INDICATORS FOR THE HEALTH OF THE SOLENT

Prepared by the Solent Forum

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SOLENT FORUM

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1. INDICATORS FOR THE SOLENT: AN INTRODUCTION

The Solent area can be described as 'a sheltered body of water on the central south coast of England, between the mainland and the Isle of Wight. It has a unique combination of open water, harbours and estuaries which form a complex biological system which is internationally important for wildlife.' (Towards Strategic Guidance 1996). It is an internationally recognised economic, recreational and environmental asset. The Solent therefore needs to be managed so that these assets are maintained in a sustainable way.

The aim of this project is to establish a robust set of environmental, social and economic indicators, which can be widely understood by the public, as a basis for future monitoring of the health of the Solent. The project arises from the opportunities for action identified in the Strategic Guidance for the Solent. In particular it takes the State of the Solent, Flagship Project 3, to fruition.

We can only be confident that the policies for the Solent are being achieved if we understand the past and future changes to the system. In order to achieve this, the project devises a series of key indicators for the social, economic and environmental health of the Solent. These will be monitored and reported on through the regular publication of the State of the Solent report. The priority audience for the indicators is the Solent Forum membership, comprising primarily of planning and regulatory bodies and user groups. However, they should also be meaningful to a wider audience.

This report gives an overview of past work which has been carried out on the development of sustainability indicators, looking at the theoretical frameworks and criteria which have been developed to select suitable indicators for the different projects. It then details the methodology which was used as a basis for selecting the most suitable indicators for the Solent. A brief overview and evaluation of possible indicators for each of the topics is then given.

The possible indicators were reviewed by a series of virtual groups using the developed methodology as a starting point. The agreed indicators for each of the topics will be published in the 2nd edition of the State of the Solent report. They will also be added to the Solent Forum website, www.solentforum.hants.org.uk, to ensure that the information is as widely accessible as possible. The indicators will be updated on an annual basis for the website and evaluated 5 yearly, linked to the publication of subsequent editions of the State of the Solent report.

2. INDICATORS

2.1 WHAT IS AN INDICATOR

Integrated Coastal Zone Management (ICZM) requires robust indicators of sustainability that gauge the 'health' of the coast in relation to both the environmental, economic and social activity. Such indicators are essential tools for monitoring the state of the coastal environment, to inform mangers and policy makers of the effectiveness of strategies in achieving sustainability. These indicators need to be based on rigorous scientific, social and economic research.

Indicators are defined by the Organisation for Economic Cooperation and Development (OECD) as 'a parameter, or a value derived from parameters which points to, provides information about, describes the state of a phenomenon/ environment / area, with a significance extending beyond that directly associated with a parameter value'. Defra describe indicators as 'quantified information which help to explain how things are changing over time. They have three basic functions: simplification, quantification and communication. Indicators generally simplify in order to make complex phenomena quantifiable so that information can be communicated'.

During the last decade environmental indicators have been recognised as a valuable tool for providing a means of measuring change in the environment as a result of human activities. They are able to illustrate change and can highlight the increasing pressures on the environment. They also show progress against the objective of sustainable development of which the environment is a key aspect. Sustainable development is generally defined as being development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs. The UK government meets the aim of sustainable development by achieving four objectives: social progress which recognises the needs of everyone; effective protection of the environment; prudent use of natural resources; and maintenance of high and stable levels of economic growth and employment.

2.2 DEVELOPMENT TO DATE

There have been a number of international, national and regional projects which have looked at developing environmental and sustainability indicators including specific indicators for the coastal zone.

Internationally, work has been carried out by a number of organisations and partnerships. The Organisation for Economic Cooperation and Development (OECD) pioneered the pressure/state/response (PSR) model[1] in 1994 and this has since been used as the basis for selecting environmental indicators for most projects. Since then the OECD has carried out a number of projects looking at the selection of environmental and sustainable development indicators. The OECD work on indicators includes several categories of indicators, each corresponding to a specific purpose and framework. The core set of environmental indicators is a commonly agreed upon minimum set of indicators for OECD countries which cover a wide range of environmental issues (OECD 2003).

The European Environment Agency (EEA) have recently produced 'Europe's Environment, the third assessment' (2003). It is the third report in a series, the first two of which were published in 1995 and 1998. The indicators used in these reports are based on the revised OECD Pressure State Response model, the DPSIR model (See section 2.2).
There has also been some work carried out by the SAIL[2] partnership which covers the Southern North Sea Region. 25 coastal sustainability indicators were chosen to represent the economic, social and environmental aspects of the SAIL area. Information representing these indicators was collected from all of the regions within the project area. So far the project has been able to generate eight indicators which can be used to measure the sustainability of the coastal zone. Indicators used relate to landuse and development, economy, pollution, tourism, social and natural environment. Further work is under way at the present time.

More recently work has been done on developing a European-wide set of indicators measuring the sustainable development of the coastal zone. This is being carried out by a working group which is made up of Integrated Coastal Zone Management (ICZM) representatives from each of the Member States and newly acceding countries. This set of indicators is itself based on the 8 SAIL indicators plus a further 18 which were under development by the SAIL partnership. These were accepted by the expert group in April 2004 and it is thought that they will then become the 'industry standard' for measuring coastal sustainability at European, national, regional and local levels. The UK will adopt the European set along with the other Member States but how they will be compiled is not certain at the moment. The EU working group on Indicators and Data will help coordinate

[1] The PSR Model is a framework developed by the OECD based on human activities exerting pressures on the environment which lead to a change in the state of the environment. Society then responds to these changes through the development of policies.
[2] The SAIL partnership was formed to help manage the issues affecting the coastlines and communities bordering the Southern North Sea Area (SNSA). The partnership has representatives from the four member states which have coast in this area of the North Sea: Essex; Kent; Nord-Pas de Calais; West Flanders and Zeeland.

the calculation of the indicators and their dissemination to Member States, regional authorities, coastal and marine agencies, and local communities, in a series of 'indicator fact sheets'.

Nationally, there have been a number of projects undertaken by the UK government and others. In May 1999 the government published 'A Better Quality of Life: a strategy for sustainable development in the UK'. This report brought the environment, social progress and the economy alongside each other. There are 15 headline indicators which cover the three pillars of sustainable development: economic growth; social progress; and environmental protection. As well as these headline indicators there is a core set of about 150 indicators which are used in the Quality of Life reports.

As well as sustainable development indicators, biodiversity indicators and climate change indicators have been collected at a national level by DEFRA and DETR respectively. Where possible, these indicators were adapted from other national biodiversity and sustainability indicators such as the 'Quality of Life Counts' (DETR, 1999). The indicators have also been selected with reference to international work including the frameworks developed by the Convention on Biological Diversity (CBD), the OECD, the Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR) and various European Union initiatives. The biodiversity indicators follow the pressure/state/response model with the indicators being largely selected to illustrate changes in the **state** of biodiversity in England (i.e. changes in species populations and habitat condition) and changes in societal **response** to these trends (i.e. implementation of policies and action plans). In the interests of keeping to a manageable list of around 50 indicators in total, only a few indicators of **pressure** affecting biodiversity are included. Other national indicator sets such as 'Quality of Life Counts' were thought to provide a comprehensive range of indicators of general pressures on biodiversity. The climate change indicators also cover mainly state and response variables as the study assumed that indicators representing pressures leading to climate change were already documented in other UK reports.

There are no specific sets of indicators for measuring sustainable development in the coastal zone at the national level.

Regionally, indicators are being collected for the 'Regional Sustainable Development Framework: A Better Quality of Life in the South East'. This is linked to the national sustainable development policy. These reports are produced by the South East England Regional Assembly (SEERA), Government Office for the South East (GOSE), South East England Development Agency (SEEDA), Environment Agency (EA) and the National Health Service.

The Environment Agency produce annual 'State of the Environment' reports for the South East of England and other regions. These reports are part of an ongoing Environment Agency initiative to report on the state of the environment and identify key areas where further work is needed to deliver environmental improvements. The indicators in the report use the PSR model and link to indicators used in the Quality of Life Counts, Regional Sustainable Development Framework and the national set of indicators used by the Environment Agency.

The Atlantic Living Coastline project produced a report 'Indicators for Sustainable Development on the Coast and their Role in the Integrated Coastal Zone Management of Devon and Cornwall'. This report detailed possible indicators which could be used. Due to funding this project has not been followed up with a report on the state of the indicators selected but does provide valuable information on methods of indicator selection.

Kent County Council produced a sustainability plan in 2000 which used 65 indicators of sustainable development. A coastal zone indicators project stemmed from this and was the first local attempt to develop such a system in the UK. There were a total of 9 indicators which represented coastal issues. These indicators have now been incorporated into the SAIL project.

A number of other local authorities have started to develop sustainability indicators. Many of these projects are in their early stages but most have taken their initial framework from the international, national and regional projects detailed above.

2.2 FRAMEWORKS FOR INDICATORS

Conceptual frameworks have been adopted by the OECD, the European Environment Agency, Eurostat and the UK government for the derivation of indicators (Grieve et al, 2003). These frameworks are variations on the same theme and provide a way to organise indicators in relation to systems components and ensure they correspond to different purposes within the system. The Sustainable Development Reference System (SDRS) represents the different dimensions of sustainable development i.e. social, economic and environmental.

The PSR model was developed by the OECD to structure its work on environmental policies and reporting in 1994. Since then it has been used as the basis for most indicator projects. The framework considers that: human activities exert **pressures** on the environment and affect its quality and the quantity of natural resources (**state**); society responds to these changes through environmental, general economic and sectoral policies and through changes in awareness and behaviour (societal **response**).

Environmental pressures describe the pressures which are usually caused by human activities but may include measures of pressures caused by natural processes, exerted on the environment. It covers underlying or indirect pressures (i.e. human activities themselves and trends and patterns of environmental significance) as well as proximate or direct pressures (i.e. the use of resources and the discharge of pollutants and waste materials). Indicators of environmental pressures are often closely related to production and consumption patterns. They often reflect emission or resource use intensities, along with related trends and changes over a given period.

Environmental conditions relate to the quality of the environment and the quality and quantity of natural resources. As such they reflect the ultimate objective of environmental policies. Indicators of environmental conditions are designed to give an overview of the situation (the state) concerning the environment and its development over time. Examples of indicators of environmental conditions are: concentration of pollutants in environmental media; exceedance of critical loads; population exposure to certain levels of pollution or degraded environmental quality and related effects on health; and the status of wildlife and ecosystems and of natural resource stocks. In practice, measuring environmental conditions can be difficult or very costly. Therefore, environmental pressures are often measured as a substitute.

Societal responses show the extent to which society responds to environmental concerns. They refer to individual and collective actions and reactions, intended to:

- mitigate, adapt to or prevent human-induced negative effects on the environment;
- halt or reverse environmental damage already inflicted;
- preserve and conserve environmental resources.

Examples of indicators of responses are environmental expenditure, environment-related taxes and subsidies, price structures, market shares of environmentally friendly goods and services, pollution abatement rates, waste recycling rates, enforcement and compliance activities and changes in policies. In practice, indicators mostly relate to abatement and control measures because those showing preventive and integrative measures and actions are more difficult to obtain.

Depending on the purpose for which the PSR model is to be used, it can easily be adjusted to account for greater details or for specific features. Examples of adjusted versions are: The Driving force - State - Response (DSR) model formerly used by the UNCSD in its work on sustainable development indicators; and the Driving force-Pressure-State-Impact-Response (DPSIR) model used by the EEA. These modified versions of the PSR model are better adapted to choosing indicators to measure sustainable development. In the DSR framework

the term ‘pressure’ is replaced by ‘driving force’. Driving force indicators include human activities, processes and patterns that impact on sustainable development. Using the term ‘driving force’ allows the impact on sustainable development to be both positive and negative, as is often the case for social, economic and institutional indicators (Grieve et al, 2003). The DPSIR framework is where social and economic development or driving forces (D) exert pressures (P) resulting in changes to its state (S). This leads to impacts (I) on environmental quality which may elicit a societal or policy response (R).

