiversity, Descriptor 4: Food webs and Descriptor 6: Sea-floor integrity

<p><b>MSFD Criterion 4.3: Abundance/distribution of key trophic groups/species</b></p>	<p>Target: 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 of, with an age and size structure for these and other key species towards sustainable populations.</p> <p>Indicator: 4.3.1 Abundance trends of functionally-important selected groups/species.</p>
<p><b>MSFD Criterion 6.1: Physical damage, having regard to substrate characteristics</b></p>	<p>Target: 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).</p> <p>Target: Those sea-floor habitats most susceptible to the significant detrimental impacts of human activity are protected to ensure their extent and functioning is maintained.</p> <p>Indicator: 6.1.1 Type, abundance, biomass and areal extent of relevant biogenic substrate.</p> <p>Indicator: 6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types.</p>
<p><b>MSFD Criterion 6.2: Condition of benthic community</b></p>	<p>Target: 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).</p> <p>Target: The sea-floor habitats are capable of supporting a healthy and sustainable ecosystem for the long-term.</p> <p>Indicator: 6.2.1 Presence of particularly sensitive and/or tolerant species.</p> <p>Indicator: 6.2.2 Multi-metric indices assessing benthic community condition and functionality, such as species diversity and richness, proportion of opportunistic to sensitive species.</p> <p>Indicator: 6.2.3 Proportion of biomass or number of individuals in the macrobenthos above some specified length/size.</p> <p>Indicator: 6.2.4 Parameters describing the characteristics (shape, slope, intercept) of the size spectrum of the benthic community.</p>
<p><b>Monitoring Programme name:</b></p> <p><b>Review of records collected under the new voluntary marine monitoring programme, to be introduced in Summer 2016 by the Department of the Environment</b></p> <p><b>Review of results from monitoring undertaken in relation to the Southern Waters of Gibraltar protected site</b></p> <p><b>Existing monitoring for the River Basin Management Plan (RBMP) under the Water Framework Directive (WFD)</b></p> <p><b>Reporting under the Tuna Preservation Regulations (2014) and Marine Protection Regulations (2014)</b></p> <p><b>Monitoring of species and habitats through existing Habitats and Birds Directives Surveillance Monitoring Programmes</b></p>	<p>Description of Monitoring Programme: The proposed Monitoring Programme for Biodiversity, Marine food-webs and Sea-floor integrity draws on a number of existing monitoring regimes within BGTW.</p> <p>In addition to the existing programmes that are currently in place, a new voluntary (citizen science) marine monitoring programme will be operating in late summer 2016. This will enable local amateur divers to register with the Department of the Environment and report information on fish species sighted, crustaceans, invasive species and the condition of different habitat types (i.e. coral, sandy seabed, rocky outcrops etc.). Observations reported as part of this scheme will provide information relevant to <b>Indicators 1.1.1, 1.1.2, 1.1.3, 1.4.1, 1.4.2, 1.5.1, 1.5.2, 1.6.1, 6.1.1, 6.1.2 and 6.2.1</b>. Additional survey and assessment work is planned under the marine habitat restoration project whose objective is to restore the population of the seagrass <i>Cymodocea Nodosa</i> and Oysters (<i>Ostrea edulis</i>) in BGTW. This work will support the monitoring of habitat extents and their condition with restoration works contributing to the overall health of habitats within BGTW.</p> <p>The Department of the Environment has installed two underwater cameras, that have been placed in the Rosia 'no take/no fishing zone' providing users with an insight of Gibraltar's underwater environment as well as vital scientific data on fish species richness and abundance. Moreover, the camera will provide unprecedented data on the effects of declaring a 'no take/ no fishing zone'<sup>3</sup>.</p> <p>The voluntary monitoring scheme will be supported with information on a number of Indicators by other, ongoing monitoring schemes. These are described below.</p>

<sup>3</sup> <http://www.thinkinggreen.gov.gi/index.php/underwater-camera>

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**Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 1: Biodiversity, Descriptor 4: Food webs and Descriptor 6: Sea-floor integrity****Review of ornithological information collected / reported on by the Gibraltar Ornithological and Natural History Society**

Site-specific monitoring of the Southern Waters of Gibraltar protected site is targeted at those habitats and species listed as qualifying features within the designation. This work includes regular (monthly) diving and intertidal surveys being completed as well as monitoring numbers of marine mammals and sea turtles. For protected bird species, the Department of the Environment relies largely on data collected by the Gibraltar Ornithological and Natural History Society (GONHS)<sup>4</sup>, which continually assesses regularly occurring bird species within Gibraltar, including BGTW. Annual accounts of research and sightings results are published by the Society in the Gibraltar Bird Report, which should be reviewed as appropriate when published to identify trends in species present, along with the results of marine surveys.

A number of physical parameters are assessed as part of RBMP monitoring under the WFD, including temperature and salinity, both at the surface and within the water column. This data will provide supporting information, in part, for **Indicator 1.6.1**.

Under the Tuna Preservation Regulations (2014) (part of the Nature Protection Act (1991)), the Authority (i.e. the Government of Gibraltar) require permit holders to provide such information as it deems necessary for the purposes of obtaining data regarding tuna. Catch data are being collected from permit holders on a regular basis. This data will be regularly analysed to give an estimate of tuna populations frequenting BGTW. Also established under the Nature Protection Act are the Marine Protection Regulations (2014), which require permits for a range of activities, including a number of fishing methods, as well as recreational fishing and marine mammal watching boat operators. Under the Regulations, the authority may request the following information from the permit holders: fishing levels, including recreational anglers, and marine mammals observed on recreational trips within BGTW. This will form a useful database of information to be drawn on for the MSFD. Information collected under the Tuna Preservation Regulations and Marine Protection Regulations (2014) will provide appropriate information in part for **Indicators 1.1.1, 1.7.1, 4.1.1, 4.2.1 and 4.3.1**.

There is currently no formal target set by Gibraltar in relation to **Indicator 4.2.1**; however, in addition to the analysis of large fish populations to monitor the health of the marine ecosystem, review of marine mammal and seabird populations will also provide information regarding food webs. As top-level predators, if their numbers remain healthy, this is an indication that the rest of the food chain is also sufficiently productive.

As Gibraltar has no commercial fishing fleet, the monitoring of bycatch has an inherent difficulty. However, bycatch from fishing licenced under the Tuna Preservation and Marine Protection Regulations (2014) will be monitored to establish levels of bycatch. This will provide information to establish whether targets to reduce bycatch are proving successful.

There are a range of biological indices that can be applied to assess the health of a community. The 'Benthic Opportunity Polychaeta Amphipoda' (BOPA) index (amended, in Dauvin and Ruellet, 2007) will be determined for sediment samples collected under the WFD, to establish the health status of the benthic community, directly related to seabed contamination. The BOPA Index assesses the number of opportunistic polychaete species against the number of amphipod species, providing a ratio which can be compared against that expected of a healthy benthic community. Monitoring the BOPA value over time will highlight any shifts in population structure towards or away from a population associated with contaminated sediments. The BOPA value has previously been calculated for benthic samples within BGTW, including work undertaken by Fa and Finlayson (2011), giving a history of values against which ongoing monitoring work can be compared to highlight potential trends. Ongoing monitoring of the BOPA value will provide information appropriate for **Indicator 6.2.2**.

In addition to the above specific monitoring, the Monitoring Programme for Descriptors 1, 4 and 6 will draw on Gibraltar's existing planning and licencing regimes, through the application of EIA, Appropriate Assessments (AA) and other licencing legislation. Baseline characterisation surveys and reporting should provide detailed and accurate assessment of the existing situation in the immediate vicinity of any proposed developments. Where potentially significant impacts are identified through the assessment processes, appropriate mitigation measures should be designed and enforced through the application of consent conditions. Review of

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<sup>4</sup> <http://www.gonhs.org/>



## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 1: Biodiversity, Descriptor 4: Food webs and Descriptor 6: Sea-floor integrity

future baseline characterisation studies within BGTW will act as an additional monitoring device, highlighting any areas where decline in quality or diversity of habitats and species present has occurred.

Use of the appropriate EIA, AA and licencing legislation will provide supporting information appropriate for **all Indicators under Descriptors 1, 4 and 6**.

The Monitoring Programme will also benefit from the review of ad-hoc studies and research projects undertaken within BGTW, for example Linares (2012), which contains the results of a six-year study of whale and dolphin populations within BGTW. Although such work is not completed to target specific elements of the MSFD, such work can highlight any trends which may be associated with MSFD Indicators and Descriptors.

## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

**(i) How does the Monitoring Programme evaluate whether targets have been achieved?**

Each of the proposed elements of the Monitoring Programme for Descriptors 1, 4 and 6 contribute to the overall assessment of the state of habitats and species present within BGTW. From this, any trends in the presence, location or distribution can be noted, and assessment against appropriate targets completed.

**(ii) How does the Monitoring Programme meet the requirements of the Directive?**

The proposed Monitoring Programme allows the identification of a range of trends, focusing on the specific Indicators and targets highlighted within the three Descriptors.

**(iii) How will the Monitoring Programme assess the effectiveness of measures?**

The indices and elements selected for this Monitoring Programme are sensitive to numerous changes in the marine environment, all linked with the aim of achieving GES. Should measures be identified and implemented, ongoing review of the Monitoring Programme's results will enable the Government of Gibraltar to ascertain how BGTW are moving towards GES.

## Part 3: Gaps and Issues

### Gaps and Issues

- It is recognised that gaps exist in terms of data availability, monitoring and analysis at a national level. It is H.M. Government's intention to initiate research projects and assessments, including the proposed voluntary monitoring scheme due to start in summer 2016, which should be able to provide information in relation to this aspect ahead on the next reporting cycle. The results of this work will be used to address these gaps and provide a robust baseline of data to establish accurate environmental status and enable comprehensive monitoring of specific habitat and species improvements into the future.