The PSR model, and its variations, highlight cause-effect relationships, and help decision makers and the public see environmental, economic, and other issues as interconnected. It therefore provides a means of selecting and organising indicators. However, these models were developed primarily to help in understanding the interactions between the economy and the environment so they are not entirely appropriate for dealing with sustainable development. For example, in both PSR and DPSIR models growth in traffic is seen only as a driver of pressures on the environment, but it is people’s desire for access – to goods and services, to work, to social and leisure opportunities – which is the underlying driver, not (in most cases, anyway) the desire to travel in itself. A sustainable development model also needs to capture the increased welfare (or increased human capital) from improved access.

Past work on indicators has concluded that the DPSIR model is a useful analytical tool, particularly in developing indicators to reflect the environmental impacts of a particular sector, but that most nontechnical users would find it confusing for the model to be used explicitly in presenting the indicators. Therefore, in this report where appropriate indicators are classified according to the DPSIR model but the choice of indicator was not constrained by these frameworks.

2.3 CRITERIA

Numerous criteria have been developed for different projects and studies at local, regional, national and international levels. These criteria can, in the majority of cases, be related to the three principal criteria of simplification, quantification and communication as defined by Adriaanse (1993).

The United Nations Food and Agricultural Organisation (FAO), base their choice of indicators on the following criteria:

- policy priorities and objectives;
- practicality/feasibility;
- data availability;
- cost-effectiveness;
- understandability;
- accuracy and precision;
- robustness to uncertainty;
- scientific validity;
- acceptability to users/stakeholders (consensus among parties);
- ability to communicate information;
- timeliness;
- formal (legal) foundation;
- adequate documentation.

The OECD has also developed a set of criteria for selecting environmental indicators based upon three simple ideas.

(i) Policy relevance and utility for users:
Provide a representative picture of environmental conditions, pressures on the environment or society’s responses;
be simple, easy to interpret and able to show trends over time;
be responsive to changes in the environment and related human activities;
provide a basis for international comparisons;

be either national in scope or applicable to regional environmental issues of national significance;
have a threshold or reference value against which to compare it, so that users can assess the significance of the values associated with it.
(ii) Analytical soundness:
be theoretically well founded in technical and scientific terms;
be based on international standards and international consensus about its validity;
lend itself to being linked to economic models, forecasting and information systems.
(iii) Measurability
Readily available or made available at a reasonable cost/benefit ratio;
adequately documented and of known quality;
Updated at regular intervals in accordance with reliable procedures.
Extract from "Environmental indicators for environmental performance reviews", OECD, 1994.

At a national level the Environment Agency use the following criteria:

- The importance of the indicator to illustrate a key aspect of the region's environment;
- The availability of the indicator to record environmental change in a meaningful way;
- The availability of data for the indicator;
- The regularity with which data for the indicator is updated.

The Atlantic Living Coastline project selected criteria based on those which had been used in previous projects, in particular those proposed in the Kent County Council coastal indicators project. The criteria that they used were:

- Relevant to the coastal zone;
- Representative;
- Meaningful i.e. sensitive to changes in the area it is supposed to indicate;
- Measurable / Data available;
- Issue led not data led;
- Show trends;
- Objective;
- Be linked to sustainability;
- Simplicity (to be understandable to the general public);
- Agreed by those who will use them

Other projects for sustainability indicators have used similar criteria when selecting appropriate indicators for their topics.

3. INDICATORS FOR THE SOLENT

3.1 METHODOLOGY

To select the most appropriate indicators for the Solent the various international, national, regional and local projects which are detailed in section 2.2 were used as a starting point. Where possible indicators were adapted from these projects to ensure that the indicators chosen to measure the health of the Solent would be nested but at the same time specific to the coastal zone. The OECD'S DPSIR model and the SDRS model were used to ensure that the indicators selected formed a comprehensive set which covered all aspects of the Solent system and the 3 strands of sustainability. In some cases the indicator chosen did not fit neatly into the frameworks and depending on how they are measured or interpreted indicators may reflect several different aspects of the DPSIR model.

The possible indicators selected were assessed against various criteria, based on those in section 3.2. The possible indicators were then sent out to a number of virtual groups for comment. The virtual groups were made up of Solent stakeholders, with each of the groups focusing of a different topic relevant to the Solent, based on the topics in the Strategic Guidance. The groups assessed the potential indicators against the selected criteria and their own specialist knowledge.

Following this consultation a meeting of the Solent Forum Research group was held and those who commented were also invited. The group reviewed the potential indicators and comments which had been made and a refined list of indicators was suggested. A table of these indicators was sent out to all Forum members for information and comments as part of the papers for the Solent Forum meeting in June 2004. Following this the final selection was made and is found in this report.

3.2 THE CRITERIA

Relevant
The indicators selected should be relevant to the issues identified in the Strategic Guidance of the Solent and any other issues identified since. They should also be relevant to the coastal zone and linked to sustainability.

Linked to other regional, national and international indicators
There are many different projects which are using indicators to measure sustainability and it is important that the ones we use for the Solent are nested within these if possible. This will ensure that there is consensus about the validity of the indicator and will also allow comparison of trends between the Solent and regional, national and international levels.

Simple and Meaningful
The priority audience for the indicators is the Solent Forum membership but they also need to be understandable by a wider audience. The indicators selected, therefore, need to show trends over time, be easy to interpret and be sensitive to the changes in the area that they are supposed to indicate.

Measurable / data availability
It is important that the indicators selected are based around existing monitoring effort. The data to measure the indicator must be available, easy to obtain, updated regularly and accurate. The cost of collection of new data is very high and there would have to be strong justification for this to happen. The future availability of the data should also be considered as should the length and homogeneity of the data series.

Agreed
The selected key indicators should be agreed by members of the Forum so that there is ownership of them. It also ensures that the indicators selected are relevant to the issues in the Solent.

3.3 POSSIBLE INDICATORS TO MEASURE THE HEALTH OF THE SOLENT

There are hundreds of possible coastal and marine indicators which could be used to get a measure of the sustainable development of the coastal zone. In this report a set of indicators have been selected based on the work which has been done at the European, national and local levels, the criteria in section 3.2 and comments from the Solent Forum Research Group and the virtual groups set up to look at the indicators under the given topics. The topics selected were based on those in the Strategic Guidance for the Solent and the State of the Solent report.

Although, the indicators are suggested under different topic headings, for the ease of reporting, there are relationships and linkages between them and none of the indicators should be looked at in isolation but regarded as a suit of measures for indicating the 'health' of the Solent.

3.31 PHYSICAL ENVIRONMENT

The Solent is an estuarine complex lying on the South coast of the UK, comprising of 12 estuaries and harbours found along the southern Hampshire and Isle of Wight Coastlines. It was once a valley though which the Solent river flowed west to east and was progressively inundated by the sea between 15000 and 5000 years before present. Sea level continues to be a major factor in the evolution of the Solent and its continued rise will determine the future coastline.

Climate change may also impact the physical environment of the Solent. Climate change is typically characterised for the South east of England as trending towards hotter, drier summers and warmer, wetter, winters, with increased storminess. This will have an effect on the natural environment including increase in some plant or bird species and decline in others, leading in turn to adjustments in behaviour of fauna, including migrations. There may also be a significant effect on the coast due to storminess and associated wave and surge actions, with rivers also seeking to discharge higher flows into the sea. This may in turn, affect flooding on the low coast and in river estuaries, as well as erosion of coastal and inter-tidal features such as shingle banks and mudflats.

Possible Indicators

1. Mean Sea Surface Temperature (SST)

Relevance

The Solent is located at a transition between different biogeographic[3] realms, therefore, many species within the Solent are at the limits of their natural ranges. Water temperature directly affects the species of plants (such as algae, seagrasses and marsh plants,) and animals (microscopic animals, larger invertebrates, fish, and mammals) that live in a the region. In addition, increases may increase the frequency or extent of blooms of harmful algae. There is widespread concern that global climate change may lead to increases in SST. Such changes, on a global level could, lead to increases in the strength and frequency of storms and changes in ocean currents, such as the Gulf Stream, that would in turn lead to shifts in regional climate.

There is a need to have a long time series of data to get meaningful long term trends for the Solent.

Linkages

At an international level this indicator has been used by the US in their State of the Nations Ecosystems report. It is not currently collected at the national, regional or local level.

Data Availability / Measurement

The data is freely available on the internet from the Channel Coastal Observatory who maintain a number of Datawell Directional WaveRider Mk III buoys of the coast round South East England. The information for the Solent is taken from 2 buoys: 1 off the coast of Hayling Island; and 1 off the New Forest Coast at Lymington. The data is collected every half hour by the buoys.

There are also indicators included in other sections of the report which will indicate a change in the physical state environment of the Solent.

[3] Biogeographic realms contain distinctive assemblages of plants and animals. The Solent lies at the transition between the warm 'Lusitanian' waters of the western English Channel - linking to the Atlantic and the Gulf Stream, and the colder 'Boreal' waters in the east, linking to the North Sea

3.32 WILDLIFE AND HABITATS

The Solent is a unique sheltered body of water lying between the mainland and the Isle of Wight. It embraces a complex of estuaries, open inshore waters and coastal and marine habitats. It is also located at a transition between different biogeographic realms, therefore, many species within the Solent are at the limits of their natural ranges.

The long term aim for nature conservation in the Strategic Guidance for the Solent is 'to ensure that the existing nature conservation value of the Solent is understood, maintained and enhanced'. There are also a number of objectives and actions which are detailed in the Nature Conservation Chapter of the Strategic Guidance.

The Solent and its three eastern harbours, can be considered as a single, huge, estuarine system. It has coastal, intertidal and marine habitats, which include grazing marsh, vegetated shingle, sea cliffs, saltmarshes, mudflats, sand flats, rocky shores, lagoons and a variety of types of sea-bed. These habitats support a wide range of nationally important flora and fauna, including internationally important bird populations. This includes the presence of nesting colonies of terns, gulls and other shorebirds, and the provision of feeding and roosting sites for migrating and over-wintering wading birds and wildfowl, supporting a winter peak population of c.150,000 birds. The shoreline habitats support a wide range of nationally important flora and fauna.

A number of factors and activities (both natural and the result of human activity) may have significant impacts of the ecology of the Solent. Many of these can only be understood by taking a long term look at the whole of the Solent's ecoystem. They include:

- Predicted changes in the world's climate. The impacts of climate change are uncertain, but a sea level rise of 6mm a year is predicted. There may also be changes in weather patterns, including an increase in extreme storms and tides, and a gradual shift in the distribution of wildlife. Within the Solent, significant loss of intertidal habitats is to be expected as they are 'squeezed' between rising sea levels and fixed coastal defences unless action is taken. Conversely, a number of important habitats are protected by existing coastal defence and could be damaged or lost if defence structures are altered;
- Modified physical processes (such as sediment movement and coastal erosion) through measures to protect the coast from erosion and flooding, and through the dredging and maintenance of shipping channels and the disposal of materials at sea;
- Loss of coastal habitats through reclamation of intertidal land, development on the coastline, and an interruption of natural habitat transitions by sea defences;
- Discharges of waste and pollution into the system from urban populations, industry and through dispersed inputs such as agricultural runoff;
- The potential risk of a pollution incident from shipping or coastal industry;
- Disturbance of birds and other species by human, commercial and leisure activities, especially that which affects birds at their summer nesting sites, winter intertidal feeding areas and roosting sites;
- The potential risk of both small scale and catastrophic pollution through accidental release of oil or chemicals into the environment from shipping or industrial sites.