## Part 4: International Considerations

### International Considerations

#### Regional Coordination

- Gibraltar will continue to monitor the outcomes of regional studies and where possible contribute to any regional research initiatives. Although outwith Gibraltar's jurisdiction, developments within the region will be monitored to identify any with the potential to affect biodiversity, food webs and the sea floor within BGTW.

## 4. Descriptor 2: Non-indigenous species

For the purposes of the MSFD, a species is classed as non-indigenous when it is found in an area that is outside of its normal dispersal potential. Such species can include any species from a pathogen to megafaunal species such as marine mammals or fish, and have the potential to cause significant damage to local ecosystems. This Descriptor covers both the presence of such species and the environmental impacts which may occur as a result of species becoming established within Gibraltar's waters.

### 4.1 Current Status

There is currently insufficient information available to properly assess the status of non-indigenous species (NIS) in BGTW. However, a recent study (Zenetos *et al.*, 2010), summarised the number of NIS within the Western Mediterranean sub-region, which includes Gibraltar. This study found four pathogenic protozoa, 91 macrophytes, 49 polychaetes, 52 crustacea, 34 molluscs, 23 miscellaneous invertebrates and 45 fish. However, it is not clear how many of these are present, or have the potential to be present within BGTW.

Given the lack of detailed understanding of NIS within BGTW, it is difficult to predict whether there will be an effect on local, indigenous populations. Any increase in development within the area, in particular shipping, brings with it the potential for NIS to be introduced to the area, e.g. in ballast water, on ships' hulls or within construction materials. With high levels of shipping activity through the Strait of Gibraltar, there is increased risk of species import. However, it is noted that the physical conditions within the West Mediterranean region (i.e. localised gyres and currents) mean that not all species transported into the area are able to settle permanently.

The primary aim with regards to NIS in BGTW is that 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.

There has been a range of guidance released regarding the monitoring of NIS, including with specific reference to the Mediterranean region (Otero, M. *et al.*, 2013). This includes advice on a monitoring programme for NIS, on which this Monitoring Programme has drawn upon.

### 4.2 Key Pressures

Although not all NIS cause significant biological or environmental harm, each has the potential to adversely affect indigenous habitats and species, due to their very nature as being alien to their new environment. Such adverse effects can include:

- ▶ Out-competing indigenous species for resources, primarily food and habitat;
- ▶ Direct predation upon indigenous species;
- ▶ Disruption to local food-webs through replacement/removal of species;
- ▶ Introduction of pathogens against which indigenous species have no immunity; and
- ▶ Alteration/destruction of local habitat.

## 4.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 2: Non-indigenous Species

##### Overall summary

The proposed Monitoring Programme for NIS in BGTW draws on the existing Habitats Directive Surveillance Monitoring Programme in Gibraltar, with appropriate focus on NIS, alongside the range of networks and alert systems which have been established for NIS both within Europe and at a wider scale.

This approach means that Gibraltar will be alerted to any specific risks which may occur in adjacent waters, i.e. the western Mediterranean. In addition, through the use of baseline characterisation studies, with particular focus on key introduction pathways, it will be possible to monitor for the presence of NIS within BGTW. Should such studies and surveys identify problematic NIS within BGTW, appropriate measures can then be taken.

##### MSFD Criterion 2.1: Abundance and state characterisation of non-indigenous species, in particular for invasive species

Target: Due to the lack of information on current abundance, distribution and impacts of NIS, targets for this Descriptor are more operational, focusing 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 high-risk species should they arrive in BGTW.

Indicator: 2.1.1 Trends in abundance, temporal occurrence and spatial distribution in the wild of non-indigenous species, particularly invasive non-indigenous species, notably in risk areas, in relation to the main vectors and pathways of spreading such species.

##### MSFD Criterion 2.2: Environmental impact of invasive non-indigenous species

Target: See Criterion 2.1 for details.

Indicator: 2.2.1 Ratio between invasive non-indigenous species and native species in some well-studied taxonomic groups that may provide a measure of change in species composition.

Indicator: 2.2.2 Impacts of non-indigenous invasive species at the level of species, habitats and ecosystem, where feasible.

##### Monitoring Programme name:

##### EU-wide Invasive Species Alert Systems

Review of records collected under the new voluntary marine monitoring programme, to be introduced in Summer 2016 by the Department of the Environment

##### Monitoring of NIS through existing Habitats Directive Surveillance Monitoring Programme

##### Transposition and enforcement of the International Convention for the Control and Management of Ships' Ballast Water and Sediment Ballast Water

##### Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species

Description of Monitoring Programme: Due to the importance of NIS as an issue in both the marine and terrestrial environments, there is significant ongoing work into ways of preventing introduction of such species, identification before they become established, and measures to remove/eradicate them, as appropriate. EU-wide initiatives from which Gibraltar can benefit include 'NOBANIS', the European Network on Invasive Alien Species, which includes species alerts from around Europe. Such alerts should be monitored to identify any which may subsequently be applicable to Gibraltar.

Should a NIS outbreak be identified in waters directly adjacent or with immediate connectivity to BGTW, additional, targeted surveys may be required to establish whether the species has subsequently moved into BGTW.

Ongoing monitoring of alert systems will provide supporting information for **all Indicators under Descriptor 2**.

In addition, the voluntary marine monitoring scheme is to be introduced in Gibraltar in summer 2016, drawing on amateur divers, spear fishermen and fishermen to undertake survey work within BGTW; one of the aspects this work will focus on will be NIS, including the coordination of a series of workshops hosted by the Department of the Environment (including local marine experts) to aid NIS identification, and establishment of a web portal with extra ID information. Another tool that will be used for the monitoring of NIS within BGTW will be the underwater cameras. This will enable recreational marine users and the Department of the Environment to report sightings, and provide information for **all Indicators under Descriptor 2**.

Where resources allow, and in particular following reports of an NIS outbreak in the vicinity of BGTW, targeted survey work should be implemented. Sample stations should be based on the species being targeted, i.e. favoured habitats or near key prey sources, and underwater visual surveys completed by experienced marine

## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 2: Non-indigenous Species

scientists. Transects should be completed perpendicular to the shoreline, and all species recorded. This will provide information for **all Indicators under Descriptor 2** as well **Descriptors 1, 4 and 6**. Should NIS be recorded within BGTW, details should be reported as appropriate. If species are recorded within a protected site, this notification process is of particular importance to allow additional assessment and, where necessary, remedial action.

It is proposed that for the identification of NIS and associated impacts within BGTW, Gibraltar also draws on the existing planning and licencing regimes, through the utilisation of EIA, AA and other environmental assessment legislation. It should be stipulated that baseline characterisation surveys take particular note of NIS, highlighting them within subsequent Environmental Statements, alongside potential impacts which may arise as a result of the proposed development, e.g. could the project result in further spread of the species? Where applicable, mitigation measures will be identified and enforced through the application of consent conditions.

The focus of all measures will be high-risk areas and known pathways / vectors for NIS, in order to establish an early-warning system for Gibraltar. Therefore, particular emphasis will be given to harbour, marina or construction projects which will increase the introduction of materials into BGTW. Furthermore, the transposition and enforcement of the requirements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments Ballast Water will significantly help control ballast water discharges in BGTW, and associated introduction of NIS.

Use of the appropriate EIA, AA and environmental assessment legislation will provide information appropriate for **all Indicators under Descriptor 2**.

With shipping and associated ballast water being acknowledged as a primary source for the transportation of NIS, international legislation will play a key role in their control. The International Convention for the Control and Management of Ships' Ballast Water and Sediment Ballast Water<sup>5</sup> was adopted in February 2004; this will come into force 12 months after ratification by 30 States, thereby representing 35% of global merchant shipping tonnage. As an example of the measures under the Convention, ships will be required to carry a ballast water log-book and carry out ballast water management procedures to given standards.

It is also proposed that species-specific action plans are developed for key marine NIS by 2020.

Although not targeting any particular Indicator under this Descriptor, adherence to the International Maritime Organisation (IMO) Convention, and development of species-specific action plans will firstly reduce the risk of NIS being introduced to BGTW, and secondly, mean that a sequence of actions to be followed have already been agreed on. This means a more rapid response time, giving authorities a greater chance of containing / eliminating the NIS, thereby minimising the risk of further spread.

In January 2015, the EU Regulation on invasive species came into force, foreseeing three types of intervention to limit the spread and impact of NIS: prevention, early warning and rapid response, and management. This includes a requirement for Member States to monitor their individual situations with regards to NIS, in terms of presence and potential effects. It is stated that within 18 months of adoption of the EU's list of NIS, Member States should establish an appropriate surveillance system, or include it within their existing monitoring regimes.

The Government of Gibraltar can further help with the monitoring of NIS by distributing information, including identification sheets, among regular marine users, in particular the diving and fishing communities which are naturally likely to encounter NIS should they be present. Similar material has already been produced to support the Tuna Preservation and Marine Protection Regulations<sup>6</sup> and NIS identification information is readily available through online resources<sup>7</sup>.

<sup>5</sup> [http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-\(BWM\).aspx](http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx). Accessed February 2015.

<sup>6</sup> [https://www.gibraltar.gov.gi/new/sites/default/files/HMGoG\\_Documents/Species\\_Identification\\_Booklet.pdf](https://www.gibraltar.gov.gi/new/sites/default/files/HMGoG_Documents/Species_Identification_Booklet.pdf). Accessed February 2015.

<sup>7</sup> <http://www.nobanis.org/Factsheets.asp>. Accessed February 2015.

## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

<b>(i) How does the Monitoring Programme evaluate whether targets have been achieved?</b>	True evaluation as to whether MSFD targets have been achieved will be that there are no significant populations of NIS (e.g. <i>Asparagopsis armata</i> ) found within BGTW. This will be monitored through baseline characterisation surveys undertaken within Gibraltar's waters and ongoing review of alert systems.
<b>(ii) How does the Monitoring Programme meet the requirements of the Directive?</b>	Including NIS surveillance in the existing monitoring programmes in place will allow regular assessment of the status and distribution of NIS within Gibraltar's waters, as well as establishing potential pathways which may arise as a result of future development or activities.
<b>(iii) How will the Monitoring Programme assess the effectiveness of measures?</b>	The overall effectiveness of measures designed to reduce NIS in BGTW will be established through ongoing review of the results of baseline characterisation surveys.

## Part 3: Gaps and Issues

### Gaps and Issues

- Limited information on NIS within BGTW is currently available, however, the amount of information will be increased through the collation of baseline data. It is H.M. Government's intention to initiate research projects and assessments, including the proposed voluntary monitoring scheme due to start in summer 2016, which should be able to provide information in relation to this aspect ahead on the next reporting cycle.

## Part 4: International Considerations

### International Considerations

#### Regional Coordination

- The results and associated outputs of international developments regarding NIS will be monitored, and any reports on NIS with the potential to influence BGTW will be reviewed accordingly.
- Gibraltar will monitor NIS alert systems, in particular alerts relevant to the western Mediterranean Sea, for species which could spread easily into BGTW, and contribute records of species found within BGTW.

## 5. Descriptor 3: Commercial fish

Gibraltar has no commercial fishing fleet, and as a result, there are no quotas for commercial species in BGTW at present, with the exception of Bluefin Tuna (*Thunnus thynnus*). However, populations of commercially-exploited species do exist within BGTW which are targeted by recreational anglers, cottage fishermen and commercial fishing vessels from Spain which use method prohibited by Gibraltar law. The focus of the Monitoring Programme for commercial fish species is therefore limited and thus reliant on recreational fisheries data.

### 5.1 Current Status

The extensive reef habitat present in BGTW, along with good water exchange and easy access to deep waters means that BGTW have the potential to support high abundances of commercial fish species which inhabit rocky reef environments and subsequently provide prey for larger species. Having no commercial fleet, there is limited information on the stocks of species present in BGTW. However, species with the highest commercial value present include tuna, breams, bass, goatfish, shellfish, swordfish, cuttlefish, octopus and mackerel to name but a few prominent species that are regularly targeted. In terms of overall fish populations, a total of 324 species of marine fish are listed as being present within Gibraltar's waters<sup>8</sup>, all recorded as native to the area. **Tables 3.1 and 3.2** in Section 3 present the main sandy seabed and pelagic fish species present within BGTW.

Fish species targeted commercially within BGTW and adjacent waters are a mixture of local stocks, and regional / shared stocks. In some cases, highly migratory stocks may also pass through Gibraltar's waters from the Atlantic into the Mediterranean.

### 5.2 Key Pressures

The major pressures facing commercial fish species are:

- ▶ Over-fishing; and
- ▶ The use of illegal fishing methods.

The major pressures facing commercial fish are overfishing and the use of fishing methods prohibited by Gibraltar law. Such commercial fishing is conducted by Spanish fishing vessels based in the ports of La Linea de la Concepcion and Algeciras (Spain), and it is therefore difficult for Gibraltarian authorities to assess the levels of catch landed that originate from BGTW. This issue was specifically highlighted in the report produced by Tydeman and 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. sharks, sunfish, etc.) including cetaceans and marine reptiles that frequent BGTW. There also exists other smaller-scale pressures such as recreational fishing and the illegal harvesting of intertidal bivalves. Due to these issues, the Monitoring Programme for Descriptor 3 will largely rely on recreational and cottage fishing activities carried out in BGTW. However, this Monitoring Programme should be considered a live document, and will be reviewed accordingly, should the situation within BGTW change in the near future.

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<sup>8</sup> Fish Base online search tool: <http://www.fishbase.org/search.php>. Accessed March 2015.



## 5.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 3: Commercial fish

<p><b>Overall summary</b></p>	<p>As Gibraltar has no commercial fishing fleet, there are limited means by which to obtain accurate information on stocks of commercially-exploited fish species in BGTW.</p> <p>It is proposed that this Monitoring Programme draws upon the reporting requirements under the Tuna Preservation Regulations (2014) and the Marine Protection Regulations (2014) which require recreational and cottage fishing catch data to be submitted to the Department of the Environment for analysis. This will give an indication of the stocks present, and the health of those stocks, present in BGTW.</p>
<p><b>MSFD Criterion 3.1: Level of pressure of recreational and cottage fishing activity</b></p>	<p>Target: No specific targets are currently proposed to monitor the level of pressure of fishing activity. However, programmes are being implemented by the Department of the Environment, via the recreational and cottage fishing sectors, to gather much-needed fisheries data. Following analysis of this data, additional, specific targets will be set.</p> <p>Indicator: 3.1.1 Fishing mortality.</p> <p>Indicator: 3.1.2 Ratio between catch and biomass index ('catch / biomass ratio').</p>
<p><b>MSFD Criterion 3.2: Reproductive capacity of the stock</b></p>	<p>Target: The geographic and depth distribution of sensitive fish should meet individual indicator targets in a statistically significant proportion of species monitored.</p> <p>Target: 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.</p> <p>Indicator: 3.2.1 Spawning stock biomass.</p> <p>Indicator: 3.2.2 Biomass indices.</p>
<p><b>MSFD Criterion 3.3: Population age and size distribution</b></p>	<p>Target: The size-composition of fish communities should reflect a healthy status and not be significantly impacted by human activity.</p> <p>Indicator: 3.3.1 Proportion of fish larger than the mean size of first sexual maturation.</p> <p>Indicator: 3.3.2 Mean maximum length across all species found in research vessel surveys.</p> <p>Indicator: 3.3.3 95% percentile of the fish length distribution observed in research vessel surveys.</p> <p>Indicator: 3.3.4 Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation.</p>
<p><b>Monitoring Programme name:</b></p> <p><b>Reporting under the Tuna Preservation Regulations (2014) and Marine Protection Regulations (2014)</b></p>	<p>Description of Monitoring Programme: Under the Tuna Preservation Regulations (2014), the Department of the Environment requires permit holders to provide catch data for the purposes of monitoring tuna stocks in BGTW. This data will be used to partially meet the requirements of Criteria 3.1 and 3.3. As from the 15<sup>th</sup> June 2015, there has been a dedicated landing point operational within Gibraltar in order to aid the monitoring and reporting requirements of the Tuna Preservation Regulations.</p> <p>Also under the Nature Protection Act (1991), the Marine Protection Regulations (2014) require all those fishing with a Class A permit (small scale longlines) to submit catch data to the Department of the Environment. It is proposed that this information is used, alongside that collected specifically for tuna, to establish levels of fishing pressure, and population age and size distribution.</p> <p>Information collected under the Tuna Preservation Regulations and Marine Protection Regulations will provide appropriate information for <b>Indicators 3.1.1, 3.3.1, 3.3.2 and 3.3.3.</b></p>



## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

**(i) How does the Monitoring Programme evaluate whether targets have been achieved?**

Through analysis of the data collected under the Tuna Preservation Regulations (2014) and Marine Protection Regulations (2014), it will be possible to gain an understanding of the general trends in commercial fish species within BGTW, and whether these stocks can be considered to be healthy. An improvement in the size distribution of species will indicate whether targets are being met.

**(ii) How does the Monitoring Programme meet the requirements of the Directive?**

Although more limited than the level of data which would be available through a commercial fishing fleet, the data collected under the Regulations will allow the general health of fish stocks to be assessed and monitored on an ongoing basis.

**(iii) How will the Monitoring Programme assess the effectiveness of measures?**

With no commercial fisheries within BGTW, monitoring catches within Gibraltar's waters is not straightforward. However, monitoring trends in the data which is collected under the Tuna Preservation Regulations and the Marine Protection Regulations together with information on catches landed in the wider region will give an indication of the data required for this Descriptor.

## Part 3: Gaps and Issues

### Gaps and Issues

- With no commercial fleet within BGTW, information on the level of commercial fishing activity is limited, particularly in relation to specific indices and levels of biomass which rely on detailed landings data. As a result, it has not been possible to establish specific Monitoring Programmes for **Indicators 3.1.2, 3.2.1, 3.2.2 and 3.3.4**.
- The Department of the Environment and Climate Change will largely rely on recreational fisheries data collected in conjunction with local fishing clubs as well as information received from the voluntary monitoring scheme due to start in summer 2016, which should be able to provide information in relation to this aspect ahead on the next reporting cycle. This additional data and information on key fish species will strengthen the baseline, allowing more species-specific targets to be set.

## Part 4: International Considerations

### International Considerations

**Regional Coordination**

- Accurate analysis of commercial fish species data is difficult as a result of unregulated commercial fishing activity in the area carried out by Spanish registered vessels.

**Other international considerations**

- Gibraltar should undertake regular review of allocated fishing quotas of species present in BGTW, to indirectly monitor the status of the wider stocks, where appropriate.

## 6. Descriptor 5: Eutrophication

Eutrophication is the enrichment of water by nutrients, in particular due to elevated levels of nitrogen and phosphorous. Such enrichment causes accelerated growth of algae and plants, which may result in an imbalance of organisms present in the water and a reduction in water quality.