Possible Indicators:

1. Wildfowl and Wader Counts

Relevance

Wild bird populations are good indicators of the state of wildlife generally as they are relatively high up the food chain and so reflect changes which are occurring lower down. They also give a representation of the health of the wider coast outside specially protected sites.

The Solent is an important area for both breeding and over wintering birds and its habitats

support a large number of nationally and internationally important bird populations. The wildfowl and wader populations which use the Solent tend to use the whole area so this indicator would indicate the health of the whole Solent system. Birds have meaning, resonance and symbolic value with many audiences, and are extremely popular with the public so this helps make the indicator widely understood.

Linkages

Populations of wild birds have been used as an indicator at the European level, although it does not include wildfowl and wader species specifically. The indicator of breeding birds is one of the 15 headline indicators used by the UK Government to review progress towards sustainable development. In the four years since its first publication, this indicator has proved a valuable tool in communicating the state of UK bird populations to a wide audience, and as a measure of change in the wider environment (RSPB, Joint Nature Conservation Committee). The populations of coastal and sea birds in England is a provisional indicator to be used in the English Biodiversity Strategy: Vision for the Coasts and Seas. At the local level the Atlantic Living Coastline project selected the number of breeding birds as a possible indicator for biodiversity and it is also being used by Chichester Harbour as one of the indicators for the Area of Outstanding Natural Beauty (AONB) Management Plan.

Data Availability / Measurement

Generally excellent national and local current and historical data exist on bird numbers, and this data is realistic and relatively inexpensive to collect. In the Solent there is a large amount of information available on the numbers of shorebirds. Most of the information is collected by the Shorebirds Study Group and the Wetlands Birds Survey (WeBS) which includes high tide counts and more recently low tide counts. WeBS core counts are used to record the number of waders and wildfowl at approximately 2000 wetland sites in the UK each year. The information which is currently collected and is collated for the State of the Solent report includes:

- The total number of waterfowl at principal waterfowl sites in the Solent as monitored by the Wetland Birds Survey;
- Numbers of bird species of national and international Importance;
- Numbers of species of wintering birds in the Solent.

Another measurement which can be used to measure this indicator is the WeBS alert reports. The Alerts system was developed to monitor population change and highlight large changes in population. It provides a standardised technique with which to monitor changes in the population sizes of wintering waterbirds in the UK over a range of spatial scales and time periods using data collected as part of the Wetland Bird Survey (WeBS). The Alerts system uses the General Additive Models so that changes in population sizes are less likely to be due to the effects of short term fluctuations in population sizes or to errors when sampling. Proportional changes in the smoothed index value of a population over 5 year, 10 year and 25 year time periods are calculated. Population declines of between 25% and 50% are flagged as medium alerts and declines greater than 50% as high alerts. Alerts can be calculated for a range of spatial scales, national, regional and local e.g. individual site. This information is freely available via the British Trust for Ornithology's website.

2. Change in the extent of coastal habitats in the Solent

Relevance

This is potentially a very valuable indicator that is sensitive to change and encompasses many other possible indicators of biodiversity. Coastal habitat change is a key indicator due to the importance of the habitat types and the range of pressures and threats that affect these habitats e.g. development pressures, recreation, sea level rise, coastal squeeze, erosion, pollution, dredging and bait digging etc. The coastal habitats of the Solent include coastal grazing marsh, saltmarsh, mudflats and sea grass bed, maritime cliffs, shingle and

sand dunes and saline lagoons. All these are priority BAP habitats and most are also covered by international and national designations.

An important measure of success in conserving biodiversity is how key species and habitats are changing. This indicator will help assess the effectiveness of a range of initiatives including regional, national and local government policy, the value that is placed on wildlife in the Solent and the health of the Solent's biodiversity.

A constraint of this indicator is the lack of baseline data against which to measure any change in the extent and distribution of habitats.

Linkages

This indicator is used at both European and Worldwide levels (Scottish Exective Central Research Unit, 2001). It is one of the proposed European indicators for measuring the sustainability of the coastal zone. It is used at a national level in the English Biodiversity Strategy: Vision for the Coast and Seas. At the regional level it is used in both the State of the Environment report, the Environment Agency's assessment of the Environment in the South East, and by SEERA in its Regional Sustainable Development Framework *(A Better Quality of Life in the South East)*. Locally it has been suggested as a possible indicator for coastal sustainability by Kent County Council and the Atlantic Living Coastline project.

Data Availability/ Measurement

Currently some data is available on the area of coastal habitats in the Solent and is reported in the State of the Solent report. This data was collected from a number of sources but most is available from the local authority biodiversity record centres.

The best way to show change in different habitats over time would be by mapping. Work done by the Atlantic Living Coastlines project looked at two approaches to measuring the extent of intertidal change. The first approach looked at the change in intertidal habitats by comparing different sets of maps. The second approach considered the main elements of the legislative and administrative change by compiling datasets of: planning applications under the Town and Country planning system; the Coastal Defence and Flood Defence consents; and the Sea Bed Development Licences. These events were then categorized according to their purpose and mapped onto a computer mapping programme to show trends and habitat changes over time.

It is not possible, at this time, to use the second method as it would require extra work. The mapping option is, therefore, more likely to be used for the measurement of this indicator. The measurement could be simplified further by just monitoring the change in the areas of the different coastal habitats over time.

3. Condition of sites designated for nature conservation

Relevance

Sites designated for nature conservation represent the best sites for wildlife in the Solent. They support many characteristic, rare and endangered species, habitats and natural features. Protected areas have a high level of protection from development, damaging activities and neglect.

This indicator will reflect the effectiveness of the management of protected coastal sites and also the state of nationally and internationally important habitats and species. This indicator is especially relevant to Solent which has a large number of nationally and internationally important coastal sites which are designated.

Linkages

This indicator would link to one of the proposed European sustainability indicators for the coastal zone: 'the effective management of designated sites'. Condition of coastal Sites of Special Scientific Interest (SSSI) in England is one of DEFRA's indicators for the English Biodiversity Strategy: Vision for the Coasts and Seas. This indicator is also used in the quality of life counts at both the national and regional levels.

Data Availability / Measurement

English Nature currently report on the condition of SSSIs. They will also be responsible for reporting the condition of the Solent European Marine Site. This information is not currently included in the State of the Solent report.

3.33 TRANSPORT, PORTS, AND SHIPPING

The long term aim in the Strategic Guidance for ports and shipping is 'to support a viable and long term future for the ports industry in the Solent'. With regards to transport it is 'to seek an integrated approach to transportation activity which will support sustainable development within the Solent'.

The Solent is a focus for intensive transportation activity. There is a substantial and heavily trafficked road network serving the region, rail links between most urban areas and vital ferry links to the Isle of Wight. The Solent itself is a major transport corridor for bulk freight shipping, and for international ferry links to France and Spain. Finally there is a regional airport at Southampton.

The fundamental trend in transportation in the twentieth century has been a progressive growth in the volume of transport demand, which has taken place in parallel with urban growth on the coast, and the increased mobility of the population resulting from mass car ownership. On land, the road network has been progressively expanded and improved, although demand continues to outstrip supply. There has also been a progressive growth in the scale of port operations in both Portsmouth and Southampton, associated in many cases with reclamation of intertidal land.

The ports industry is of great commercial significance within the Solent and is a major contributor to the regional and national economy. Southampton is one of the largest and busiest commercial ports in the country. It is the UK's number 2 container port (2nd to Felixstowe), the number one cruise port and the number one car import/export port. Portsmouth is the UK's number two continental ferry port (Dover is number 1), and is also a major importer of fruit and vegetable. Portsmouth is also the main naval base in the UK, and therefore the main base port for the nation's fleet of warships. Marchwood is the country's sole army port and was heavily used by the army for the movement of troops and equipment in the Falklands, Gulf and Iraq wars. The port of Cowes is the major port for commercial shipping on the Isle of Wight. It handles approximately 400,000 tonnes of cargo annually, including fuel, stone, shingle aggregates, timber, grain and general cargo. The Red Funnel passenger/ vehicle ferries operate between East Cowes and Southampton and the fast services runs between West Cowes and Southampton.

The expansion of the ports industry is driven by trends in the world market for shipping, which are essentially governed by market forces, the demands of the ship operators, and the supply within the ports. Competition within the UK ports industry and with Northern European ports is intense. The main trend driving the development of the Port of Southampton is the buoyant market in containerised goods, particularly from the Far East, and the recent increase in the maximum size of the container ships. Other significant trends include:

- Growth in car imports and exports through Southampton, coupled with the demand from importers for dockside car parking, allowing distribution straight to retailers; stability in the volume of oil traffic;

- Changing patterns of ferry traffic to France and Spain, with a tendency to larger and more luxurious ferries and the possibility of faster craft;
- Consolidation of fruit and fresh produce imports at Portsmouth;
- a growth in the market for cruise shipping, and increased competition for this business within UK ports.

The expansions of the ports in the Solent has had a number of implications both for the environment and navigational safety. The main environmental concerns are the impacts on the nature conservation resource of intertidal areas, many of which are designated, and the impacts of capital and maintenance dredging in terms of its effects on the sea-bed, its potential to cause erosion of adjacent saltmarshes and its possible impact on fisheries. As well as the increase in port traffic there has also been an increase in recreational craft and this has lead to concerns about navigational safety. To reduce the risk of conflict byelaws and regulations have been created. Other transport issues include the coast's attraction to recreational visitors, this generates travel demand accordingly and can lead to congestion on some rural roads at 'honeypot sites', notably within the New Forest and on the Isle of Wight. There is interest in the promotion of alternatives to car transport for recreational trip-making.

Possible Indicators

1. Total volume of freight handled by Solent ports

Relevance

One of the actions in the ports and shipping section of the Strategic Guidance for the Solent is to address the need for port expansion and development. The contribution of the port's industry to the regional and national economy, and to the positive management of the Solent is very significant. It is desirable, in principle, to support port development provided it does not cause unacceptable or long-term damage to the environment, and is in balance with recreational and other uses. This indicator would give a measure of trends in the usage of the ports in the Solent for freight transportation and give an indication of the growth of this market.

Linkages

This indicator is one of the proposed European Indicators for sustainable development of the coastal zone. There are currently no national or regional sustainability indicators for port and shipping.

Data Availability / Measurement

This data is currently collated in the State of the Solent report, the data available is for the major ports in the Solent, namely Portsmouth and Southampton, from the Department of Transport.

2. Economic importance of the ports industry in the Solent

Relevance

Maintenance of high and stable levels of economic growth is one of the three pillars of sustainable development. The growth of the local ports can have negative impacts on the environment but this needs to be balanced with the economic importance of the industry to the Solent region as well as the national economy. In Portsmouth and Southampton the port industry, including the Naval Base, is one of the major employers. This indicator would give a measure of the importance of the industry to the region and any changes over time.

Linkages

At the European level this is one the SAIL partnership indicators for sustainable development of the coastal zone.

Data Availability / Measurement

This data is not currently included in the State of the Solent report and further information is needed on who could supply it and how it should be reported.

3. Employment reliant on the ports industry

Relevance

The ports industry, including Portsmouth Naval Base, is one of the major employers in the region. Levels of employment by the sector will give an indication of the economic growth and importance of this sector. However, there is a trend towards ports becoming more automated and consequently the number of staff needed may be reduced even if there is a growth in the industry itself. This indicator would also have to consider the indirect jobs employment which is reliant on this industry.

Linkages

N/A

Data Availability / Measurement

This information is not currently included in the State of the Solent report. The data may be available from the ports themselves.

4. Number of shipping movements through the Eastern and Western Solent

Relevance

This indicator would give a measurement of the pressure on the Solent from port activities. The greater the number of shipping movements in the Solent the greater the potential pressure on the environment and on other users of the area. This indicator would also show the number of movements of the different types of vessels in the Solent i.e. tankers, military, ferries etc. Therefore, it would also show the state of shipping movements over time. It is an indicator which would be easily understood and will show trends over time.