### 6.1 Current Status

There are limited pollutant sources with the potential to contribute to eutrophication within BGTW since there are no rivers in Gibraltar and the only major source of nutrients is the point source release of sewage at Europa Point; an area with an extremely high dispersive capacity given its location within the Straits of Gibraltar. The risk of eutrophication is therefore considered to be negligible. However, a new Secondary Waste Water Treatment Plant is being built at Europa Point and is expected to be commissioned by 2017, as a result of the need to comply with the Urban Wastewater Treatment Directive (91/271/EEC)<sup>9</sup>.

Assessments carried out under Gibraltar's 1<sup>st</sup> cycle River Basin Management Plan (RBMP), as required under the Water Framework Directive (WFD), have categorised Gibraltar's waters as having 'good' levels of nutrients, with the exception of the heavily-modified water body within the harbour, which is classed as being 'probably at risk' from sewage overflows due to its enclosed nature.

The WFD also covers monitoring for phytoplankton species in terms of species richness and abundance. As the main food source for many food-webs, it is important for both benthic and pelagic communities. Diatoms are the most frequently-recorded type of phytoplankton with microflagellates also present in high numbers. There are short-lived blooms at most recording sites in February, with higher levels of chlorophyll-*a* also recorded in summer months and November. Winter and spring blooms are common in the Mediterranean. Levels of chlorophyll-*a* recorded at all sites indicated a high ecological status, suggesting that nutrient input is not adversely affecting phytoplankton communities in BGTW.

With the exception of the harbour, there are generally good levels of water exchange within BGTW, therefore levels of nutrients with the potential to cause eutrophication are unlikely to rise to 'at risk' levels.

The hydrodynamics of a water body are a key consideration when assessing the potential for any accumulation of material, whether nutrients or contaminants (as discussed and addressed later in this report). Several numerical models have been applied to establish the levels of flow and water circulation within the Bay of Gibraltar (e.g. Sammartino *et al.*, 2012). These have shown a noticeable internal tide in the Bay characterised by an inward propagation. This study found that as a result of flow patterns in the area, Atlantic and Mediterranean waters accumulate in the Bay during the rising and falling tides, respectively, the opposite pattern to that observed within the wider Straits of Gibraltar.

### 6.2 Key Pressures

The main pressure on eutrophication within BGTW is point source release and sewage overflows, in particular around Europa Point. Although there are no agricultural activities in Gibraltar, there is still the capacity for run-off to occur, carrying additional nutrients into coastal waters.

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<sup>9</sup> Full text available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0271>

## 6.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 5: Eutrophication

<b>Overall summary</b>	<p>The Monitoring Programme for eutrophication is based primarily on the information gathered for the RBMP under the WFD. Through regular monitoring, the levels of nutrients in BGTW are monitored against standard measures, so that any significant changes in absolute or relative levels will be identified, and, if required, investigative analysis is undertaken.</p> <p>The Programme will also draw on the existing planning and licencing regime in Gibraltar, looking to identify those projects which may have the capacity to lead to increased nutrients being released into the water column.</p>
<b>MSFD Criterion 5.1: Nutrient levels</b>	<p>Target: Nutrient concentrations do not lead to an undesirable disturbance to the balance of organisms present in the water or to the quality of the water concerned resulting from accelerated growth of algae.</p> <p>Indicator: 5.1.1 Nutrients concentration in the water column.</p> <p>Indicator: 5.1.2 Nutrient ratios (silica, nitrogen and phosphorous) where appropriate.</p>
<b>MSFD Criterion 5.2: Direct effects of nutrient enrichment</b>	<p>Target: 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.</p> <p>Target: There should be no or little increase in abundance of the indicator species <i>Abra alba</i> (N. Simboura and A. Zenetos 2002). With known links to eutrophic conditions, monitoring any increases in population density or abundance will indicate a shift towards eutrophic conditions.</p> <p>Target: There should be no or little increase in populations of indicator species <i>Aponuphis bilineata</i>, <i>Eunice vittata</i>, <i>Glycera convulsa</i>, <i>Lumbric latrellie</i> and <i>Scolecopsis ciliate</i>. 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.</p> <p>Indicator: 5.2.1 Chlorophyll concentration in the water column.</p> <p>Indicator 5.2.2 Water transparency related to increase in suspended algae, where relevant.</p> <p>Indicator: 5.2.3 Abundance of opportunistic algae (not including NIS) and algal blooms within BGTW.</p> <p>Indicator: 5.2.4 Species shift in floristic composition such as diatom to flagellate ratio, benthic to pelagic shifts, as well as bloom events of nuisance/toxic algae blooms (e.g. cyanobacteria) caused by human activities.</p>
<b>MSFD Criterion 5.3: Indirect effects of nutrient enrichment</b>	<p>Target: Indirect effects of nutrient enrichment associated with growth of macroalgae, sea grasses and reductions of oxygen concentrations do not constitute an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.</p> <p>Indicator: 5.3.1 Abundance of perennial seaweeds and seagrasses<sup>10</sup> adversely impacted by decrease in water transparency.</p> <p>Indicator: 5.3.2 Dissolved oxygen i.e. changes due to increased organic matter decomposition and size of area concerned.</p>
<b>Monitoring Programme name:</b>	<p>Monitoring under the RBMP and WFD regimes are well-established in Gibraltar's waters, with data having been collected since 2009 at three sampling sites within the coastal water body, and at one site within the harbour, representative of a heavily-modified water body. Samples are collected monthly, and analysed for nutrients, chlorophyll-a and suspended solids to obtain an accurate picture of</p>
<b>Existing monitoring for the River Basin Management Plan (RBMP) under the Water Framework Directive (WFD)</b>	

<sup>10</sup> Wording taken from MSFD documentation: it is noted that there is currently no seagrass within Gibraltar, and that schemes are being implemented to reintroduce it. At this stage, the reference to seagrasses will be reconsidered.

## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 5: Eutrophication

### Monitoring of nutrients through existing regulatory assessment process

primary production levels in the sea throughout the year (AMEC, 2013). This work has resulted in a long-term dataset for: total N; total P; NO<sub>3</sub><sup>-</sup>; NO<sub>2</sub><sup>-</sup>; NH<sub>4</sub><sup>+</sup>; NH<sub>3</sub><sup>+</sup>; PO<sub>4</sub><sup>3-</sup>; dissolved oxygen; chlorophyll-a. Samples are also analysed for the presence and levels of key phytoplankton species.

In addition, following initial sample collection and analysis, a series of actions have been put in place through the RBMP, including commitments by HMGoG to prevent storm overflows containing sewage discharges into Gibraltar's waters, the development of a new sewage treatment plant and specific plans and commitments regarding oil spill contingencies. Investigative work is also undertaken as necessary.

Continuation of the RBMP/WFD monitoring will provide information appropriate for **Indicators 5.1.1, 5.1.2, 5.2.1, 5.2.2 and 5.3.2.**

In addition, the existing planning and licencing regime within Gibraltar is used to identify those projects with the potential to affect nutrient discharge levels, and the appropriate level of EIA or AA assessment is undertaken as part of the consenting process. Where applicable, mitigation measures will be identified, and continue to be enforced through the application of consent conditions.

## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

#### (i) How does the Monitoring Programme evaluate whether targets have been achieved?

Analysis of samples collected for the RBMP under the WFD will allow levels of key nutrients, phytoplankton and other elements to be directly assessed with established targets and objectives. Long-term datasets are already in existence for many of the targets, so trends over time can be analysed against any short-term changes.

In addition, the existing planning and licencing regime in Gibraltar requires appropriate application of the EIA, AA and WFD legislation. As a result, any proposed developments with the potential to affect marine nutrient levels will be identified, and assessment completed as necessary.

#### (ii) How does the Monitoring Programme meet the requirements of the Directive?

The Monitoring Programme, drawing on the existing monitoring regime for the RBMP, meets the requirements of the MSFD by establishing the levels of key nutrients within BGTW and monitoring these to establish any occasions on which target levels are exceeded. Through comparison to long-term trends in the existing datasets, any potentially anomalies can be identified and, where necessary, appropriate measures put in place.

With regards to the assessment of effects, the current planning and licencing regime in Gibraltar requires an assessment of any activity which has the potential to cause significant effects. This includes the release of nutrients into the marine environment. Such assessments will highlight whether activities or developments will result in significant changes to the environment, and may require mitigation measures, as appropriate.

#### (iii) How will the Monitoring Programme assess the effectiveness of measures?

Should the regular monitoring and review of proposed developments as proposed above identify any changes, or potential for changes, in nutrient levels within BGTW, there is the opportunity to put in place measures to combat this, or undertake additional, investigative monitoring to establish what is causing the increase.

Through the planning and licencing regime, the application of mitigation measures can be enforced through consent conditions. Baseline characterisation of future projects will act as a means of monitoring the success of mitigation measures.

## Part 3: Gaps and Issues

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### Gaps and Issues

- At the time of writing, there is no continuous monitoring plan in place for perennial seaweeds within BGTW. Plans are however in place for the ongoing reintroduction of seagrasses within BGTW. The seagrass reintroduction project will have its specific monitoring programme and regime, which will be incorporated into this Monitoring Programme, thereby allowing monitoring for **Indicator 5.3.1**.

## Part 4: International Considerations

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### International Considerations

#### Regional Coordination

- The results and associated outputs of neighbouring RBMPs should be monitored, and any changes with the potential to influence BGTW reviewed accordingly, for example, a significant increase in levels of nutrients, or changes to monitoring regimes which may result in data no longer being comparable.
- Gibraltar should monitor proposals for developments or activities in adjacent waters which have the potential to affect nutrient levels in BGTW. Although it may not be possible to enforce mitigation measures on such projects, regular review of the situation will identify any major issues.
- Gibraltar will continue to liaise with the European Commission with specific regards to the sewage overflow which is currently causing Western Beach to fall below the standards required by the Bathing Water Directive.

#### Other international considerations

- No other international considerations have been identified.

## 7. Descriptor 7: Hydrographic conditions

Hydrographic conditions are a key consideration in the marine environment with the capacity to affect a wide range of factors. As a result, changes to the hydrographic regime within BGTW has the potential to adversely affect a range of other Descriptors under the MSFD.

### 7.1 Current Status

Gibraltar forms the eastern edge of the Bay of Gibraltar. The Bay is 8 km wide and extends 10 km into the mainland. It is one of the deepest bays in Europe (over 400 m) 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 55,500 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.

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.

The bathymetry surrounding Gibraltar is varied. On the West coast there is a narrow shelf area and steep continental slope with deep water (>200 m) within a mile of the shoreline. In the centre of Gibraltar Bay the water depth reaches around 400 m. To the South, the coastal slope separating Gibraltar from Morocco declines to around 900 m 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. 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.

There are no rivers in Gibraltar. Freshwater input into the Bay arises from two Spanish rivers, Río Palmones and Río Guadarranque, which create localised salinity gradients in the vicinity of their outfalls. Salinity levels generally lie within the euhaline range (30 to <40 ppt), with the coastal water type of BGTW being considered Mediterranean euhaline intermediate.

A new and detailed Multi-Beam bathymetric survey was carried out in 2013 of the entirety of BGTW.

### 7.2 Key Pressures

With a high population density, there is significant development in Gibraltar's coastal region, mostly residential and light industrial, including harbour and marina infrastructure. There is generally greater development along the west coast, including a large semi-enclosed body of water behind a seawall, compared to the east, which is predominantly a protected marine reserve along with residential areas and sandy beaches to the North. Due to its enclosed nature and shipping use, Gibraltar Harbour has been designated as a heavily-modified water body.

Activities likely to cause an impact on hydrographic conditions include:

- ▶ Dredging;
- ▶ Land reclamation;
- ▶ Coastal development, e.g. harbours and marinas;



- ▶ Discharge of water and material from industrial and sewage processes; and
- ▶ Coastal defences, e.g. seawalls, rock armour or beach stabilisation works.

The above activities each have the capacity to alter the coastline or immediately adjacent coastal waters in such a way to affect hydrodynamic and sedimentary regimes, and, indirectly, the habitats and species which are found within the Bay of Gibraltar. Within the harbour, for example, water exchange and movement has been restricted by the sealing of a channel which allowed water exchange between the harbour and the Bay of Gibraltar. The present currents are, as a result, sometimes insufficient to allow suitable levels of water movement within the harbour. Coupled with the low tidal range, this can lead to stagnation within the harbour at certain times of the year. Low levels of water movement may also lead to sedimentation within the harbour, resulting in further alterations to hydrographic conditions, and the potential need to dredge regularly to maintain depth. Sediment build up in the harbour may also contain levels of contaminants, which could be released through dredging activities, resulting in increased levels of suspended sediment, and reduced water quality.

Although individual developments may result in only minor alterations to hydrographic conditions, cumulative effects may cause major changes to processes.

## 7.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 7: Hydrographic Conditions

<b>Overall summary</b>	The approach to MSFD Descriptor 7, Hydrographic Conditions, is to continue monitoring in line with the requirements of the WFD as well as monitoring the licence applications of any proposed developments around Gibraltar's coastline through building applications which have the potential to alter hydrographic conditions. For example, large-scale marine projects or coastal defences. Any such developments will be monitored, and assessed to confirm whether there is a requirement for additional licencing, monitoring or assessment beyond that necessary as part of the EIA and AA processes.
<b>MSFD Criterion 7.1: Spatial characterisation of permanent alterations</b>	<p>Target: All developments must comply with the existing regulatory regime, and guidance should be followed to ensure that regulatory assessments take into consideration all potential impacts, including cumulative effects at an appropriate scale.</p> <p>Indicator: 7.1.1 Extent of area affected by permanent alterations.</p>
<b>MSFD Criterion 7.2: Impact of permanent hydrographic changes</b>	<p>Target: 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.</p> <p>Target: There should be no increase in the abundance or density of <i>Corbula gibba</i> or <i>Eunice vittata</i>. These species are known to indicate disturbed sediment and often colonise shortly after dredging or damage from anchoring.</p> <p>Indicator: 7.2.1 Spatial extent of habitats affected by the permanent alteration.</p> <p>Indicator: 7.2.2 Changes in habitats, in particular the functions provided, due to altered hydrographical conditions.</p>
<b>Monitoring Programme name:</b>  <b>Monitoring of hydrographic conditions through existing regulatory assessment process and WFD RBMP process</b>	Description of Monitoring Programme: No specific Monitoring Programme has been proposed for the assessment of hydrographic changes within BGTW. As described above, it is proposed that the existing monitoring under the WFD as well as monitoring under the planning and licencing regime within Gibraltar will be used to identify those projects with the potential to affect hydrographic regimes Under the existing system, a hydrographic study is a requirement stipulated within all Scoping Opinions provided for qualifying projects. Where applicable, mitigation measures will be identified, and enforced through the application of consent conditions.

## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 7: Hydrographic Conditions

Use of the appropriate EIA, AA and licencing legislation will provide information appropriate for **Indicators 7.1.1, 7.2.1 and 7.2.2.**

### Part 2: Meeting Requirements

#### How does the Monitoring Programme meet requirements?

<b>(i) How does the Monitoring Programme evaluate whether targets have been achieved?</b>	The existing planning and licencing regime in Gibraltar requires appropriate application of the EIA, AA and WFD legislation. As a result, any potential large-scale developments within Gibraltar's waters will be identified, and assessment completed as necessary.
<b>(ii) How does the Monitoring Programme meet the requirements of the Directive?</b>	The current planning and licencing regime in Gibraltar requires an assessment under EIA and other legislation of any activity which may interfere with hydrographical processes, e.g. significant changes to the thermal or salinity regime, or sediment transport processes. Such assessment will highlight whether activities will result in significant changes to such processes, and require mitigation measures, as appropriate.
<b>(iii) How will the Monitoring Programme assess the effectiveness of measures?</b>	The licencing process will ensure that any developments with the potential to alter the hydrographical regime in Gibraltar's coastal waters will be fully assessed and, where necessary, apply such conditions so that appropriate mitigation measures are put in place. Baseline characterisation of future projects will act as a means of monitoring the success of mitigation measures.

### Part 3: Gaps and Issues

#### Gaps and Issues

- No gaps or issues have been identified.

### Part 4: International Considerations

#### International Considerations

<b>Regional Coordination</b>	<ul style="list-style-type: none"> <li>Gibraltar should monitor proposals for developments in adjacent waters which may have the potential to affect hydrographic conditions in BGTW. Although it may not be possible to enforce mitigation measures on such projects, regular review of the situation will identify any major issues.</li> </ul>
<b>Other international considerations</b>	<ul style="list-style-type: none"> <li>No other international considerations have been identified.</li> </ul>

## 8. Descriptors 8 and 9: Concentrations of contaminants

As with Descriptors 1, 4 and 6, there is a significant overlap in the status, pressures and effects of contaminants, whether they be present within the water column or adhered to marine sediments. Elevated concentrations of contaminants within the marine environment have the potential to cause harm, not only directly to any marine species which may consume them, but also by bio accumulating in different trophic levels that may eventually affect humans thus giving rise to public health concerns (e.g. elevated levels of heavy metals in tuna species). Ongoing monitoring of the levels and types of marine contaminants is therefore essential to the overall health of the marine environment.

### 8.1 Current Status

This section addresses the current status of contaminants within BGTW, from both a water quality and marine species perspective.

Under existing water monitoring regimes, there are three monitoring stations within Gibraltar's coastal water body and one within the harbour, which is designated a heavily-modified water body (HMWB). Monitoring of physio-chemical parameters is monitored on a monthly basis, and monitoring of specific pollutants and priority substances is undertaken on a quarterly basis. Sediments are monitored for priority substances on a yearly basis. Water body classification was carried out in 2015 (at the start of the second cycle of RBMP). The coastal water body around Gibraltar was classified as having attained 'Good Ecological and Chemical Status' with an overall 'Good' status and the HMWB as 'Good Ecological Potential' but 'Fail Chemical Status' due to high levels of tributyltin (TBT). Organotins are harmful to marine organisms (e.g. acting as an immunosuppressant in cetaceans), as well as accumulating through the food chain with the potential for affecting fish and shellfish for human consumption. Most notably, TBT causes imposex in marine gastropods.

As well as the chemical contaminants described above, other priority and hazardous substances are monitored, such as hydrocarbons. Oil contamination is one of the key causes of pollution worldwide and can cause long- and short-term adverse effects on marine wildlife. In slick form, oil has the capacity to coat the feathers of seabirds or the skin of marine mammals and enter the blowholes of cetaceans, each potentially causing significant biological harm if ingested. In Gibraltar, the greatest risk is fuel oil spills as a result of shipping activity and bunkering. However, these are generally small in scale, and surface-based, and with spill response facilities in place, are unlikely to be long-lived in the marine environment. Analysis has shown elevated levels of hydrocarbons in coastal sediments within the harbour. This may have subsequent impacts on benthic communities, in particular if these are released through other activities such as dredging or construction.