Linkages

This indicator links to the indicator of 'oil tanker traffic' one of the European Blue Pan indicators of sustainable development.

Data Availability / Measurement

This information is currently collated for the State of the Solent report for Southampton. Information on this indicator is available from all the Harbour Authorities in the Solent. The information currently collected includes the types of vessel as well as the number of movements.

5. Proportion of journeys taken by public transport

Relevance

The increase in the use of public transport to visit coastal sites reduces the environmental pressure on these areas. This indicator would give a measure of the trends towards sustainable transport in the region.

Linkages

This was one of the proposed indicators by the Atlantic Living Coastline project.

Data Availability / Measurement

This data is not currently included in the State of the Solent report. Further work is needed to determine if and where this information can be found.

6. Number of ferry passengers to the Isle of Wight

Relevance

There are three major vehicle crossings and three regular passenger crossings from the main land to the Isle of Wight. All of which are of vital strategic importance to the economy of the island. This indicator would give a measure of the importance and use of these services.

Linkages
N/A

Data Availability / Measurement

This information is currently collated from the ferry companies which go to the Isle of Wight for the State of the Solent report.

7. Volume of traffic on major coastal roads

Relevance

It is important to strike the right balance between transport's role in helping the economy progress and allowing people to travel wherever they need to go, while at the same time protecting the environment and improving quality of life. In the past traffic growth has been associated with economic growth, but the resulting volume of traffic leads to congestion, noise and air pollution and contributes to greenhouse gas emissions which cause climate change. This indicator will give an overall idea of the trends in traffic volumes in coastal areas.

Linkages

At the European level this is one of the OECD core environmental indicators. It is also one of the SAIL partnership indicators of sustainable development of the coastal zone. At the national and regional level It is one of the indicators which is used by the UK Government to measure sustainability. At the local level it was suggested by Kent County Council as one of their coastal sustainability indicators.

Data Availability / Measurement

Information on the traffic flow on the major coastal roads in Hampshire is collected and reported in the State of the Solent report. This information is available from the local authorities and is updated on an annual basis.

3.34 ENVIRONMENTAL QUALITY

The long term aim for Environmental Quality in the Strategic Guidance for the Solent is ‘to support the maintenance of high standards of water and environmental quality within the Solent and improvements where appropriate.’

Environmental quality is the term used to embrace the quality of air, water and land.

Within the Solent the prime issues are water quality within the inshore waters and estuaries. Investment in infrastructure to improve environmental quality lies principally in the hands of those whose activities could cause environmental damage. However all those who use the Solent have the potential to cause pollution, for example, through discarding litter or pouring oil down drains. Whilst it is unlikely that individuals cause significant impacts, cumulative impacts can be locally significant.

The trend in environmental quality over the last century has been a long term decline due to urbanisation and a lack of adequate investment in waste management. More recently there have been significant improvements in environmental quality due to the implementation of environmental legislation. The future trend will be for a continued decrease in the amount of pollution discharged to the marine environment, particularly through the implementation of the EC Urban Waste Water Directive (UWWD), which is driving the investment programme in sewage treatment and disposal. The Water Framework Directive (WFD) is another substantial piece of EC water legislation. It requires all inland and coastal waters to reach 'good ecological status' by 2015. It will do this by establishing a river basin district structure within which demanding environmental objectives will be set, including ecological targets for surface waters.

There is currently a wide range of datasets collected with regard to environmental quality and a range of possible indicators. Some of the environmental quality 'state' indicators may link to some of the proposed indicators under the other topics.

Possible Indicators for Environmental Quality

1. Compliance with the EC Shellfish Hygiene Directive

Relevance

Shellfishing is one of the main types of fishery in the Solent. The most significant shellfishery is for the native oyster which represents the largest self-sustaining stock in Europe and is of international conservation importance. Commercial Clam digging for the American hard shelled Clam also takes place throughout the year.

Shellfish harvesting areas are monitored for the suitability of the shellfish for human consumption under the European Community (EC) Shellfish Hygiene Directive (91/492/EEC). Bivalve production areas are classified according to the level of treatment they require prior to their sale. This information is collected by local authorities and compiled nationally by the Food Standards Agency. Standards are set in terms of concentrations of coliform bacteria and Salmonella. Harvesting sites are classified from A to C, where grade A sites require no pre-treatment and grade C sites require intensive purification.

Compliance with EC Shellfish Hygiene Directive is linked to compliance with the EC Bathing Waters Directive. Both these are dependant on the improvement in the treatment of discharges from the water companies through their Asset Management Plans (AMP) and the standards are measured using concentrations of coliform bacteria found in the water.

Linkages

N/A

Data Availability / Measurement

This information is currently reported in the State of the Solent report and is collected by local authorities and held by the Centre for Environment Fisheries and Aquaculture Science (CEFAS). It is updated on an annual basis.

2. Compliance with the EC Bathing Waters Directive

Relevance

A key issue for the coastal environment is to prevent contamination of coastal waters by pollution from human activities. Contamination of bathing waters can pose a risk both to human health and the environment. Bathing water quality may be affected by discharges from sewage treatment works and storm overflows, rivers, agriculture and other diffuse sources. Improving water quality will contribute to the overall quality of the environment in the Solent.

The EC Directive on Bathing Water (76/110EEC) sets water quality standards designed to protect the health of the bather and to maintain and improve overall water quality. Standards are set for bacteria which are typically indicators of sewage or farm waste. There are two types of standards: imperative standards that a bathing water must meet; and higher guideline standards which should be aimed for. In December 2000 the Commission published a Communication which set out their thinking on the broad principles of the revisions to the Bathing Water Directive. These have been widely endorsed and in October 2002 they produced a proposal for the revision of the Bathing Water Directive. The revision included a tighter bathing water quality standard that could result in a dramatic fall in compliance as well as provisions for recreational waters and some management measures for bathing waters. These include public warnings when run off from agricultural land or sewage discharges could reduce bathing water quality temporarily after rainfall, and proposals for improved public information at bathing water sites.

Water companies have carried out extensive improvements to their plants under the Asset Management Plan process to ensure that the discharges do not pollute coastal waters. As the levels of treatments of waste waters improves, diffuse sources of pollution become more relevant. It can be the case that water quality is worse over a wet summer than a dry one. Climate change in the South East is predicted to lead to the increase in occurrence of severe storms. This indicator will highlight the quality of bathing waters in the Solent and the compliance with the EU directive.

Linkages

The Indicator of Compliance with the Bathing Water Directive is used from the European level down to the local level. It is one of the proposed European indicators for the sustainable development of the coastal zone. It is used at a national level in the UK Government's sustainable development indicators and then feeds down to the regional level where it is used in the Better Quality of Life in the South East report and also in the Environment Agency's State of the Environment report. It has been suggested at the local levels by the Atlantic Living Coastline project and also in Kent County Council's sustainability indicators for the coastal zone.

Data Availability / Measurement

The Environment Agency (EA) are responsible for enforcing bathing water standards and water quality is currently sampled 20 times during the bathing season at EU designated bathing sites (May 15 – September 30). Samples are taken from representative sampling points. In order for a bathing water to comply with the Directive 95% of samples must meet with the imperative standard.

This information is currently collated for the State of the Solent report and is obtained from the Environment Agency.

3. Beach litter

Relevance

Marine and coastal litter includes all litter items that appear on beaches or at sea due to man's activity. It includes items deposited directly from tourists and other beach users in addition to litter that has been deposited from adjacent land or waterways, debris thrown overboard or lost from sea-going vessels, sewage outfalls and offshore installations. The types of litter found indicate pressures from the different sources.

Marine litter impacts on both nature and man; affecting marine and coastal wildlife and ecosystems, communities, health and the economy of the Solent.

This indicator links to one of the objectives in the Strategic Guidance which is to 'act to reduce the amount of litter and debris on the Solent shorelines.' Trends in the sources and amount of beach litter will indicate where the pressures are with regard to marine and coastal litter in the Solent.

The problems of coastal and marine litter are widely understood and important to people who visit and live at the coast. There have been a number of national and local initiatives to try and reduce the amount of coastal and marine litter, including the 'bag it and bin it' campaign and BeachWatch. This indicator could also highlight if such campaigns are working and if more needs to be done.

Linkages

Beach litter is used as an indicator of sustainability in a number of projects. The amount of coastal, estuarine and marine litter is one of the proposed European indicators of sustainable development of the coastal zone and is also used in the SAIL project. At a national and regional level it is used in the Environment Agency's State of the Environment report as an extra quality of life indicator, in this report both the density and source of the litter found is measured. At the local level it was used in the Kent County Council's set of coastal sustainability indicators.

Data Availability / Measurement

The Marine Conservation Society (MCS) carry out an annual national beach litter survey 'BeachWatch'. This has taken place every September since 1993. The results are published annually in the BeachWatch report.

There is also the Online Aesthetic Survey Information System (OASIS). This database is a collaboration between the Environment Agency and the National Aquatic Litter Group (NALG). This system was launched in 2002 and contains details of litter on beaches surveyed using a protocol developed by NALG. It has been designed so that data from the MCS BeachWatch and the Adopt a Beach surveys can be incorporated. However, to date, this does not seem to be widely used and the information on the database is limited.

Currently BeachWatch data for the Solent is included in the State of the Solent report, showing the total number of items found per metre. In the future it may be of use to show the percentage of the different sources of litter in the Solent. This could give a measure of the trends of the sources of litter as well as the amount of litter. Unfortunately the same beach is not always surveyed every year, and the data may vary depending which beaches are surveyed.

4. Riverine and direct inputs of nitrogen and phosphorus

Relevance

Nitrogen and phosphorus enter water courses from a number of direct and indirect sources. The input of nitrogen and phosphorus into coastal and marine waters can lead to eutrophication. This is the process of nutrient enrichment in waters which results in the stimulation of a range of changes, including increased production of algae and plants, which may affect the water quality. This indicator will give a measure of the pressure on estuarine and coastal waters from these pollutants and show the trends over time. This indicator may be replaced with the implementation of the WFD.

Linkages

This indicator is used widely at the European level. It is one of the proposed European indicators for measuring the sustainable development of the coastal zone and is also being used by the SAIL partnership. It is used as an environmental pressure indicator at the EU level and is one of the OECD core environmental indicators. At the national level riverine and direct inputs of nitrogen and phosphorous are used as one of DEFRAs indicators for coastal and marine water quality, in combination with the inputs of heavy metals. It is used by the Environment Agency at the national and regional level. At the local level eutrophication was one of the suggested coastal sustainability indicators by Kent County Council.

Data Availability / Measurement

This data is collected by the Environment Agency and there are standard methods for estimating the inputs or loads of chemicals, which have been provided by OSPAR. All of the principal rivers are sampled monthly just upstream of their tidal limits to assess freshwater discharges into marine waters. All major trade effluents or sewage effluents to estuaries or coastal waters are also sampled monthly to assess direct discharges to marine waters. This information is collected for the State of the Solent report.

5. Volume of Oil Spillages and Discharges

Relevance

Small amounts of fuel, oil, and other petroleum hydrocarbons introduced into the marine environment are a problem. Incremental pollution, a little here, some there, adds up to hundreds of thousands of gallons globally every year (Olsson, 1999). Oil spills can damage marine and coastal ecosystems, pollute beaches and coastlines and can impact on marine organisms especially seabirds. Once in the marine environment, oils and fuels have a tendency to accumulate in bottom sediments and concentrate in marine organisms.