Environmental radiation is another key concern from a marine perspective, due to the potentially wide-ranging negative effects on both the environment and humans. Although major incidents are the most commonly thought-of source of radioactive material, accumulation of small levels of radiation may occur through the food chain. There are currently no major sources of radio-nucleotides within Gibraltar; however, there is ongoing monitoring completed by the Environmental Agency on desalinated drinking water in line with the Drinking Water Directive (98/83/EC). It is noted though, that radioactive pollution tends to be long-lived, with some elements taking centuries to become neutral, with potential for materials to reach levels sufficient to harm upper food chain organisms, including humans. Should elevated levels be identified, measures will be required, due to the potential for bioaccumulation and associated adverse public health effects.

The final key source of contamination is microbial contamination, which is routinely monitored in BGTW in line with the requirements of the Bathing Water Directive. The prime concern with microbial contamination is human health. High concentrations in frequently used bathing waters may result in severe human illness and result in

the closure of the beach until the issue is resolved. In a tourism-dominated economic climate, there is, therefore, the socioeconomic element of microbial contamination to consider as well.

All main bathing beaches within Gibraltar are monitored under the Bathing Waters Directive, with particular focus on sewage-based contaminants. Due to the high levels of hydrodynamic exchange within Gibraltar's waters, dispersal occurs relatively quickly, meaning that concentrations of contaminants generally do not reach high levels, with the exception of western beach due to transboundary microbial contamination from an overflow pipe from Spain.

As with all contaminants, microbial contamination can be consumed and carried up through the food chain via bioaccumulation, resulting in potential harm to higher trophic levels, including humans.

### Current contaminant control measures

As described previously within this report, high levels of water movement within BGTW mean that any contaminants present are usually rapidly dispersed. In addition, there are a number of measures in place to monitor and reduce the risk of contaminants entering the marine environment, such as the Oil Spill Prevention and Contingency Plan produced by the Gibraltar Port Authority, Gibraltar's National Action Plan for the Sustainable use of Pesticides<sup>11</sup> which includes specific measures designed to protect the aquatic environment and drinking water. Other salient measures in place include the Environment (Control of Dust) Regulations 2010. These Regulations require building, construction works and other works to produce a dust control plan for consideration by the Environmental Agency who will then grant a licence once the plan is approved. Guidance has also been produced to control the release of dust into the environment, primarily as a result of construction activities, noting the potential for material to enter water bodies and affecting water quality<sup>12</sup>.

### Contaminants in fish and seafood

With regards to levels of contaminants in fish and seafood, the Department of the Environment is currently undertaking a biota monitoring programme which looks into levels of contaminants in both fish and shellfish. In addition, ad-hoc investigations carried out on cetaceans in the Bay and Straits of Gibraltar, specifically *Delphinidae*, have shown that the levels of some contaminants are higher than in neighbouring Atlantic populations. This has been attributed to industrial activities in the area, and the intense shipping activity (and associated pollution) which is characteristic of the Straits of Gibraltar.

## 8.2 Key Pressures

The key pressures with regards to contaminants are any activities which may result in deliberate or accidental release of pollutants into the marine environment some of which may subsequently be consumed by marine organisms. These pressures include:

- ▶ Industrial run-off;
- ▶ Release of litter; and
- ▶ Shipping pollutants.

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<sup>11</sup>[https://www.gibraltar.gov.gi/new/sites/default/files/1/15/National Action Plan for the Sustainable Use of Pesticides.pdf](https://www.gibraltar.gov.gi/new/sites/default/files/1/15/National_Action_Plan_for_the_Sustainable_Use_of_Pesticides.pdf). Accessed March 2015.

<sup>12</sup> [https://www.gibraltar.gov.gi/new/sites/default/files/1/15/Dust\\_Best\\_Practice\\_Guide.pdf](https://www.gibraltar.gov.gi/new/sites/default/files/1/15/Dust_Best_Practice_Guide.pdf). Accessed March 2015.

## 8.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptors 8 and 9: Concentration of contaminants

<p><b>Overall summary</b></p>	<p>The Monitoring Programme for Descriptors 8 and 9 is based on current monitoring work on biota within BGTW, analysing the levels of contaminants present, as well as existing and established monitoring regimes in place under the WFD and associated RBMP and Bathing Waters Directive. The latter Directives have generated long-term datasets within BGTW allowing not only analysis against MSFD Indicators and their proposed targets for GES but also an indication of any trends in quality over the recorded years.</p>
<p><b>MSFD Criterion 8.1: Concentration of contaminants</b></p>	<p>Target: Concentrations of contaminants in water, sediment or biota are kept within agreed levels and these concentrations are not increasing.</p> <p>Target: 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 WFD).</p> <p>Target: Targets for proposed contaminants are based on existing WFD targets.</p> <p>Indicator: 8.1.1 Concentration of the contaminants listed, measured in the relevant matrix, in a way that ensures compatibility with the assessments under WFD.</p>
<p><b>MSFD Criterion 8.2: Effects of contaminants</b></p>	<p>Target: Abundance and distribution of benthic invertebrate species known to indicate contaminant levels should remain constant or, where possible, reduced to naturally-occurring concentrations.</p> <p>Indicator: 8.2.1 Levels of pollution effects on the ecosystem components concerned, having regard to the selected biological processes and taxonomic groups where a cause/effect relationship has been established and needs to be monitored.</p> <p>Indicator 8.2.2 Occurrence, origin (where possible), extent of significant acute pollution events (e.g. slicks) and their impact on biota physically affected by this pollution.</p>
<p><b>MSFD Criterion 9.1: Levels, number and frequency of contaminants</b></p>	<p>Target: As with concentration of contaminants in the water column, concentrations are kept within agreed levels and are not increasing.</p> <p>Indicator: 9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded regulatory levels. Regulatory levels used within this Monitoring Programme are those stipulated within the Water Framework Directive (2000/60/EC)<sup>13</sup> and the Priority Substances Directive (2013/39/EU)<sup>14</sup></p> <p>Indicator: 9.1.2 Frequency of regulatory levels being exceeded. This is established through the current WFD monitoring programme.</p>
<p><b>Monitoring Programme name:</b></p> <p><b>Existing monitoring for the River Basin Management Plan (RBMP) under the Water Framework Directive (WFD)</b></p> <p><b>Existing monitoring for classification under the Bathing Water Directive</b></p>	<p>Monitoring under the WFD is well-established in Gibraltar's waters with data having been collected since 2009 at three sampling sites within the coastal water body, and at one site within the harbour which is classified as a heavily-modified water body. Quarterly monitoring is undertaken to establish concentrations of priority substances and specific pollutants under the WFD. Results for each water body are compared against EQS values to identify any non-compliance which may occur. Substances sampled for include: pesticides, heavy metals, polynuclear aromatic hydrocarbons (PAHs), chlorinated hydrocarbons; organotins, DEHP, benzene, urons, phenols and other specific pollutants (chromium VII, copper and zinc). In addition to the regular monitoring under the WFD, investigative analysis is also being undertaken across</p>

<sup>13</sup> Regulatory levels used are those outlined in The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010 and as updated by UKTAG in 2014.

<sup>14</sup> Note that revised environmental quality status (EQS) for existing priority substances should be met by 2021 and EQS for newly identified priority substances by the end of 2027.

## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptors 8 and 9: Concentration of contaminants

### Calculation of the BOPA Index used under the WFD

all sites as a result of TBT levels being found to be 'less than good'. Sediment and water samples have subsequently been collected in the four regular sites and three additional sites (two within the harbour, and one at Europa Point). Continuation of the monitoring under the WFD will provide information appropriate for **Indicator 8.1.1**.

### Review of results from H.M.GoG's biota monitoring programme

### Analysis of dredged material

Under the Bathing Water Directive, sampling is undertaken on a weekly basis from the 15<sup>th</sup> April to the 30<sup>th</sup> October each year, at six designated bathing waters around Gibraltar's coast: Camp Bay, Catalan Bay, Eastern Beach, Little Bay, Sandy Bay and Western Beach. The results of the samples are analysed against requirements under the Directive and classification based on a three-year trend to avoid one-off incidents or bad weather conditions affecting overall results for an area. Continuation of the Bathing Water Directive monitoring will provide information appropriate for **Indicator 8.1.1**.

It is also proposed that the BOPA Index (amended, in Dauvin and Ruellet, 2007) be continue to be used for analysing sediment samples collected under the WFD, to establish the health status of the benthic community.. The BOPA Index assesses the number of opportunistic polychaete species against the number of amphipod species, providing a ratio which can be compared against that expected of a healthy benthic community. Monitoring the BOPA value over time will highlight any shifts in population structure towards or away from a population associated with contaminated sediments. The BOPA value has previously been calculated for benthic samples within BGTW including work undertaken by Fa and Finlayson (2011), giving a history of values against which ongoing monitoring work can be compared to highlight potential trends. Ongoing monitoring of the BOPA value will provide information appropriate for **Indicator 8.2.1**.

For significant and acute pollution events, such as hydrocarbon or chemical spills, targets and approaches will need to be incident-specific and 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 the appropriate response. Throughout general operations, strict adherence to protocols and guidance will continue to be taken to minimise the potential for any spills. For oil spills in particular, H.M. Government of Gibraltar has recently (January 2015) revised its Oil Spill Contingency Plan<sup>15</sup>, following detailed review of the previous plan and extensive stakeholder consultation. Generation of incident-specific clean-up and monitoring approaches will satisfy the requirements of **Indicator 8.2.2**.

The Department of the Environment is undertaking a biota monitoring programme, looking into the levels of contaminants in both fish and shellfish. This will provide information relevant to **Indicators 9.1.1 and 9.1.2**.

Regular sampling is also undertaken by the Environmental Agency under the Drinking Water Directive, to monitor levels of radio-nucleotides within desalinated drinking water. These results should be monitored to ensure that concentrations remain within established safe values under the Directive. This will provide information appropriate for **Indicator 8.1.1**.

Any application for disposal of dredged material at sea must be made to H.M. Government of Gibraltar, and adhere to the appropriate guidance<sup>16</sup>; such applications must include characterisation of the material to be deposited, including physical, chemical and biological parameters. Where applicable, the Government may request cleaning of material, or propose alternative solutions. Adherence to the guidelines will assist in compliance with **Indicator 8.1.1**.

<sup>15</sup> Government of Gibraltar press release:

<https://www.gibraltar.gov.gi/new/sites/default/files/press/2015/Press%20Releases/19-2015.pdf>. Accessed March 2015.

<sup>16</sup> Guidelines for the assessment of dredged material.

[https://www.gibraltar.gov.gi/new/sites/default/files/HMGoG\\_Documents/guidelines\\_dredging\\_2nd\\_edition.pdf](https://www.gibraltar.gov.gi/new/sites/default/files/HMGoG_Documents/guidelines_dredging_2nd_edition.pdf). Accessed March 2015.



## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

**(i) How does the Monitoring Programme evaluate whether targets have been achieved?**

The review of long-term datasets in the context of newly-collected data will enable the identification of trends in the data and should there be an increase in contaminants above target levels, this will show whether such an increase is an anomaly or a greater cause for concern which may require measures to be put in place.

Direct monitoring of contaminant levels will show clearly whether targets for levels of priority substances are being achieved.

**(ii) How does the Monitoring Programme meet the requirements of the Directive?**

The requirements of the MSFD are met through the sampling regime which will monitor the levels of contaminants within BGTW. Furthermore, where levels exceed the recommended concentrations, this will be immediately highlighted, enabling H.M. Government of Gibraltar to put in place a programme of measures to bring levels back to required levels in order to reach GES.

**(iii) How will the Monitoring Programme assess the effectiveness of measures?**

The aim of the Monitoring Programmes and the existing regimes on which they are based is to maintain or restore good water quality based on each set of appropriate parameters. Any measures put in place as a result of these regimes will therefore rely on the aforementioned programmes to assess their effectiveness.

## Part 3: Gaps and Issues

### Gaps and Issues

- No gaps or issues have been identified.

## Part 4: International Considerations

### International Considerations

**Regional Coordination**

- As well as the results of their own Monitoring Programme, Gibraltar will undertake regular review of the results of adjacent countries, in particular Spain, to identify any adverse trends which may affect BGTW.

**Other international considerations**

- No other international considerations have been identified.

## 9. Descriptor 10: Litter

Litter in the marine environment can range from large-scale items such as tyres, to particulate matter suspended within the water column. All of these have the potential to cause significant harm. Such harm may include ingestion of material, entanglement and in extreme cases may result in death. A large amount of material which enters the marine environment is non-biodegradable such as plastics. If the introduction of litter is constant over a long period of time, there will be a subsequent build-up of material. There is currently a limited understanding of the level, properties and impacts of marine litter within BGTW and therefore, trend-based, rather than quantitative targets, have been proposed for this Descriptor.

### 9.1 Current Status

Due to the relatively small size of Gibraltar and its dense population, waste management does pose its challenges with limited space being available for processing or end-disposal of waste materials. Many of the solutions found in other countries, such as large-scale landfill sites, are simply not possible in Gibraltar and therefore Gibraltar currently exports all of its waste streams to dedicated recycling, re-use or end-disposal facilities in Spain. An advanced energy from waste plant is nevertheless seen as the best practicable solution for Gibraltar. The population increase as a result of tourist visits exacerbates the problem particularly during the summer months.

Litter enters the environment via a number of channels with transboundary litter, shipping and litter left behind on Gibraltar's coastline being the most likely sources within BGTW.

Areas known to have issues with litter include the Europa foreshore due to its popularity with anglers along with Europa Advance Road. The Straits of Gibraltar also have strong incoming and outgoing currents bringing with it transboundary marine litter, particularly from within the Mediterranean Sea. Gibraltar does have a comprehensive waste management plan (Government of Gibraltar, 2011, revised 2013), although this does not currently provide for the scientific analysis of marine or coastal litter. In addition to the regular cleaning of coastal areas carried out by Government appointed contractors, there are also annual clean-ups organised by the Environmental Safety Group who participate in the global '*Clean up the World Campaign*'<sup>17</sup>. The Gibraltar Government's Litter Committee ensures that all reports of both marine and coastal litter are highlighted and the necessary remedial actions taken.

As well as being unsightly and causing disturbance to marine users, litter in the marine environment has the potential to be ingested by marine species. Galgani *et al* (2014) carried out research into the effects of litter on large vertebrate species in the Mediterranean in the context of the MSFD. The report notes the generally high density of litter within the Mediterranean environment and the increasing harm this is causing to marine populations. It is noted that although larger species tend to be affected more, there is the capacity for micro-particles of litter to affect smaller organisms. Post-mortem examination of sea turtles as part of a Mediterranean-wide project found litter in 30-80% of loggerhead turtles which washed up along the shorelines.

### 9.2 Key Pressures

The main sources of marine litter within the Mediterranean and therefore key pressures with regards to this Descriptor include:

- ▶ Illegal waste disposal;

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<sup>17</sup> Examples of past campaigns can be found on <http://www.esg-gib.net/clean-up-the-world/>

- ▶ Tourist facilities and associated increase in visitor numbers;
- ▶ Run-off from waste installations/facilities;
- ▶ Pleasure crafts;
- ▶ Direct disposal from urban areas;
- ▶ Shipping;
- ▶ River run-off.

## 9.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 10: Litter

<b>Overall summary</b>	This Monitoring Programme draws partly on existing waste collection strategies and incorporates new measures as necessary to meet the requirements of the MSFD. These new measures are based in part on the Department of the Environment's plans to commence a marine litter monitoring programme in 2016.
<b>MSFD Criterion 10.1: Characteristics of litter in the marine and coastal environment</b>	<p>Target: The amount of litter and its degradation products 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, e.g. through entanglement or indirectly, e.g. reduced fecundity or bioaccumulation of contaminants within the food web.</p> <p>Indicator: 10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and source where possible.</p> <p>Indicator: 10.1.2 Trends in the amount of litter in the water column (including floating at the surface) and deposited on the seafloor, including analysis of its composition, spatial distribution and source where possible.</p> <p>Indicator: 10.1.3 Trends in the amount, distribution and, where possible, composition of micro-particles.</p>
<b>MSFD Criterion 10.2: Impacts of litter on marine life</b>	<p>Target: No specific targets have been set for this criterion.</p> <p>Indicator: 10.2.1 Trends in the amount and composition of litter ingested by marine animals.</p>
<b>Monitoring Programme name:</b>	Description of Monitoring Programme: The European Commission has produced guidelines on monitoring marine litter, with specific reference to the MSFD (EC/Joint Research Centre, 2013). This proposed Monitoring Programme has drawn on this guidance, adapted to suit Gibraltar's particular needs, and the proposed marine litter monitoring programme, due to commence in 2016.
<b>NEW – MSFD Litter Monitoring Programme, based on existing waste management strategies</b>	<p>It is proposed that analysis of material collected during the weekly or daily beach-cleans be undertaken, to determine trends in the volume of waste material present in the environment and supply detailed information on the composition and amount of litter as well as giving an indication of the potential sources. Material should be collected and the total weight of litter recorded, along with notes on composition (including percentages where possible) and information regarding potential sources of litter. This information should be mapped, allowing regular review of this information throughout the monitoring period.</p> <p>This will provide information relevant to <b>Indicator 10.1.1</b>.</p> <p>A floating-visual litter survey will give an indication of the volume of litter in the water column although a more accurate picture will require targeted surveys. It is proposed that underwater surveys are completed of those areas deemed most likely to suffer from accumulations of litter, for example the harbour area. This work should be completed via diving or underwater video surveys and an estimate of weight and volume of litter, as well as potential origins should be made. Where possible, litter</p>

## Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 10: Litter

will be removed from the area to prevent any possible damage to habitats and species.

Water sampling will also provide an assessment of the level of litter in the water column by analysing both macro- and micro-particles. Micro-particles of litter may result from direct release of such particles or from the breakdown and fragmentation of larger litter items. The variety of litter sources makes identifying trends in micro-particles in the marine environment particularly difficult. Analysis of regular samples will identify levels of litter in the water column, including particulate matter.

Such sampling will provide information relevant to **Indicators 10.1.2 and 10.1.3**.

It is noted that unavoidably, the review of litter ingested by marine animals must be on an opportunistic basis, when carcasses are located. Should any carcasses be found during the regular review of shoreline litter this will be retained for further analysis of stomach contents to establish the level of marine litter within. This method is not without error given that animals washed up on Gibraltar's coasts may have travelled hundreds of miles, with none of the ingested litter originating in BGTW. As with the shoreline litter, the total weight and composition of ingested material should be recorded. As well as those animals washed up on the shore, wherever possible stomach analysis should be undertaken on any captured bycatch resulting from fishing activities within BGTW. Although Gibraltar does not have a commercial fishing fleet, several fishing activities are licenced under the Tuna Preservation and Marine Protection Regulations (2014) through which the Government of Gibraltar obtains catch information.

As well as the general approach described above, it is proposed that Gibraltar contributes to any proposed Mediterranean-wide schemes, as proposed in Galgani *et al.* (2014), including coordinated monitoring at a regional level, identification of at-risk species and establishment of research protocols as appropriate, further research into the effects of marine litter and evaluation of other monitoring methods, e.g. use of commercial fisheries stomach analysis data.

Ongoing stomach analysis will provide information relevant to **Indicator 10.2.1**.