Oil spills in the Solent could occur from a number of activities:

- Shipping could cause an oil spill either as a result of a collision or through poor maintenance of a vessels engine or fuel systems. A minor spillage of light boat fuel is more likely in summer months and potential spillages of crude oil from tankers are likely at any time, though there is probably an increased risk during foul winter weather.
- Land based spillage could potentially damage the site either directly or through spillage into a watercourse.
- Fuelling points in the rivers.
- Terminals at Hamble and Fawley.
- Marinas. (SEMS 2004)

This indicator would give a measure of the pressure on the marine environmental quality especially from the marine industries of the Solent, including ports and shipping, military activity, recreational marine leisure and the terminals at Hamble and Fawley as these are

the main potential sources of oil pollution.

Linkages

At the European level oil pollution in the coast and at sea is used as an EU environmental pressure indicator. Amount of oil spills is also one of the proposed European Indicators for measuring sustainable development of the coastal zone and is also one of the SAIL indicators. This indicator is not currently used at the national level. At the regional level the EA used the indicator of water pollution incidents which could link to this. At the local level it was one of the suggested coastal sustainability indicators by Kent County Council.

Data Availability

Data is collected by the Environment Agency on oil spills and pollution incidents which are reported to them, these are generally the larger spills (or smaller spill) which are not in a harbour. Minor spills in the harbours may be reported to the relevant harbour authority and recorded. This information is not currently collated in the State of the Solent report.

3.35 MARINE INDUSTRIES

The long-term aim in the Strategic Guidance is 'to support development of the marine industries, and the promotion of the Solent as a centre of excellence for marine research and technology'.

The Solent's marine industry sector contains a wide diversity of businesses. In addition to the commercial ports the main categories are industrial processing sites, requiring waterside locations for bulk shipping transport and/or the ready supply of seawater for use within processes (e.g. Esso, Exxon, Fawley Power Station). Additionally there are businesses requiring a waterside location and / or the use of waterspace, to provide services for recreational and commercial craft, for example, marinas, boatyards, shipyards and sailing clubs. There is also the maritime research and development sector. The area is a leading centre of excellence in maritime research, providing a home to three academic institutions, all of which have specialist coastal courses and maritime research programmes. There are also national manufacturers or service providers located in the Solent area by choice including defence industries.

The growth of the marine industry, coupled with the growth in ports activity and recreation, has created a recognised focus of excellence and expertise which provides an established base for economic development within the area. The development requirements of industry have led to a range of concerns about their impact on the environment. From an environmental point of view, there is a need to protect landscape, wildlife and heritage, whereas industry highlights the risks of business stagnation through the application of restrictive policies. Other environmental impacts of industry relate to the disposal of waste including discharges to air and water.

A challenge for the sustainable development of the industry sector is to reduce its negative impact on the environment through air emissions and water discharges, to use energy and resources more efficiently and to increase the share of renewable energy and material used.

Possible Indicators

1. Economic importance of marine industry, excluding the port industry, in the Solent

Relevance

Maintenance of high and stable levels of economic growth is one of the three pillars of sustainable development. Gross Domestic Product (GDP) is the best measure of economic prosperity and is used as a key indicator for the maintenance of high and stable levels of economic growth and employment. GDP is the sum of incomes earned by residents from the

production of goods and services in the region. This could be relevant to the coast if the coastal economy can be separated from the overall trend.

Marine industries represent a very significant economic force within the Solent area, and have been identified by economic development interests as one of the area's major strengths. This indicator would show trends over time of the economic importance of the different marine industry in the Solent.

Linkages

GDP is one of the key indicators used in both the national quality of life counts and the South East regional report 'A Better Quality of Life in the South East'.

Data Availability / Measurement

British Marine Federation[4] produce a yearly report on the industry revenue for the marine leisure industries in the Southern region. The value for the Solent would have to be obtained from this information. This could then be shown along with the revenue from the other industries in the Solent namely the oil industry, boat building industry and ports and shipping. Currently the total revenue for the leisure boating industry in the Southern region is included in the State of the Solent Report.

2. Employment reliant on marine industries

Relevance

As marine industries are a very significant economic force within the Solent area they are important for employment in the region. Employment would provide an economically viable and easily measurable indicator. This indicator may link to economic 1, the importance of marine industries in the Solent indicator.

Linkages

N/A

Data Availability / Measurement

This information is not currently included in the State of the Solent report and further work is needed to determine the sources of this information for the variety of marine industries in the Solent.

3. Diversity of the industrial base in the Solent

Relevance

An important factor of sustainable economic development is the requirement to maximise the industrial base, thereby allowing a strong, flexible economy in the region. This indicator would show the change of use for particular areas. The indicator would be easy to measure and analyse.

[4] The British leisure marine industry is a distinct group of over three thousand firms and sole traders that provide specialised products and services to marine leisure users across the world. These include: new leisure craft, secondhand boats, engines, insurance, finance, mooring, berthing and storage, boatyard service and repair, chandlery, waterways holidays, sailing holidays, boating equipment, marine electronics, deck hardware, clothing, safety equipment, sailing schools, corporate events, watersports kit etc etc. Leisure marine is separate from commercial marine or maritime industries such as oil&gas, shipbuilding, port development, the cruise industry, port management, ship repair etc etc. BMF is predominantly leisure orientated but many members are also involved in commercial areas. For example British builders of small commercial workboats are strongly represented within BMF.

Linkages

This was one of the proposed indicators by the Atlantic Living Coastline project.

Data Availability / Measurement

This information is not currently collected in the State of the Solent report and further research is needed to assess the best way of collecting this information.

3.36 NATURAL RESOURCES

The two most exploited natural resources in the Solent are fish, which have been an important resource for centuries, and marine aggregates which are dredged for the construction industries.

a) Fisheries

The main aim in the Strategic Guidance for fisheries is 'to support the continued development of a sustainable fishing industry within the Solent'. A sustainable fishery is achieved when a high proportion of fish stocks are able to replenish themselves over a long period of time within a sound ecosystem while offering stable economic and social conditions for all those involved in the fishing activity (OECD). The key issue for sustainability of fish stocks is to prevent the over exploitation of stocks and to balance fishing effort against the natural ability of fish stocks to regenerate (Atlantic Living Coastline project).

The Solent is a mixed sea fishery and the fishing effort varies between a number of different commercial species throughout the year. The inshore waters have an important role as a nursery area for bass, with specific areas identified for protection, and for a range of other fin-fish and shellfish. The various fishing activities which take place include:

- Demersal trawling;
- Drift netting;
- Fyke netting;
- Long lining;
- Set netting;
- Beam trawling;
- Trapping;
- Sea angling. (SEMS, 2004)

The amount of objective information about most aspects of the fishery in the Solent is very limited. A fundamental reason for this is that the majority of the inshore fleet are under ten metres in length and, therefore, exempt from the requirement to make full catch returns. Research on the fishery is also limited, although annual surveys of the stock levels within the oyster fisheries are made, and there has been extensive work on the populations of salmon and sea trout within the rivers Test and Itchen. The Sea Fishery Committees and DEFRA have detailed knowledge on the sea-fish and shellfish industry in the UK.

Possible Indicators

1. Number of Salmon returning to the rivers Test and Itchen

Relevance

The main salmon fishery in the Solent is in the River Test and River Itchen. Salmon are under significant stress from a combination of climate change pressures, increasing development and changes in the management of the marine and estuarine environment. To flourish salmon and trout require strong river flows, high water quality, clean gravel and

productive marine and freshwater environments in which to grow and feed. The eggs of salmon are at risk from being choked by silt and diffuse pollutants which settle into the river gravels (Environment Agency).

The number of salmon and trout returning to the rivers to breed provides an indicator of water quality which is essential for the sustainability of the Solent's fisheries. It also provides an indication of the state of the seas where they spend much of their adult life, only returning to freshwater to spawn. It would also give an indication of the state of the wild fish stock.

Linkages

This indicator is not used at the European level. At the national and regional levels it is one of the indicators which is used in the State of the Environment report compiled by the EA.

Data Availability / measurement

The Environment Agency has a duty to maintain, improve and develop the fisheries resource, including salmon and sea trout stocks. They therefore measure the abundance of salmon and trout by a number of methods including: fish counters; traps; rod and net catches; and juvenile surveys. The salmon rod catches provide the best historical record of the stocks and date back to 1900s. This information is currently collated for the State of the Solent report.

2. State of the main fish stocks in the Solent

Relevance

The fishing effort of the inshore fleet within the Solent is believed to be exploiting resources within acceptable limits at present although accurate information to confirm this view is not available and there are some concerns about elasmobranch fisheries (Strategic Guidance, 1997). The main fishery in the Solent is the Native Oyster, currently the largest self sustaining fishery in north west Europe.

Linkages

At the European level the state of the main fish stocks by species and sea area is one of the proposed European indicators to measure sustainable coastal development. State of fish stocks is also used as an indicator by the European Environment Agency, the OECD and the Blue Pan project. At the national level fish stocks around the UK fished within safe limits are used as a sustainability indicator for the seas, oceans and coasts. At the local level the size of 'target' spawning stocks was suggested as a possible indicator by the Atlantic Living Coastline project.

Data Availability / Measurement

This data is not currently reported in the State of the Solent report, CEFAS currently produce a report on the state of the oyster fishery in the Solent.

3. Total fish landings for Solent ports, tonnage and value

Relevance

There are a number of harbours where fish are landed in the Solent, although not all the fish landed are from the Solent fishery. This indicator will give a measure of the pressure on the fish stocks of both the Solent and wider area. It will also give an idea of the economic importance of the fishing industry to the Solent.

Linkages

This indicator would link to the European Indicator on sustainable development on the coastal zone which measures fish stocks and landings. It is also suggested as a indicator for the measurement of sustainable fisheries by the OECD in the "Economic and Social Sustainability Indicators for Fisheries" study and is used in the Baltic 21 set of indicators. At the local level it was suggested as an indicator by the Atlantic Living Coastline project.

Data Availability / measurement

Data is collected by DEFRA on fish landings both the quantity of fish landed and the value. This data is currently reported in the State of the Solent report.

4. Number, size and average power of registered fishing vessels in the Solent

Relevance

The size of the fishing fleet (number of vessels, tonnage and power) is an important factor in managing fishing effort. Fishing capacity is defined in terms of tonnage and engine power but there are many parameters that determine the fishing mortality exerted by a fleet. However, in simple terms, excess capacity leads to overfishing and increased environmental pressure.

Advances in technology and design may well mean that new vessels exert more fishing pressure than older vessels of equivalent tonnage and power. The sustainability of the fish resources (i.e. stocks fished within safe biological limits) cannot be achieved solely by controlling the fleet capacity and fishing effort. Control must also be exerted on net mesh sizes, landing sizes, by- and incidental catches, use of selective gear and closed areas and seasons. This indicator will give a measure of the fishing effort in the region.

Linkages

At the European level this is one of the suggested indicators by the OECD in its "Economic and Social Sustainability Indicators for Fisheries" study. It is also used as an indicator for sustainable development by the Blue Pan project.

Data Availability / Measurement

This data is available from the Sea Fisheries Committees and is reported in the State of the Solent report.

b) Marine Aggregates

The aim in the Strategic Guidance is 'to recognise the needs of the aggregate industry, and ensure wise management of resources, seeking integration between the offshore and onshore aspects of the industry.'

The Solent is an active focus for the aggregates industry; this activity can be divided into two functions:

- Extraction of aggregates, of which little takes place within the Solent, although there is substantial activity off the south-east coast of the Isle of Wight, and in Christchurch Bay;
- Landing of aggregates, including both marine dredged material and imported crushed rock. Landing for use on the mainland takes place at a number of wharves on the Rivers Itchen and Test, and at Portsmouth and Langstone Harbours. Marine aggregates are supplied to the Isle of Wight via wharves at Cowes and Newport.

Marine aggregates make up about 20% of the total use of aggregates in the UK. Trends in demand for aggregates are principally governed by the market responding to the

construction industry, such as housing and road building. Long-term forecasts are for an increase in demand for aggregates, although recent years have seen a decline. The use of aggregates for beach nourishment is a growing market.

To date there is little information on sustainability indicators for marine aggregates. Marine aggregates are non renewable and as such need to be used wisely. To ensure this the government have introduced targets for the efficient use of primary aggregates and greater use of recycled and waste materials. Other approaches include the aggregates levy which was introduced on 1 April 2002.

Possible Indicators

1. Number of active licences issued in the Solent and area / volume dredged

Relevance

The aggregate industry is important to the economy of the Solent, both the extraction and landing. There is currently no aggregate extraction in the Solent and no licences are currently being issued. Marine aggregate extraction does occur south of the Isle of Wight and proposals within the Solent could occur in the future.

This indicator would give a indication of the potential pressure on the marine aggregate resource in the Solent. It would not, however, give an indication of the sustainability of the aggregate dredging on the marine environment.

Linkages

N/A

Data Availability / Measurement

This data is easily available from the British Marine Aggregate Producers Association (BMAPA) or the Crown Estate.

2. Levels of aggregates from secondary & recycled sources

Relevance

The higher the percentage of recycled aggregates which are used in the construction industry and for beach recharge the more sustainable the industry is. This indicator would not be specific for marine aggregates but would apply to the aggregate industry in general.

Linkages

N/A

Data Availability

This data is not currently collected for the State of the Solent report. With the current data available it would be very difficult to get a figure for the Solent, more work is needed on this indicator.

3. Number of aggregate wharfs in the Solent and tonnage of material landed

Aggregate wharfs in the Solent are necessary for the supply of marine aggregates to the region's construction industry and for beach recharge which is an increasing use of marine aggregates. They are important to the economy of the region. This indicator will give an indication of the importance of the aggregate wharfs in the Solent and show a pattern in their usage.

Linkages

N/A

Data Availability

This data is currently collated for the State of the Solent report and the information is available from South Coast Shipping.

3.37 RECREATION AND TOURISM INDICATORS

The long term aim in the Strategic Guidance is 'to support recreation and tourism activities within the Solent, and extend opportunities where possible'. Recreation and tourism are vital to the Solent and in turn the quality of the Solent is vital for recreation and tourism.

Recreation can be counted as the Solent's most significant activity in terms of the number of people which take part and it is certainly the most diverse, with at least twenty different activities taking place, each with its own characteristic distribution and pattern of use. Tourism is also significant, particularly for the Isle of Wight. On the Hampshire coast there are fewer long stay visitors but the number of day and short stay visitors is significant.

For tourism and recreation to be sustainable in the Solent there has to be a balance between the pressures on the environment and social and economic benefits.

Possible Indicators

1. Number of berths and moorings for recreational boating in the Solent

Relevance

Recreational boating is one of the main recreational activities in the Solent, which is internationally and national recognised as one of the best areas for boating. It takes place throughout the Solent with specific concentration of activity associated with local sailing clubs and marinas. Boats vary in size from personal water craft, small dinghies and RIBs to large motor cruisers and yachts. There has been a noticeable trend towards the increased use of powered craft.

Recreational boating is important to the economy of the region. It attracts a wide range of visitors and there are a large number of marine industries associated with it. It also makes an important contribution to the quality of life of the area leading to participation in active recreation. Recreational boating also brings with it pressures on the environment, for example the potential for habitat loss and water pollution.

This indicator will give a measure of the trends in recreational boating in the Solent, however it will not include users who store their boats ashore or trail their boats to the slipway. However, just measuring the numbers berths and moorings in the Solent would not give an idea of trends in recreational boating and it may be necessary to collect more specific measures. These include: number of boats by category; average size of vessels; waiting list and occupancy levels; and berth and mooring prices.

Linkages

This indicator is one of the proposed European indicators for sustainable development in the coastal zone and is also used by the SAIL partnership.

Data Availability and Measurement

Data is currently collected for the State of the Solent report on the number of berths and moorings in principal marinas and yacht harbours in the Solent. Data on the other suggested measures of this indicator are not currently collected for the State of the Solent report but the data should be available from the marinas and harbour authorities.

2. Level of participation in coastal based recreational activities in the Solent

Relevance

Participation in coastal activities is an important measure of the quality of life for people in the area. The question has to be asked are local people currently benefiting from the recreational resource of the area or are the main users from outside the Solent area? This indicator would give a measure of the social aspect of recreation in the Solent area. It will also link to indicator number 3 'intensity of recreational activity in the Solent'.

Linkages

N/A

Data Availability and Measurement

This data is not currently collected for the State of the Solent report and further work needs to be done to see if this data is readily available and if not how it would be collected.

3. Intensity of recreational activity, land-based and water based

Relevance

The Solent coast, in particular its sheltered sailing waters, is an important recreational zone for local day visitors and tourists from further a field. It offers a unique location for recreation, due to its human influences, natural scenery and coastal waters. The range of activities which take place include walking, cycling, horse riding, angling, sun bathing, bird watching, ball games, picnics, visitor attractions and maritime events, a variety of watersports including: personal water craft; waterskiing; canoeing; rowing; raft races; windsurfing; diving; swimming and sailing.

This indicator would provide a measure of the value people place on the recreational aspects of the Solent coast, and how many people visit an area because of the recreational opportunities in the coastal zone. It will indicate both the level of social and economic activity in the region and also reflects the pressures exerted on coastal resources due to human use.

Linkages

This indicator was suggested in the Atlantic Living Coastline project where it was considered of direct relevance by the tourism and recreation specialist sub group.

Data Availability and Measurement

Data would need to be collected from a number of sources by conducting regular surveys on:

- Number of recreational clubs and membership of these clubs;
- Number of beach visitors;
- Number of water sports participants per location;
- Density of Water craft;
- Slipway usage;

- Number of registered recreational vessels;
- Number of people using the Solent Way;
- Number of people using Isle of Wight coastal paths;
- Number of people using cycle routes in the Solent.

Currently there are limitations on this data, some data is collected by a variety of organisations but the data sources are scattered, incomplete and inconsistent in quality and timing (Geodata Institute, 2004). This disparity currently prevents measurement of this indicator and further work is required to develop a methodology.

4. Number of overnight stays in tourist accommodation on the Solent and the number of day visitors

The Solent has long been a tourist destination. On the Hampshire coast, long-stay tourism is not such a major economic factor, but it is still significant on Hayling Island and in Southsea. On the Isle of Wight tourism is more significant, counting for 20% of employment, and income to the island of over £200 million per year. It should be noted that only a proportion of this activity is reliant on the Island's Solent coast.

This indicator would give a measure of the intensity of visitor pressure, as well as an indication of the economic value of visitors to the area. The number of day visitors as well as the number of overnight stays should be measured as the as many of the visitors to the tourist attractions especially on the Hampshire coast are day visitors.

Linkages

One of the proposed European indicators for sustainable development in the coastal zone is the intensity of tourism and this is also used by the SAIL partnership. This indicator is measured by the number of overnight stays in tourist accommodation and occupancy rate of bed places.

Data Availability / Measurement

This data is not currently collected for the State of the Solent report. Data is currently collected on the number of day visitors and room occupancy for the whole of the Isle of Wight. This data is not split into areas so it is not possible to get a figure for the coastal areas. For Hampshire room occupancy rates are collected through the Hants Tourism Trends Survey. This is aggregated to a district level and is only expressed as a percentage i.e. the actual numbers are not available. The information is based on a sample within each district and may not be representative of providers along the Solent coast. Also the number of people staying for business as opposed to leisure is not noted. The number of day visitors is not currently collected.

5. Visitor numbers to key attractions

Relevance

The Solent has a number of key attractions which attract both day and longer stay visitors. The key attractions include the four Country Parks on the Solent coast: Royal Victoria; Lepe; Manor Farm and Fort Victoria. The shores of the Solent are dotted with remains of its defence heritage and the industries the coast once supported. Such sites are valued not just for their contribution to the coastal landscape but also as cultural and educational resources. There are also a number of nature reserves, both local and national, which are a popular attraction for visitors and residents alike.

This indicator would show the number of people which visit the key attractions in the Solent. It would give an indication of the value that people put on these attractions and also the economic value of these key attractions to the Solent's economy.

Linkages

N/A

Data Availability and Measurement

Data is currently collected for the number of visitors to the country parks and the heritage sites. This information is reported in the State of the Solent report. The information for the indicator uses information from selected sites in the Solent. The sites are selected based on the reliability of the data and location so sites from around the Solent are used.

6. Proportion of attractions with environmental quality management plans which are being implemented

Relevance

The Solent's natural and heritage resources make it a popular area to visit and these sites need to be managed sustainable so that they will be there for future generations.

Linkages

This indicator links to the proposed European coastal zone indicators of 'sustainable tourism' which is measured by the number of tourist accommodation holding EU Eco-label. It also links to one of the national sustainable tourism indicators 'the number of business signed up to environmental management schemes.'

Data Availability / Measurement

Currently the Solent Forum holds a list of plans and projects which could be used to assess which of the key attractions in the Solent have environmental management plans. It would also be necessary to collect information on which of these plans are being implemented.

3.38 SAFETY AND EMERGENCY PLANNING

The long term aim in the Strategic Guidance for this topic is 'to ensure that adequate mechanisms to achieve maximum practicable safety within the Solent continue to be maintained.'

Ensuring the everyday public safety within the Solent embraces a number of different aspects, and falls within the responsibilities of several different organisations. The key areas are: ensuring safety of navigation; ensuring shipping is safe; ensuring competence of those afloat; organisation of search and rescue; ensuring safety on beaches and shoreline; safety of industry and the prevention and detection of crime.

The most notable trend with regard to safety within the Solent, is the growth in the number of recreation-related incidents recorded by the Coastguard. In the last ten years the numbers of incidents attributed to commercial craft have remained stable, whereas those for recreational activity have increased.

Possible Indicators

1. Health and safety incidents in the Solent

Relevance

This is one of the indicators which has been suggested by the Solent recreation survey. As is stated above the most notable trend with regard to safely within the Solent is the growth of the number of recreation-related incidents. This indicator could give a measure of both the pressure for capacity and a measure of response in terms of dealing with marine safety issues. It may also be equated with improvements in training and the numbers going through marine training in the Solent.

The indicator could also look at the number of incidents with other commercial vessels and this may give a measure of the potential conflict with other users.

Linkages

N/A

Data Availability and Measurement

Some safety data is currently collated for the State of the Solent report from the Royal National Life Boat Association (RNLI) and the Solent Coastguard. Other data is available from the Maritime and Coastguard Agency (MCA).

3.39 HUMAN SETTLEMENT, LAND USE AND MANAGEMENT

The long-term aim in the Strategic Guidance for the Solent for land and seascape is 'to maintain the character and quality of the Solent's landscape and seascape, and enhance it where possible'. The Strategic Guidance does not currently include a chapter on the social aspects of the Solent but this will be updated when it is reviewed in 2004.

Over one million people live round the shores of the Solent and the coast is extensively used for recreation and industry. The quality of landscape within the Solent is fundamentally determined by the type and quality of land-use and use of water space. The Solent, therefore, provides a diverse range of landscapes and seascapes, these include the mainland coastline of Hampshire and Chichester Harbour, the north coast of the Isle of Wight and the open Solent seascape, punctuated only by navigation buoys and marks and the east Solent forts.

The dominant forces which have influenced the character of the Solent in the 20th century are the growth of urban settlement on the coastal plain of Hampshire and development and reclamation associated with the growth of commerce, defence and recreational activities. The location of industries served by coastal traffic, principally the complex around Fawley, have also significantly affected the coastline's character. Change on the Isle of Wight has been much less dramatic, although similar trends can be identified. Whilst some changes to character are obvious, such as those resulting from major development, many result from a gradual process of smaller scale developments or land-use changes. Marina development has had a particularly noticeable effect on landscape in a number of places, particularly on the character of the Lymington and Hamble Rivers.