In addition to those measures described above, H.M. Government of Gibraltar will monitor ongoing work by the MSFD Technical Sub-group on Marine Litter and seek to implement further guidance introduced, where appropriate. Voluntary cleaning campaigns such as Clean up the World and World Ocean Days will continue to be supported by the Department of the Environment in conjunction with the official programme.

## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

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| <p><b>(i) How does the Monitoring Programme evaluate whether targets have been achieved?</b></p> | <p>The MSFD requires that the level of litter in the coastal and marine environment shows a downward trend with no previous data available on the volume, composition and source of litter. The first year of data collection will establish an appropriate baseline, against which future years can be compared, showing whether such trends exist, thereby showing whether the MSFD targets are being achieved.</p>  |
| <p><b>(ii) How does the Monitoring Programme meet the requirements of the Directive?</b></p>     | <p>Following completion of the first year of data collection and analysis, ongoing work will enable trends in the volume of litter present to be identified, in terms of both volume and potential impact. A downward trend in the average volume of litter ingested by stranded marine mammal carcasses, for example, can be taken as a reflective indicator of a downward trend of litter in the marine environment. The requirements of the Directive will therefore be met via ongoing review of monitoring results.</p> |
| <p><b>(iii) How will the Monitoring Programme assess the effectiveness of measures?</b></p>      | <p>Any additional measures put in place with regards to Descriptor 10 will seek to reduce the volume of waste being released into the marine environment and potentially seek to reduce the volume of waste being generated in total. The outcome of these measures should therefore result in a reduction of material being recorded along beaches, in the water column and in the stomach contents of any stranded animals.</p>  |

## Part 3: Gaps and Issues

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### Gaps and Issues

- A marine monitoring programme comprising beach litter, benthic litter and floating litter surveys is currently being undertaken by the Department of the Environment and Climate Change. Such a review of the waste material found along Gibraltar's coastline will give a good indication of the sources of such materials, and should be able to provide information in relation to this aspect ahead on the next reporting cycle.

## Part 4: International Considerations

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### International Considerations

#### Regional Coordination

- Waste found in BGTW may not have originated from BGTW; this is a challenge for analysing the effects of litter on the environmental status of Gibraltar's waters.
- Gibraltar should monitor waste material closely, and if a single external source be identified as a significant contributor of litter, liaise with the appropriate country to establish whether mitigation steps can be taken.

#### Other international considerations

- It is assumed that any significant external sources of litter will be regional, however, should sources be identified which are beyond the immediate vicinity, Gibraltar should again liaise with the appropriate country to establish whether mitigation steps can be taken.
- Gibraltar should also ensure that any ships using its waters adhere to appropriate maritime legislation regarding waste, e.g. the International Convention for the Prevention of Pollution from Ships<sup>18</sup> (MARPOL), which seeks to reduce the release of pollution from ships whether by accidental or intentional means.

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<sup>18</sup> [http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-\(MARPOL\).aspx](http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx). Accessed February 2015.

## 10. Descriptor 11: Underwater noise

Underwater noise in the marine environment has the potential to affect marine fauna in a number of ways from disruption of communication to physical injury and mortality. Globally, it is thought that ambient underwater noise levels are increasing. There is currently limited understanding of the ultimate impacts this may cause to marine animals, in particular marine mammals, which use noise in a number of ways.

### 10.1 Current Status

There is currently insufficient evidence available to provide a comprehensive assessment of trends in underwater noise within BGTW. The Bay of Gibraltar and adjacent waters are one of the world's most active shipping lanes so the ambient noise levels are likely to be elevated. BGTW are used by various types of vessels but large vessels particularly cruise liners, cargo ships and tankers. 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 1 $\mu$ Pa. 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 1 $\mu$ Pa, however, cavitation noise from these smaller vessels can be as high as 10 kHz. These frequencies and amplitudes have the potential to interfere with biological signals used cetaceans (OSPAR, 2009). In addition to shipping noise, seismic surveys are not uncommon around the Strait of Gibraltar.

Globally, it is acknowledged that ambient underwater noise levels are increasing. The IMO Marine Environment Protection Committee has recently (April 2014) approved guidelines for the reduction of underwater noise from commercial shipping in an attempt to reduce impacts on marine life. During the discussions, it was recognised that such noise can have both short- and long-term impacts on marine life. This work is ongoing.

Due to the relatively limited level of information available for BGTW and the general lack of existing monitoring strategies adopted for underwater noise, guidelines for the implementation of MSFD monitoring have been produced and drawn on within this Monitoring Programme (Dekeling *et al.*, 2014).

### 10.2 Key Pressures

From a biological perspective, the cumulative increase in underwater noise is of key concern. This may result in animals which rely on underwater noise, e.g. whales and dolphins, finding it difficult to hunt prey, locate a mate or other individuals of their species. There are also concerns over disruptive effects of sound on smaller fish. If sound causes fish to avoid specific areas, this can have negative implications on spawning and feeding behaviours as well as impact 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 (OSPAR, 2009).



## 10.3 Monitoring Programme

### Part 1: Targets, Indicators and Monitoring Programme

#### Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 11: Underwater noise

##### Overall summary

The proposed approach to MSFD Descriptor 11, Underwater Noise, is through a combination of the existing licencing and planning regimes within Gibraltar, and a newly-designed approach, targeting specific causes and effects of underwater noise.

Gibraltar will monitor the licence applications of any proposed developments around Gibraltar's coastline which have the potential to increase the ambient underwater noise levels, for example large-scale marina or harbour developments, or construction works. Any such developments will be monitored and assessed to confirm whether there is a requirement for additional licencing, monitoring or assessment beyond that necessary as part of the EIA and AA processes.

Additional monitoring draws on the advice of Dekeling *et al.* (2014), including establishing a register of noise generated within BGTW and ongoing review of the development of appropriate international standards.

##### MSFD Criterion 11.1: Distribution in time and place of loud, low and mid frequency impulsive sounds

Target: 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.

Indicator: 11.1.1 Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level or as peak sound pressure level at one metre, measured over the frequency band 10 Hz to 10 kHz.

##### MSFD Criterion 11.2: Continuous low sound

Target: Continuous low-frequency sound inputs do not pose a significant risk to marine life at the population level.

Indicator: 11.2.1 Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz measured by observation stations and/or with the use of models if appropriate.

##### Monitoring Programme name:

##### Monitoring of underwater noise through existing regulatory assessment process

##### Establishment of a noise register for events within BGTW

Description of Monitoring Programme: As there is currently no noise monitoring programme within BGTW, it is proposed that the existing planning and licence regime will be used to identify projects with the capacity to increase ambient underwater noise levels, and appropriate levels of assessment will be undertaken as part of the EIA process. Where applicable, mitigation measures will be identified, and enforced through the application of consent conditions.

Use of the appropriate EIA, AA and licencing legislation will provide information appropriate for **Indicators 11.1.1 and 11.2.1**.

In addition, Gibraltar will establish a register of impulsive noise events, as well as those likely to significantly increase ambient noise levels within BGTW. This will provide information appropriate for **Indicators 11.1.1 and 11.2.1**.

The Department of the Environment is in the process of developing an underwater noise monitoring network, using passive acoustic equipment. This will be developed in such a manner that the data collected will satisfy the requirements of Descriptor 11. Furthermore, Gibraltar will monitor ongoing international discussions regarding the development of standards for ambient underwater noise levels, and apply these to BGTW as appropriate.

## Part 2: Meeting Requirements

### How does the Monitoring Programme meet requirements?

<b>(i) How does the Monitoring Programme evaluate whether targets have been achieved?</b>	The noise monitoring programme will establish an appropriate baseline against which noise data can be compared, showing whether any trends exist and whether the MSFD targets are being achieved. In addition, the existing planning and licence regime in Gibraltar requires appropriate application of the EIA and AA legislation. As a result, any potential large-scale developments within Gibraltar's waters will be identified and assessed in relation to the targets established under the MSFD.
<b>(ii) How does the Monitoring Programme meet the requirements of the Directive?</b>	The requirements of the Directive will be met via the ongoing analysis and reporting of monitoring results.
<b>(iii) How will the Monitoring Programme assess the effectiveness of measures?</b>	The aim of the underwater noise monitoring programme is to reduce and prevent underwater noise along with any potential impacts on marine species. Any measures put in place will, therefore, rely on the wider monitoring programme (e.g. cetacean monitoring) to assess its effectiveness.

## Part 3: Gaps and Issues

### Gaps and Issues

- It is acknowledged that the Monitoring Programme is being established to review an aspect of the marine environment which is not at the current time fully understood. It is anticipated then that this element in particular will need further review in the future as additional information and understanding is gathered.

## Part 4: International Considerations

### International Considerations

<b>Regional Coordination</b>	<ul style="list-style-type: none"> <li>Gibraltar will monitor proposals in adjacent waters for developments with the potential to alter existing underwater noise levels in BGTW. Although it may not be possible to enforce mitigation measures on such projects, regular review of the situation will identify any major or long-term issues which may arise.</li> <li>It is proposed that Gibraltar follow the proposals outlined in Dekeling <i>et al.</i> (2014) to liaise with neighbouring states to set up ambient noise monitoring systems, and to work together on noise reduction strategies where appropriate.</li> </ul>
<b>Other international considerations</b>	<ul style="list-style-type: none"> <li>Gibraltar will monitor the work of the IMO with regards to reducing underwater noise from commercial shipping, as this is a key source of noise generated within BGTW. Should guidelines and legislation be introduced, this should be reviewed and adhered to as appropriate.</li> <li>Gibraltar will also monitor any other developments in international legislation and any associated guidance with the intention of reducing both impulsive and ambient underwater noise.</li> </ul>

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