Possible Indicators

1. Change in the Seascape of the Solent

Relevance

A seascape is defined as a combination of land, sea and coastline that is experienced together visually and has common characteristics and qualities. The seascape of the Solent is essential to the character of the area and the constant but varied pattern of marine related activity is an intrinsic part of the character of the system, including major shipping movements (particularly in the East) and recreational craft cruising and racing in various numbers throughout the year.

Linkages

N/A

Data Availability / Measurement

There has been no work to date done on the seascape of the Solent area. A study has been carried out in Wales which looked at how seascape should be defined and then surveyed

these units. Until more work has been done on this topic in the Solent it is hard to define an indicator to measure its change.

An indicator for the seascape of the Solent will be reassessed when the indicators are reviewed in five years time.

2. Change in area and type of developed land in the coastal zone

Relevance

Development both on the land and sea will change the character of the Solent's coastline. This indicator would monitor the extent of change in the area and type of development in the coastal zone.

Linkages

At the European level this is one of the proposed indicators to measure sustainable development of the coastal zone.

Data Availability / Measurement

This information may be available from local authorities. It is not currently collected for the State of the Solent report.

3. Use of Brownfield as opposed to Greenfield sites for development on the coast

Relevance

New developments within existing urban areas, on Brownfield sites, contribute to the revitalisation of communities and enable people to live near shops and employment, reducing the need to travel. Building homes or development in general on previously developed land wherever possible is also important for the protection of the countryside and the landscape of the area.

This indicator would monitor the degree to which development is taking place on Brownfield or Greenfield sites. It will indicate whether the land available is being used in a sustainable way. This indicator is not directly relevant to the coast but would have an impact on the overall land and seascape character of the area.

Linkage

This indicator links to one of the possible European indicators of sustainable development for the coastal zone 'the rate of development on previously undeveloped land'. At the national level the indicator 'the amount of new homes which are build on previously developed land' is one of the government's national sustainability indicators. At the regional level it is used in the Quality of Life Counts and by the Environment Agency in the State of the Environment report. Locally it was suggested by Kent County Council as one of its sustainable coastal indicators and was also suggested as a possible indicator by the Atlantic Living Coastline project.

Data Availability / Measurement

The data may be available from local authorities. The indicator could be measured by the area converted from non-developed to developed land use. It could also be measured by using the amount and type of development on Brownfield areas. The two could then be compared.

4. Number / Percentage of landscape characteristic features lost, degraded or enhanced

Relevance

There is a need to understand and monitor the nature of gradual and piecemeal changes to the character of the Solent, and to ensure that long-term damage does not result through the cumulative effects of small-scale developments.

This indicator would give a measure of change to the main characteristic features of the Solent.

Linkages

This indicator is used locally by the New Forest Committee as one of their headline indicators. It is also used by Chichester Harbour Conservancy as an indicator for land use change in their Area of Outstanding Natural Beauty (AONB) management plan.

Data Availability / Measurement

This data is not currently collected for the State of the Solent report. However, the data could be collected by examining photos of fixed point locations of key views around the Solent and looking at the extent of change. This could be used for both the landscape and the seascape. Developments which have occurred on the Solent's coastline which have caused a change in the land and seascape would also have to be noted.

It may not be practical to do this for the whole Solent but the information could be collated, in the State of the Solent report, from the information that is currently available i.e. that from Chichester and the New Forest and any other local areas which use it. Further work needs to be done to see if this indicator is used anywhere else in the Solent.

6. Changes in landscape assessments carried out by local authorities

Relevance

There is a growing recognition of the role of landscape assessment as a basis for the planning and management of environmental resources. This was given greater emphasis through the publication of new guidance on landscape assessment by the Countryside Commission in 1993. The Commission encouraged local planning authorities to undertake landscape assessments as part of the Government's policy on sustainable development and sees their general purpose as providing informed background for policy and development control decisions and countryside management priorities and initiatives. These assessments will assist in the preparation of the case for designation of landscapes at the national, county and local level.

This indicator would be a good measure of the change in the landscape character of the Solent, but it does not cover any changes to the character in the seascape.

Linkages
N/A

Data Availability / Measurement

This information is not currently collected in the State of the Solent report. It may be available from the local authorities, further information is needed on this indicator and its measurement.

6. Number, extent, quality and degree of investment of landscape and seascape improvement schemes

Relevance

The landscape quality of the Solent is variable. There are a range of sites which have become degraded and unattractive as a result of poor quality development, neglect or lack of maintenance. The resources to improve such sites are finite, and there is an ever greater need for working in partnership on improvements, and to seek funding from external sources such as the National Lottery. One of the objectives in the Strategic Guidance is 'to improve the quality of the landscape and seascape were possible'.

This indicator would monitor improvements to the environment and character of the Solent.

Linkages

N/A

Data Availability / Measurement

This data is not currently collected in State of the Solent report. The data needed would include all the character enhancement projects undertaken. This would include voluntary work, work by the local authorities as well as big lottery and urban regeneration projects. It may be hard to collate information on all these schemes especially the smaller ones.

7. Perceived quality of the coastal landscape

Relevance

The quality of the coastal land and seascape may be monitored by reference to the value that people attach to it.

Linkages

N/A

Data Availability / Measurement

This information is not currently collected for the State of the Solent report. The data would have to come from surveys which would have to be carried out on a regular basis.

8. Index of multiple deprivation for the Solent

Relevance

The index of multiple deprivation is information which looks are how deprived or affluent a district or areas is. The index is made up of seven different index groups: income; employment; health deprivation and disability; education; skills and training; barriers to housing and services; crime and living environment. This indicator will give an good measure of the degree of social exclusion in the Solent area.

Linkages

This is one of the European indicators being used to measure the sustainable development of the coastal zone. It is also used at a national level as one the UK government's sustainability indicators.

Data Availability and Measurement

This data is available from the Regional Development Agency and also from the local authorities. It would also be useful to look at other measurements separately such as average household income and the percentage of the population with a higher educational qualification. This could be measured by looking at those with qualifications at 19 which is one of the indicators being used by the UK government to measure sustainable development.

3.310 COASTAL DEFENCE AND SEA LEVEL RISE

The aim in the Strategic Guidance for the Solent for coast protection and sea defence is 'to achieve a long term approach to the management of the Solent's shorelines, which will promote conservation of natural systems in balance with the proper protection of human life and property'.

The Solent coastline is defended along most of its length, reflecting the substantial urban population living within the coastal zone, together with the number of commercial and other properties. The historical trend in coastal defence has been for the progressive construction of walls, groynes and other works to prevent erosion and flooding. These have caused considerable modifications to the natural systems by altering their fundamental geomorphological processes. In recent times there has been a change in policy from one of holding the line and building sea defences to returning the coastline to its natural dynamic state where possible and looking at more strategic long term solutions. In the Solent one of the main concerns is that of sea level rise which increases the need for coastal defence works. As well as sea level rise there is the risk of increased storminess. Both these impacts are linked to climate change, and may lead to increased rates of both flooding and erosion.

Possible Indicators

1. Length of protected and defended coastline (Percentage of natural coastline and that defended by hard and soft engineering techniques)

Relevance

Shoreline Management Plans (SMPs) are produced for all areas around the coast of England. As understanding of coastal processes and the effects of coastal defence policies has increased, the policies for some areas have started to change from those of 'hold the line' to policies of 'non intervention' and 'managed realignment'. There has also been an increase in the use of more sustainable soft engineering techniques. This change in policy and engineering techniques will lead to a change in the coastline, where appropriate, to a more dynamic natural state.

As the coastline of the Solent has been developed sea defences have followed to ensure that properties are protected from the risk of flooding. This develop - defend cycle is unsustainable and a movement away from it is important in the Solent. The change in the length of protected and defended coastline and that is protected by soft engineering techniques as opposed to hard will indicate a change to a more sustainable coastal defence policy.

The length of defended coast is an indicator of the loss of natural coastline, which indirectly indicates loss of natural habitats and loss of land available for public use. This indicator will also give a measure of the trends in the type of coastal engineering used i.e. hard or soft.

Linkages

This indicator has been used in a number of other projects. At the European level it is part of the proposed set of indicators for sustainable development of the coastal zone. At the national level it is used in the Scottish Environmental Indicators group. At the local level it

was proposed by the Atlantic Living Coastline project and also by Kent County Council as a coastal sustainability indicator.

Data Availability / Measurement

The data is available from SMPs which detail the coastal defence policies for the Solent coastline. Information may also be available from the Environment Agency and maritime district councils who are responsible for coastal defence. This information is not currently detailed in the State of the Solent report.

2. Rate of relative sea level rise

Relevance

Relative sea level rise in the Solent is predicted to rise at a rate of 6mm per year. One of the greatest pressures on the intertidal habitats of the Solent is that of coastal squeeze, where the intertidal habitats are trapped between rising sea levels and fixed coastal defences.

Relative sea level rise is one of the main natural pressures facing the coastal zone. It is generally accepted that sea levels are rising due to the effect of climate change which is also causing an increase in the number of storm events which can lead to an increase in wave heights. This will have an impact on the sustainability of present coastal defence policies and strategies and the cost of defences.

Current defences will have to be upgraded to cope with these pressures or the policies will need to be changed to allow the coastline to respond to the pressures naturally. This indicator is linked to the frequency and duration of floods as the greater the rate of relatively sea level rise and number of storm events the greater the chance of coastal flooding.

Linkages

This indicator is used in a number of other indicator programmes. The number of stormy days and rise in sea level relative to land is one of the possible European indicators of sustainable development in the coastal zone. It is also highlighted as a pressure indicator for climate change by the EEA. Nationally, the rate of sea level rise is used by the Environment Agency and is also one of the UK indicators of climate change in the UK. Locally it was one of the indicators proposed by the Atlantic Living Coastline project.

Data Availability / Measurement

The data for relative sea level rise will be measured by using the mean sea level at the coast. The mean sea level at the coast is defined as the height of the sea with respect to a local land benchmark, averaged over a period of time long enough that fluctuations caused by waves and tides are largely removed, such as a month or a year.

A network of 44 high quality tide gauges is currently operated in the UK to give continuous records of sea level. Annual 'Revised Local Reference' (RLR) sea level data is available for sites around the UK coast from the Permanent Service for Mean Sea Level at the Proudman Oceanographic Laboratory which maintains the UK strategic sea level monitoring system. One of these gauges is based in the Solent in Portsmouth and this will be used as the measurement for this indicator.

3. Natural human and economic assets at risk from coastal flooding

Relevance

Much of the coastline of England and Wales is vulnerable to coastal flooding and erosion, this is also true for the Solent. It is accepted that developments in many coastal locations

are adequately protected. However, a significant proportion of natural, human and economic assets are at risk. It is recognised that the impacts of climate change are likely to exacerbate coastal flooding, erosion and instability. Combined with the effects of sea level rise coastal areas are likely to become increasingly vulnerable.

Linkages

This is one of the proposed indicators for measuring the sustainable development of the coastal zone.

Data Availability / Measurement

This data is not currently in the State of the Solent report. The data may be available from the Environment Agency's Flood and Defence database or from the local authorities in the Solent.

3.311 HERITAGE, ARCHAEOLOGY AND DEFENCE INTERESTS

The long term aim in the Strategic Guidance for the Solent is 'to identify and protect the archaeological and historic heritage of the Solent, and promote its understanding and enjoyment, ensuring equal attention to sites on land and underwater'.

The Solent is a unique, nationally important focus for maritime heritage and archaeology. Out of a total of 42 UK sites, 7 protected wrecks are within the Solent and over 800 archaeological sites are currently recorded in the Solent and Wight waters.

The Solent's historical and archaeological sites are one of its most important assets, and represent a nationally significant resource of buildings, landscapes and artefacts both on land and underwater. There are three particular aspects which are of interest:
1. Historic buildings and structures associated with the maritime history of the region. The Solent contains the most important concentration of coastal defence heritage features in the UK, important sites associated with the history of commercial activity and coastal settlement, and a large number of shipwreck sites below high water mark;
2. Submerged archaeological evidence of past landscapes and land uses at times of lower sea level;
3. Known and as-yet undiscovered archaeological remains and historic structures, under particular threat, including those put at risk by coastal erosion.

To date there has been a limited amount of work done on selecting sustainability indicators for historic and archaeological purposes, due in part to the complexity of choosing such indicators. The Atlantic Living Coastline project looked at developing sustainability indicators for the historic environment and found that there were concerns with using a numerical approach which has been used when selecting indicators for other topic areas. Totals such as numbers of sites in the Sites and Monuments Records (SMR), or listed buildings can be misleading. Often the figures reflect the amount or nature of the archaeological work taking place. For example as a result of a pre development archaeological evaluation and recording exercise the number of sites in the SMR may rise but the number of sites surviving *in-situ* would be less. The other limitation is that the majority of historic sites are not statutorily protected and so using sites which are is not a true reflection of the historic environment. This is especially true for maritime heritage where a very limited number of historic assets are protected.

English Heritage has produced reports on the State of the Historic Environment which include regional summaries. These reports aim to quantify and monitor the condition of the historic environment, the pressures it faces and its contribution to economic and social well-being. In these reports there is no specific mention of maritime historic assets and the pressures faced by these. The Council for British Archaeology have identified that there is a clear need to develop marine cultural heritage sustainability indicators on a UK-wide basis. A watching brief will need to be kept so that any of these indicators appropriate to the Solent can be included in future reports.

Possible Indicators

1.Buildings and monuments, including wrecks, at risk of decay

Relevance

The Solent region is an important area for the historic environment and has a number of important historic sites and monuments, many of which are military structures linked to the past use of the area. Conservation of the historic environment helps encourage tourism and support viable communities in which people want to live and work. The extent to which historic assets are in poor to very bad condition is an indicator of the state of health of the built environment and other historic assets. However, this indicator only includes sites of national importance which are scheduled or designated and therefore already recognised in the planning process. There are many other regionally and locally important sites which would not be included in this indicator, it is important to note that this represents only a small proportion of the total archaeological resource. Also with only a few sites underwater being designated as historic wreck sites this indicator would have to be used with care for submerged heritage.

Linkages

There are currently no specific European indicators for heritage but this indicator would link to one of the proposed European set of indicators for sustainability of the coastal zone which is the effective management of designated sites. Nationally, the historic environment is currently only minimally represented at national level by just a single indicator, the number of Grade I and Grade II* buildings on English Heritage's 'Buildings At Risk' register. This indicator is also used regionally in the Quality of Life in the South East report.

Data Availability / Measurement

Currently there is no data relating to historic heritage and archaeology in the State of the Solent report. The English Heritage At Risk register brings together information on all Grade 1 and II* listed buildings[5] and scheduled monuments[6] known to be at risk of decay or due to an uncertain future are vulnerable to becoming so. Information on buildings at risk is also available from the local authorities, Further information is needed on wrecks at risk.

There is a pilot in the East Midlands which is looking at a method for assessing the condition of the scheduled monuments. This could also be done in the Solent.

2. Number of sites recorded on Sites and Monuments Records databases in the Solent

Relevance

This indicator would give a measure of the sites which are being recorded and would include all sites, not just those which are scheduled or designated. The total number of sites in the Sites and Monuments Records (SMR) at a given time and the increase of that number over a period of time could also provide an indication of the effectiveness of archaeological fieldwork and other investigations taking place locally. This could be related to the pace of development and as suggested above may reflect the destruction of sites or may reflect the extent to which local archaeological projects are able to secure funding.

This indicator is not really an indicator of the sustainability of the historic and

[5] Listed buildings are those of special architectural or historic interest

[6] Scheduled Monuments are selected by the Secretary of State for Culture, Media and Sport. Scheduling of an historic site or building signals the intention to ensure its preservation as a monument as far as possible without significant alteration.

archaeological resource but a reflection of effort in the recording of sites. However, it is important that all information gathered is recorded on the National Monuments Record (Maritime) and the local Sites and Monuments Records as it provides an element of protection as the sites or finds will be recognised in the planning process.

Linkages

This was one of the suggested indicators by the Atlantic Living Coastline project.

Data Availability / Measurement

The data related to this indicator could be analysed to assess trends over time.
The Sites and Monuments Record, the archive of archaeological and historic sites maintained by local authorities, the National Sites and Monuments Record maintained by English Heritage would hold this information.

Datasets for this indicator could include: Hampshire County Historic Buildings Sites and Monuments Record; Isle of Wight Sites and Monuments Record; National Sites and Monuments Record (maritime); Hampshire & Wight Trust for Maritime Archaeology 'Solent Marine Historic Environment Record'. There may be a substantial amount of overlap between these datasets, however, no single data set would enable the indicator to be fully assessed. The data will be collected for coastal and marine areas of the Solent.

3. Area and number of designated conservation areas for heritage and archaeology

Relevance

Local authorities have a duty to designate as conservation areas any 'areas of special architectural or historic interest the character or appearance of which it is desirable to preserve or enhance'. Designation of conservation areas is carried out by local planning authorities and remains, therefore, a response to local assessment and pressures. There is no formal guidance on size or boundaries for conservation areas. Some single designations cover large parts of a city, while others divide large historic areas into a number of separate but often contiguous conservation areas. However, this indicator only applies to built heritage and not to submerged heritage.

Linkages

At the European level this indicator would link to one of the proposed indicators to measure the sustainable development of the coastal zone, the 'Area of Land and sea protected by statutory designations.' At the national and regional level, English Heritage's report 'Heritage Counts' records the number of conservation areas and the number of conservation area consents. Some work is also being carried out to develop a methodology that will allow the quantification of change in historic areas.

Data Availability /Measurement

This information is available from local authorities, but it is not currently reported in the State of the Solent report. It may be useful to measure the character change in designated conservation areas. There is currently very limited statistical information on conservation areas and almost nothing is known about loss of character by piecemeal change, which is considered to be the biggest threat. To do this a sample survey, carried out at regular intervals, is likely to be necessary. This will need to cover a wide range of aspects from loss of buildings, architectural features, boundary walls and spaces to the impact of traffic volumes and signage. Further work is needed on the collection of this data

3.4 LIMITATIONS OF INDICATORS

Indicators can help to focus public attention on key issues and help to highlight significant trends which are occurring in the Solent. However, they do not give the full story as they represent a simplification of the real life situation. Indicators are only one tool for evaluation; scientific and policy-related interpretation is usually required for them to acquire their full value. They often need to be supplemented by other qualitative and scientific information, particularly research to explain the causes of change as measured by indicators (OECD, 1998).

In the Solent indicators are being used to measure the sustainability of development in the coastal zone. A variation on the OECD PSR framework has been used, the DPSIP, as starting point to select possible indicators. The three strands of sustainable development; environmental; social and economic aspects have also been taken into account.

However, these frameworks have limitations as they oversimplify reality and ignore many of the linkages between issues and the feedbacks between the social, economic and ecological systems. The relationships between elements of the frameworks may not always be simple and responses to one pressure may become a pressure on another part of the system. The indicators selected should were possible have a balanced coverage of different elements in relation to the PSR framework and also to sustainable development but should avoid being driven by this as the many issues in the Solent may not fit well into this framework.

Other limitations include lack of available data, gaps in the data available, insufficient economic and regional breakdown of data. Where the data is not available for the Solent the indicator is still noted as this information may be available in the future. It must be remembered that indicators are only one tool in the coastal management toolbox.

4. REPORTING OF THE INDICATORS

The indicators will be measured as described and published in the State of the Solent report which is published on a five yearly basis. They will also be available on the Solent Forum's website via an 'indicator porthole'.

The indicators will be updated on an annual basis and the trends will be looked at by the Solent Forum Research Group and the Solent Forum Steering Group they will also be available on the website for comments by Solent Forum members. The trends will not be classed as either positive or negative but possible reasons may be given for trends in the data. Having the indicators available on the website will ensure that they reach as wide an audience as possible.

As well as being updated annually the indicators themselves will be evaluated on a five yearly basis and adapted to ensure that the most suitable indicators are being used to measure the 'health' of the Solent.

APPENDIX 1 – TABLE OF INDICATORS

Topic	Indicator Selection	Status
Physical Environment	Mean Sea Surface Temperature	✓
Nature Conservation	Wildfowl and wader counts	✓
	Change in the extent of coastal habitats in the Solent	✓
	Condition of sites designated for nature conservation	✓
	Loss / gain in area of land and sea protected by nature conservation designations	X
Transport / Ports and Shipping	Total volume of freight handled by Solent ports	✓
	Economic importance of the ports industry in the Solent	*
	Employment reliant on the ports industry	*
	Number of shipping movements through the Eastern and Western Solent	✓
	Proportion of journeys taken by public transport	*
	Number of ferry passengers to the Isle of Wight	✓
	Volume of traffic on major coastal roads	✓
Environmental Quality	Compliance with the EC Shellfish Hygiene Directive	✓
	Compliance with the EC Bathing Waters Directive	✓
	Beach litter	✓
	Estuarine Water Quality	X
	Dangerous substances in water	X
	High estimates of Nitrate and Orthophosphate from point sources in the Solent	✓
	Volume of oil spillages and discharges	*
Marine Industries	Economic importance of marine industry, excluding the port industry, in the Solent	*
	Employment reliant on marine industries	*
	Diversity of the marine industry base in the Solent	*
Natural Resources	Number of salmon returning to the rivers Test and Itchen	✓
	State of the main fish stock in the Solent	✓
	Number, size and average power of registered fishing vessels in the Solent	✓
	Number of licences issued in the Solent and area / volume dredged	✓
	Number of aggregates wharfs in the Solent and tonnage landed	✓
	Levels of aggregates from secondary and recycled sources	*
Recreation and Tourism	Number of berths and moorings for recreational boating in the Solent	✓
	Number of overnight stays in tourist accommodation on the Solent coast	*
	Intensity of recreational activity, land and water based	*
	Visitor numbers to key attractions	✓
	Proportion of attractions with implemented environment quality management plans	✓
	Level of participation in coastal based recreation facilities in the Solent	*
Safety and Emergency Planning	Health and safety incidents in the Solent	✓
Human Settlement, Land Use and Management	Change in the area and type of developed land in the coastal zone	*
	Change to the seascape of the Solent	✓
	Use of Brownfield as opposed to Greenfield sites for development on the coast	✓
	Number / percentage of landscape features lost, degraded or enhanced	*
	Changes in landscape assessments carried out by local authorities	*
	Number, extent, quality and degree of landscape and seascape improvement schemes	*
	Perceived quality of the coastal landscape	*
Coastal Protection and Sea Defence	Length of protected and defended coastline (% of natural coastline and that protected by hard and soft defences)	✓
	Rate of relative sea level rise and number of stormy days	✓
	Frequency and duration of floods	X
	Change in Shoreline Management Plan Policy	X
	Natural, Human and economic assets at risk from coastal flooding	✓
Historic Heritage and Maritime Archaeology	Buildings and monuments at risk of decay	✓
	Number of sites recorded on the sites and monuments record	✓
	Area and number of designated conservation areas for heritage and archaeology	*

* Further work is needed to collect the data for this indicator for the Solent

✓ This information is available and will be published in the State of the Solent report

X This indicator is not included in the final selection

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